PROPOSED DEMOLITION OF EXISTING COMMERCIAL BUILDINGS AND CONSTRUCTION OF A RESIDENTIAL DEVELOPMENT AT 36 & 38 HOLBEACH ROAD, SPALDING, PE11 2HQ

FLOOD RISK ASSESSMENT



Existing Building and River Welland

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 new development at Holbeach Road, 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.

Introduction

An application has been made to South Holland District Council to demolish two existing buildings at 36 & 38 Holbeach Road, Spalding and construct six two story dwellings on the site for residential use.

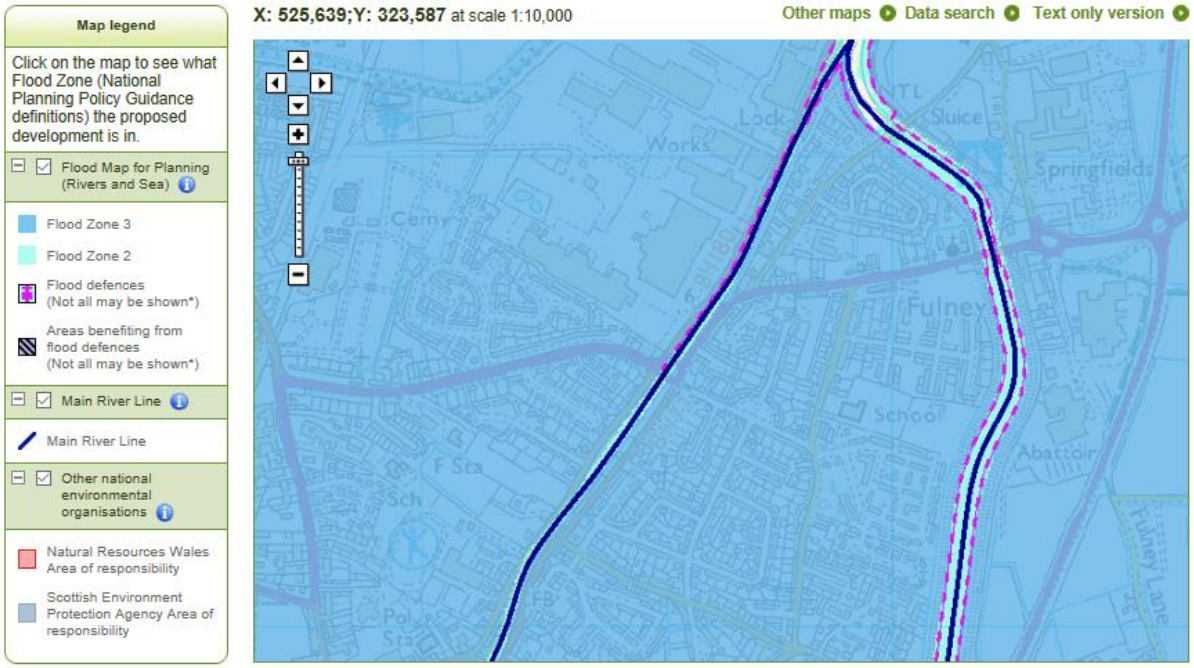
The site is within Flood Zone 3 on the Environment Agency's Flood Zone Map. These maps do not take into account existing flood defences.

The Planning Application requires a Flood Risk Assessment to be carried out as required in the Technical Guidance to the National Planning Policy Framework.

The site is within the defended area of the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map and is located in the South Holland 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 the whole area of Spalding is in Flood Zone 3.

Application Site

The development is located on the western side of the River Nene. The National Grid Reference of the site is 525630 323630.

The location of the site is shown on the plan at the end of this document.

The proposed development is within Flood Zone 3 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, 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 *	✗	✗	✗	✓*

As the area is not within the functional flood plain and is within a defended area it can be designated as being within flood zone 3(a). Therefore it can be seen that for "More vulnerable" development the sequential and the exception tests need to be applied to the development.

Sequential Test

The aim of the Sequential Test, as set out in the Planning Practice Guidance, is to ensure that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones as defined in the Strategic Flood Risk Assessment for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

The greater part of the area of Spalding, as can be seen from the map on page 2 of this report, is in Flood Zone 3.

Taking into account the guidance, it can be seen that it is extremely unlikely that an alternative site within a lower flood risk zone could be found in Spalding for this development. The safety of the development will be delivered by ensuring the floor level of the proposed new dwellings 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 Spalding available for residential development. Therefore there is a requirement for further land to be brought forward 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.

South Holland DC Strategic Flood Risk Assessment

Consultants have produced a Strategic Flood Risk Assessment (SFRA) for the South Holland District Council (SHDC). This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

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

1. **Flood Maps Table D1**

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

For the present day Depth of flooding … zero

Extent of flooding .. zero

Hazard …. Nil

Velocity … Nil

For year 2115 Depth of flooding … Between 0 and 500mm

Extent of flooding …High

Hazard … Significant

Velocity .. Greater than 0.25m/sec

The maps illustrate the residual flood hazard which is as follows:-

For the present day Depth of flooding ...Between 0 and 500mm

Extent of flooding .. High

Hazard … Moderate

Velocity .. Greater than 0.25m/sec

For the year 2115 Depth of flooding...Between 500mm and 1.0m

Extent of flooding .. High probability

Hazard … Significant

Velocity .. Greater than 0.25m/sec

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

2. **Maximum flood levels:**
   Maximum flood levels in the River Welland and the Coronation Channel are shown in the reports as follows:

	Present	Present + Climate Change
1 in 100 year	4.32	4.69
1 in 1,000 year	4.34	4.69

- The minimum freeboard on the east bank of the Coronation Channel is 70mm.
- The maintenance standards of these banks are good and defences are well maintained and regularly inspected.

3. **Extreme tide levels**
   The extreme tide levels in the section of the Coronation Channel and River Welland between Fulney Lock and Marsh Road Sluice are 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

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The lowest bank level on the left bank of the Coronation Channel is 6.88m OD.

The lowest bank level on the right bank of the tidal River Welland is 7.57m 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" 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 20 metres from the River Welland, which is the main river and maintained by the Environment Agency.

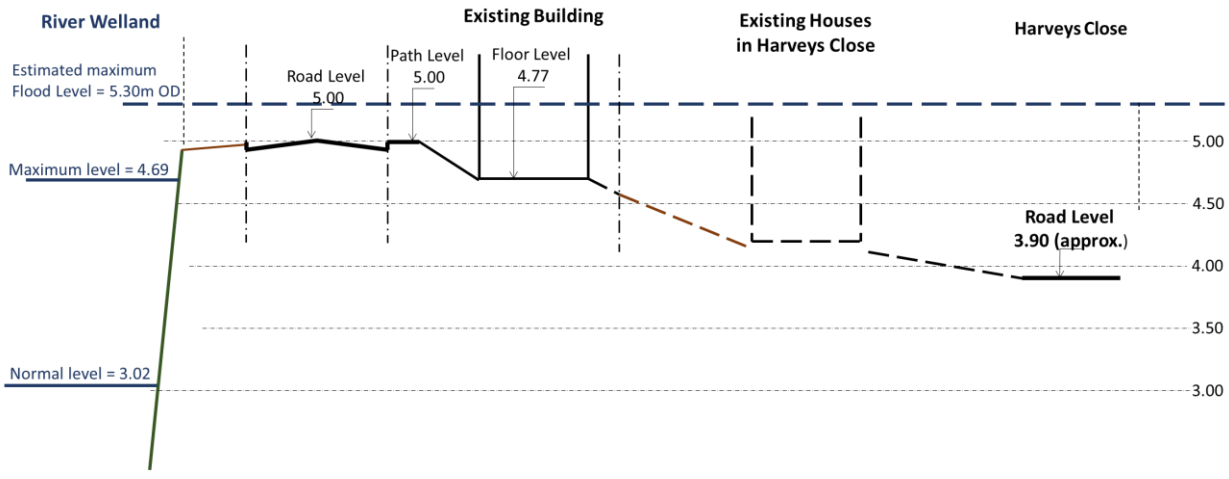
The site is approximately 0.6 km south of the tidal defences of the River Welland and Coronation Channel.

The area between the River Welland and the Coronation Channel is drained by surface water sewers maintained by Anglian Water, which discharge either into the River Welland or into drainage channels maintained by South Holland Internal Drainage Board. The water levels in the IDB channels are controlled by Clay Lake Pumping Station, which is operated by South Holland IDB, and discharges into the Coronation channel.

Proposed Levels of Buildings

The level of Holbeach Road in front of the site is approximately 5.00m OD. The floor level of the existing workshop is 4.77m OD, and levels fall towards Harveys Close further away from the river.

The west – east section below shows all of these levels, which can also be seen on the plan on sheet 13.



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. Overtopping or breaching of the Coronation Channel.
4. Failures of Clay Lake Pumping Station (IDB)
5. Blockages in Exeter Drain (IDB)
6. Blockages in local surface water sewers (highway or Anglian Water)

1. Failure or overtopping of tidal defences.

There is a short length of tidal defences on the Coronation Channel west of Marsh Road Sluice and on the River Welland north of Fulney Lock that defends the area between the River Welland and the Coronation Channel from tidal flooding. The SFRA states that the defences are adequate to withstand a 1 in 200 year (0.5%) probability event for present day but in the future (2115) some of the banks would be overtopped in a 0.5% probability event.

Crest levels of this bank have been surveyed and these are shown below. These levels range from 7.28m OD near Fulney Lock to above 8.00m OD on the main section of bank. The low level of 6.88m OD mentioned in the SFRA was not found. All the surveyed levels are higher than the 1 in 200 year extreme tide level in 2115 of 7.12m OD stated in the SFRA.

These banks are well maintained and have a top width of at least 4.0 metres, and it is reasonable to assume that during the next one hundred years, considering the assets that are protected by this bank, further maintenance and capital works will be carried out on the tidal banks to ensure a continuing minimum defence standard of 1 in 200 years.



If a breach occurred in the tidal bank during a 1 in 200 year event in the year 2115 flood water would flow southwards and start to flood the whole area between the Coronation Channel and the River Welland. The hazards of this will be considered later in the report.

2. Overtopping of the River Welland.

The east bank of the River Welland is at an approximate level of 5.08m O.D. east of the building. The highest predicted fluvial level for a 1 in 1000 year event in the fluvial River Welland in 2115 is 4.69m OD. The level of the east bank of the River Welland varies between 5.10 and 5.30m OD through the town of Spalding.

The banks on this length are at least 15 metres wide with a road and footpaths parallel to the river. Therefore the possibility a breach occurring in this section of the bank of the river and flooding the building from this source can be discounted.

3. Overtopping or Breaching of the Coronation Channel

The area between the River Welland and the Coronation Channel is protected from flooding by banks on the west side of the channel, which are approximately 2.0m to 3.0m above the land. The top level of these banks are at a level of 5.40m OD, which gives a freeboard of at least 700 mm above the 1 in 1,000 year maximum design level in the channel.

If a breach occurred in the channel the maximum water level in the flooded area could reach between 4.0 m and 4.1 m OD for the present day situation and between 4.3m and 4.4 m OD if climate change is allowed for. As the proposed ground floor level of the new dwellings will be 5.35m OD the risk of flooding from this source can be discounted.

4. Failure of Clay Lake Pumping Station

The South Holland IDB estimate that the Clay Lake Pumping Station provides a 1 in 50 year standard with a freeboard, which in effect provides a 1 in 100 year protection against flooding. The pumping station is maintained in good condition and should a failure occur the Drainage Board would quickly deploy temporary pumps to alleviate the situation. It is highly unlikely that any flooding from this source would extend as far as this site, as the flood water would need to rise above 5.00m OD, which is higher than the ground levels around the pumping station itself which would flood first.

Therefore flooding from this source can be discounted.

5. Blockages in Exeter Drain

The South Holland IDB has a regular annual maintenance programme and they remove weed growth from channels such as these twice each year. However, any flooding from this channel will not cause any flooding to the development site, as explained in (4) above.

Therefore flooding from this source can be discounted.

6. Blockages in local surface water sewers

Both Anglian Water and the Highways Authority maintain surface water drainage systems in this area. If there is a blockage in an underground surface water pipe there is a slight risk that a small amount of water could enter through the doorway but the main volume would discharge over the bank into the river.

Therefore the risk from this source can be considered extremely low.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the last 50 years.

Probabilities and Trends of Flooding

The probability of this development being flooded 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.

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 14 to 17). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Residual Risk

The SFRA has calculated the consequences arising from a possible breach occurring at any point along the raised defences. Also considered were scenarios in which gates or other assets fail to operate allowing water to flow inland and cause flooding.

If the potential sources of flooding are considered again, it can be seen that all of the consequences of river flooding and failures in the internal drainage system will not lead to the water level rising to a level of 5.35m OD, and these would not cause any flooding to the proposed properties.

The consequences of a breach of the tidal defences would cause greater flood depths in this area of Spalding. From the levels taken of the bank it can be seen that the bank will not be overtopped in a 1 in 200 year event in 2115.

If a breach occurred in the tidal bank of the River Welland or the Coronation Channel between Fulney Lock and Marsh Road Sluice flood water would flow into the area between the Coronation Channel and the River Welland. It is possible that the water level could reach a level of 5.30m OD, but it is unlikely to rise above this level as flood water would then flow into the River Welland as soon as the flood level increased

above 5.00m OD. However the risk of a breach occurring in this short length is extremely low. Breaches are more likely to occur during an event with return period of 1 in 200 years or greater. However a breach could occur in any part of the tidal defences, and this would reduce water levels in the tidal Welland during the event.

Conclusions

The following conclusions can be made:

- The proposed development is not in a functional flood plain as defined by PPS 25.
- Although the site is in flood zone 3(a), the actual risk of the site flooding from any Environment Agency water course is low.
- There is no actual risk of flooding at the present time in a 1 in 200 year event.
- The actual risk of flooding in 2115 in a 1 in 100 year event water is not predicted to overtop the tidal defences. You would also expect that the Environment Agency will if necessary increase the levels of these defences sometime in the next 100 years, considering how many properties are protected by this defence.
- The SFRA states there is a residual risk that the site could flood if a breach occurs in the tidal defences. Although the risk of a breach occurring is very low, it can be shown that if a breach 50 metres wide and 3.0 metres deep is assumed to form within minutes, then water levels in the area between the River Welland and the Coronation Channel could eventually reach 5.30m OD.
- If a breach occurred then the whole area between the Coronation Channel and the River Welland would start to fill with flood water. A major emergency would be called by the Authorities as there would be hundreds of houses at risk. When the water level reached 5.00m OD the water would start to flow into the River Welland and the Coronation Channel, which would limit the further increase in level of flood water. At the same time the level of the tide would be falling and the inflow of flood water would stop for around 6 hours until the next tide. The new buildings should be higher than the level of the flood water and not be affected.
- It is proposed that the ground floor level of the proposed properties should be raised to a level of 5.35m OD which is above the maximum predicted flood level for this area.
- If flooding were to occur in an extreme event residents of the buildings will be able to leave the area by walking south along Holbeach Road and crossing the bridge to access the east side of the River Welland. From here they would be able to walk to the central part of Spalding where the land levels are higher, and the risk of flooding is lower.
- 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.

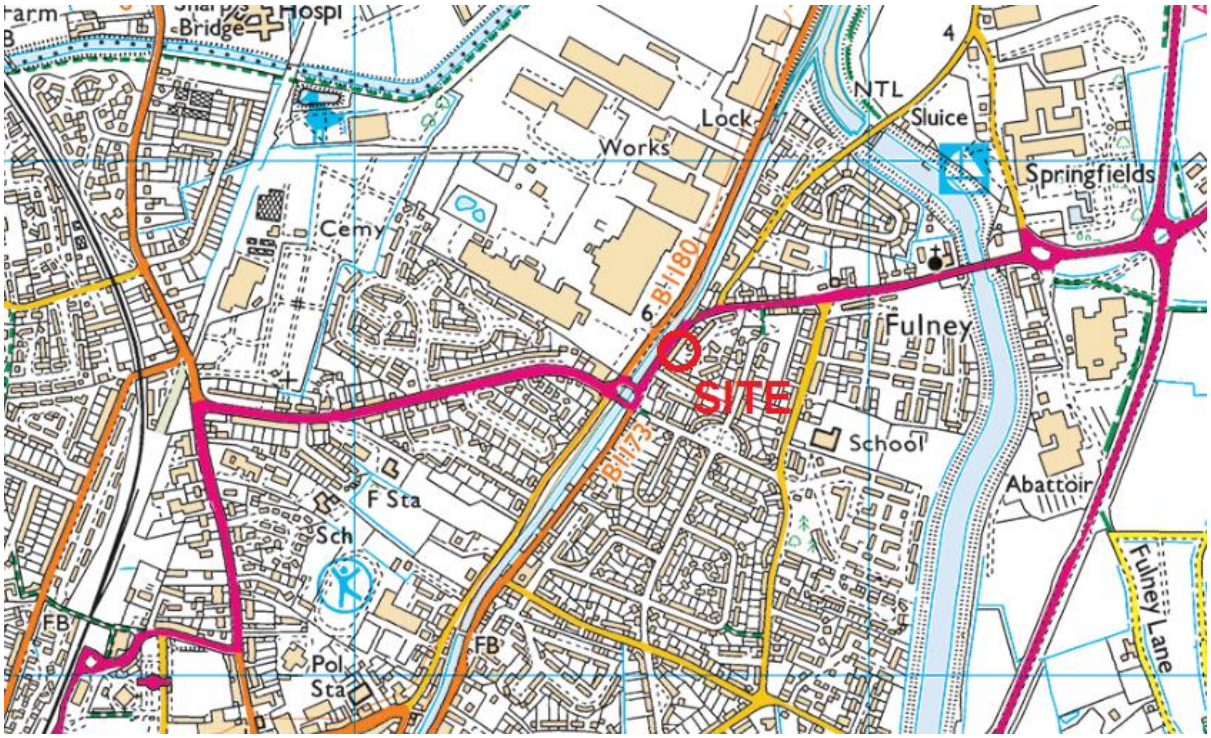
Recommendations

- It is proposed that the ground floor level of the proposed buildings should be raised to a minimum level of 5.35m OD.
- In any area at risk of flooding, even though in this case the risk is extremely low, it is preferable that a building in a defended area should be of two story construction with all bedrooms at first floor level. This will provide a refuge for residents if the building were to become flooded and ensure there is no danger to residents when they are asleep.
- Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service. If a very high tide is predicted (greater than 6.50m OD) then the occupiers are advised that they should make preparations to monitor the situation and be prepared to evacuate the building immediately if flooding begins to take place. They should drive or walk to the central area of Spalding or be advised of a safer place to go.

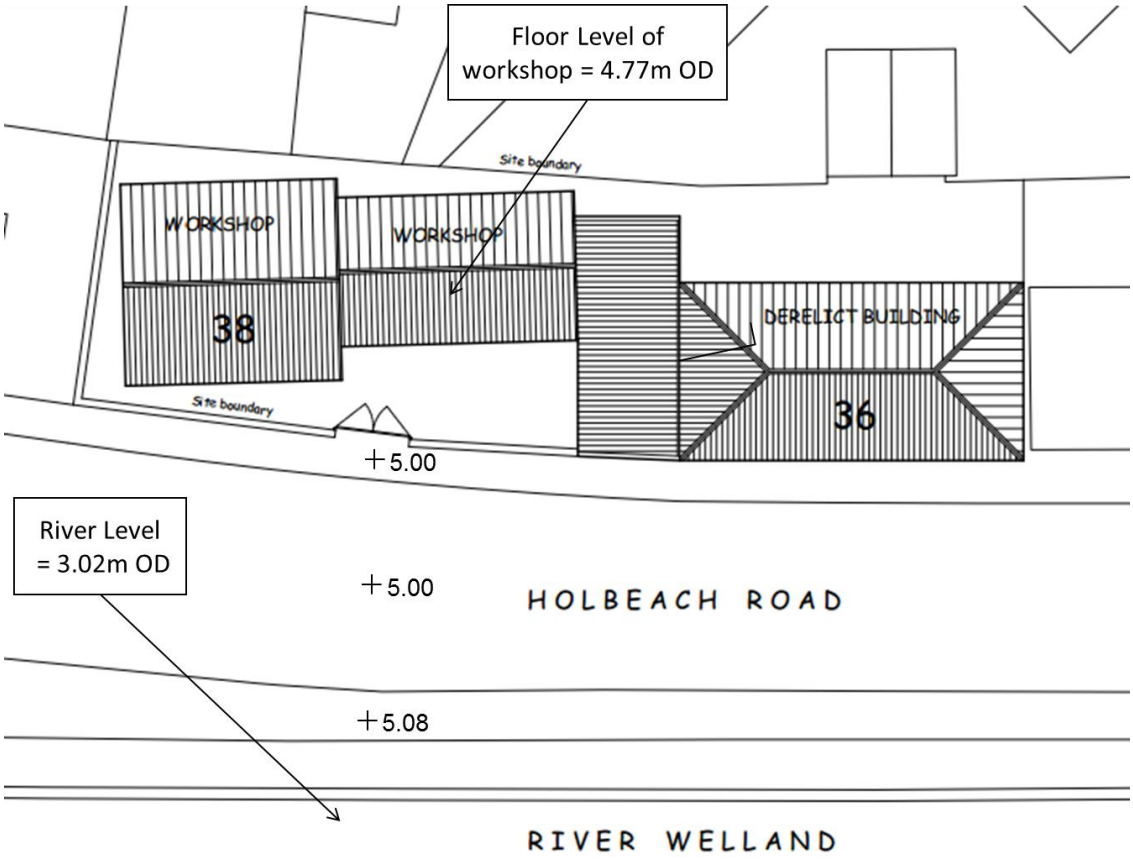
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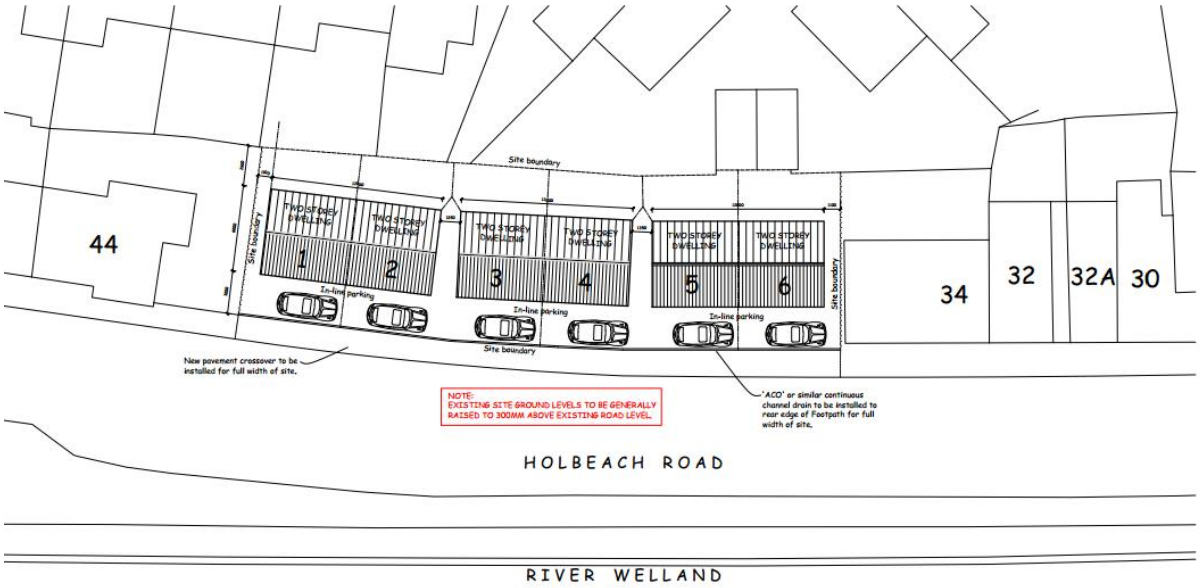
LOCATION PLAN



PLAN OF SITE LEVELS



PROPOSED BLOCK 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

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 fluvial section of the River Welland, the Coronation Channel or IDB drainage system

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

Therefore it can be seen that the revised guidance increases the maximum allowance for sea rise in 2115 by 100mm. This may slightly increase the risk of a breach occurring in the tidal bank north of the site. It may also slightly increase the flow of water inti the area between the Coronation Channel and the River Welland. 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 and the Coronation Channel 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.

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 as the major flood risk to the sit in Holbeach Road is from tidal flooding then any increases in flow from fluvial sources do not need to be considered further.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the ground floor levels should be a minimum level of 5.35m OD is satisfactory.