FLOOD RISK ASSESSMENT FOR PROPOSED DWELLING ADJACENT TO 74 RESERVOIR ROAD, SURFLEET SEAS END, SPALDING, PE11 4DH



Proposed site from Reservoir Road

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Revision A: 23rd March 2015: Paragraphs on Sequential and Exception Test amended.

Revision B: 17th October 2017: Report Rewritten incorporating new SFRA and EA recommendations.

This flood risk assessment has been prepared solely to support the planning application for the proposed new dwelling at 74 Reservoir Road, Surfleet Seas End, 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 for planning permission to construct a new dwelling on a site west of 74 Reservoir Road, Surfleet Seas End, Spalding. Reservoir Road is located on the top of the north bank of the River Glen and the development site is 400 metres west of the main outfall sluice from the River Glen in to the tidal River Welland.

The site is within Flood Zone 1, indicating a low risk, as shown on the Environment Agency's (EA) 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 (NPPF) Development and Flood Risk.

The site is within a defended area as specified on the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) 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 the site, which is immediately north of the river bank, is within flood zone 1. The fields to the north are lower and are mostly within flood zone 3.

Application Site

The development is located approximately 1 mile east of the new A16 road at Surfleet, three miles north of Spalding city centre. The National Grid Reference of the site is 527830 329110.

The position and extent of the site is shown on the plan at the end of this document.

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 *	✗	✗	✗	✓*

It can be seen that “More vulnerable” development is appropriate in flood zone 1.

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 area north of the River Glen is in flood zone 3, but the immediate area on the north bank of the river is in flood zone 1 as it almost as high as the road on the top of the bank. Therefore it would be difficult to find a similar site for the development within the Surfleet Seas End village boundary that has a lower flood risk..

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 outside the town of Spalding available for residential development. 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.

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:

For the present day	Depth of flooding … zero
	Extent of flooding .. Low or medium
	Velocity ……. Nil
For year 2115	Depth of flooding … 0 – 500mm
	Extent of flooding .. High
	Peak Velocity …… Greater than 0.25m/sec

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
	Hazard ……. zero
	Velocity …….. zero
For the year 2115	Depth of flooding ….0 – 250mm (north part only)
	Extent of flooding …High (north part only)
	Hazard …… Low hazard (0 – 0.75) (north part)
	Velocity ……. 0 – 0.3m/sec (north part only

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

1. **The maximum flood levels in the fluvial section of the River Glen shown in the SFRA are as follows:**

Year	2007	2115
1 in 100 year	4.13	4.65
1 in 1,000 year	4.65	4.68

The bank level on this side of the river at chainage 0.4km is shown to be 4.83m OD.

2. **The extreme tide levels in the section of the River Welland at chainage 16.1km is shown in the report as follows:**

	2007	2055	2115
1 in 100 year	5.99	6.32	7.13
1 in 1,000 year	6.32	6.65	7.46

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The bank levels of the west bank of the tidal River Welland north and south of the River Glen outfall are at a level of approximately 7.50m OD and above, but the bank level at 16.1km, the River Glen outfall is shown to be 7.05m OD.

3. **Rapid Inundation Zone:**

The maps in the SFRA show that the site is not within the rapid inundation zone.



Information from the Environment Agency

The Environment Agency has provided predicted flood levels for the River Glen which are taken from the Welland Catchment Model produced in 2016. The levels quoted below are maximum predicted water levels in the River Glen directly south of the development site.

	2007	2007 including 20% climate change allowance
Peak 1 in 100 year flood level	4.18m OD	4.78mOD
Peak 1 in 1,000 year flood level	4.31m OD	4.83m OD

Site Levels

Levels have been taken of the site which are shown on the section below. The level of the River Glen on 4th August 2015 was 2.89m OD and the level of Reservoir Road

south of the site is 4.89m OD. The level of the site next to the road is 4.68m OD, and the site slopes down to a level of 4.25m OD approximately 5 metres further north. The site then slopes down to a level of 4.05m at the rear of the site. The fields behind the site are slightly lower at a level of 3.90m OD.

It is proposed that the finished floor level of the new building should be a minimum of 4.90m OD.

Existing Flood Alleviation Measures

The site is 400 metres from the tidal sluice at Surfleet Seas End where the River Glen discharges into the tidal section of the River Welland. Both watercourses are main river and maintained by the Environment Agency.

Potential Sources of Flooding

The following sources of flooding have been identified:

1. Flooding from the River Glen.
2. Overtopping of the tidal River Welland.
3. Flooding from failure of IDB systems.

1. Flooding from the River Glen

Flooding could occur if the bank, which incorporates the road, were to breach when levels in the River Glen are high. The level of the bank shown in the SFRA is 4.83m OD, and the level taken at the same time as the site levels was 4.89m OD. The maximum predicted level in the River Glen at this location is 4.12m OD for a 1 in 1000 year event at the present time. Therefore at the present time there is adequate freeboard and a robust bank with a 7.0 metre top on which a tarmaced road is laid. Therefore the risk of a breach occurring at this location can be considered extremely low.

The SFRA indicates that the 1 in 100 year level for the year 2115 will be 4.65m OD. The EA have carried further modelling and the 2016 Welland Catchment model predicts the 1 in 100 year level in 2115 will be 4.78m OD. As the level of the road on top of the bank is 4.89m OD there will be a freeboard of 110mm in this event. Wave action on the river might cause some overtopping but as the top of the bank is more than 6.0 metres wide with tarmac surfacing and a very shallow gradient on the back of the bank it extremely unlikely that a breach will be formed.

Therefore as the proposed property will be raised above ground level this risk is adequately mitigated.

2. Flooding from the tidal River Welland

The River Welland is tidal in the section adjacent to the River Glen outfall sluice. 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 would be overtopped with a 0.5% probability event.

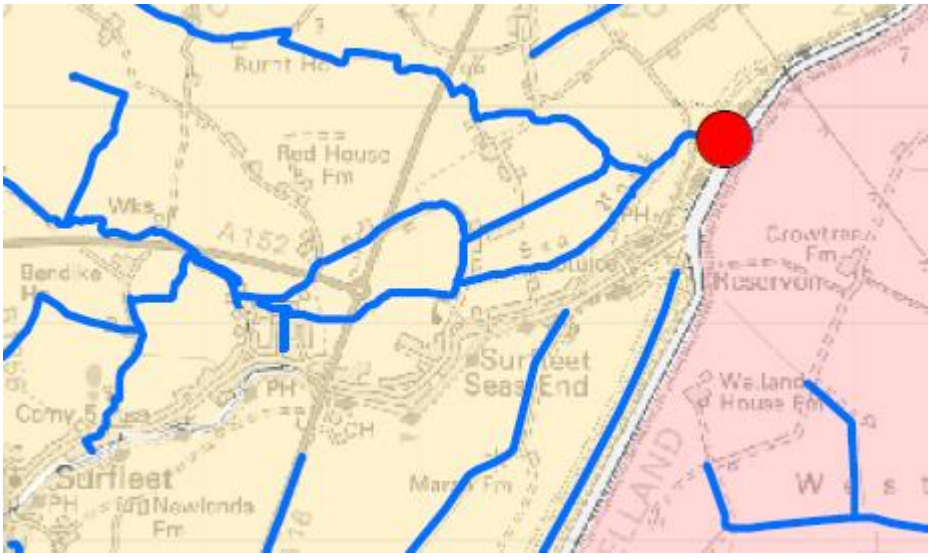
It is reasonable to assume that within the next 100 years the tidal defences will be raised to continue to provide a 1 in 200 year level of protection to this area.

The development site could be affected if the west bank of the tidal Welland north of Surfleet Seas End were to breach. Flood water would flow into Surfleet Marsh and could flow south westwards and reach the Development site. The hazard maps in the updated SFRA state that the predicted flood depth in a 1 in 200 year tidal event in 2115 would be up to 250mm in depth.

Therefore the risk of flooding from this source can be considered remote.

3. Flooding due to failure of IDB Systems.

There is a system of IDB drainage channels which drain the fenland area north of the site. These lead to Surfleet Marsh Pumping Station where the water is pumped into the tidal River Welland. This pumping station provides an overall standard of protection to the area of between 1 in 50 and 1 in 100 years. There is an IDB drain, called Old Beach East Drain, immediately north of the site which runs eastwards to the pumping station. Welland and Deepings IDB have stated that the 1 in 100 year predicted maximum level at Surfleet Marsh Pumping Station is 1.75m OD, which is 2.25m lower than the lowest ground levels on the site.



It is expected that Welland and Deepings IDB will continue to review predicted 1 in 100 year levels over the next 100 years to ensure that freeboards are retained in the future.

As the proposed ground floor level of the property is more than 3.0metres above the predicted maximum flood level in the IDB drain flooding from this source can be considered to be remote.

Extent of known Flooding

There is no history of flooding having occurred over this section of the north bank of the River Glen for the last thirty years at least.

Probabilities and Trends of Flooding

The probability of this development flooding from Environment Agency tidal River Welland is very low. In an extreme event water levels in the River Glen could rise and flood the property but any effect on this location would not be sudden and there would be time for residents to take precautionary measures to limit the impact of any flooding that may occur.

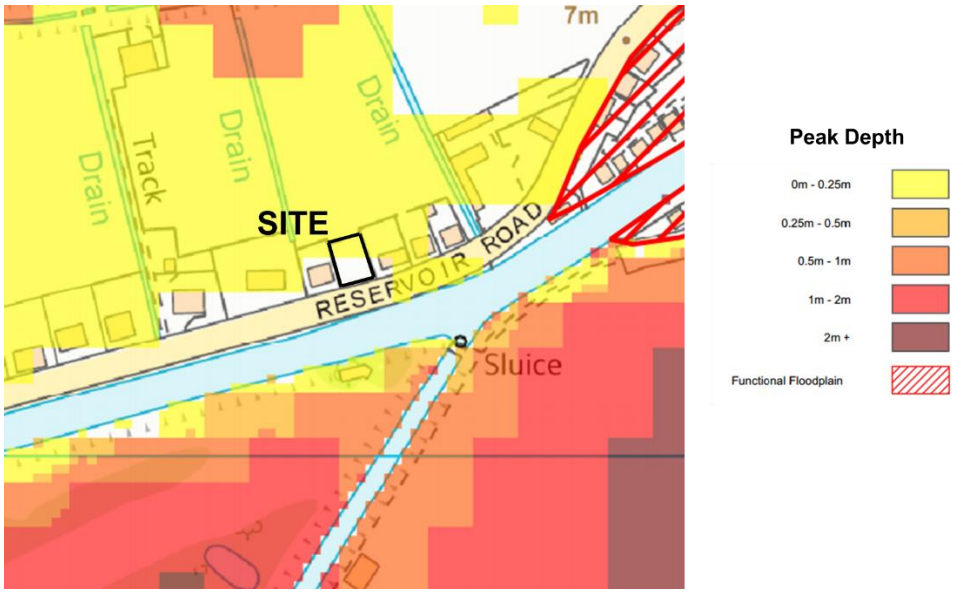
Residual Risk – Extreme Events

The residual risk from extreme events is very low on this site. The major risk to the site is from high levels in the River Glen. The present levels of the banks of the River Glen along the stretch from Surfleet Seas End to West Pinchbeck are as low as 4.28m OD and overtopping of the river will begin to occur above this level.

Summary of Risk of Flooding to the Site

There is a risk that the west bank of the River Welland north of Surfleet Seas End could breach and flood water would flow into the area between the banks of the River Glen to the south, possibly the A16 road and the A17 to the north.

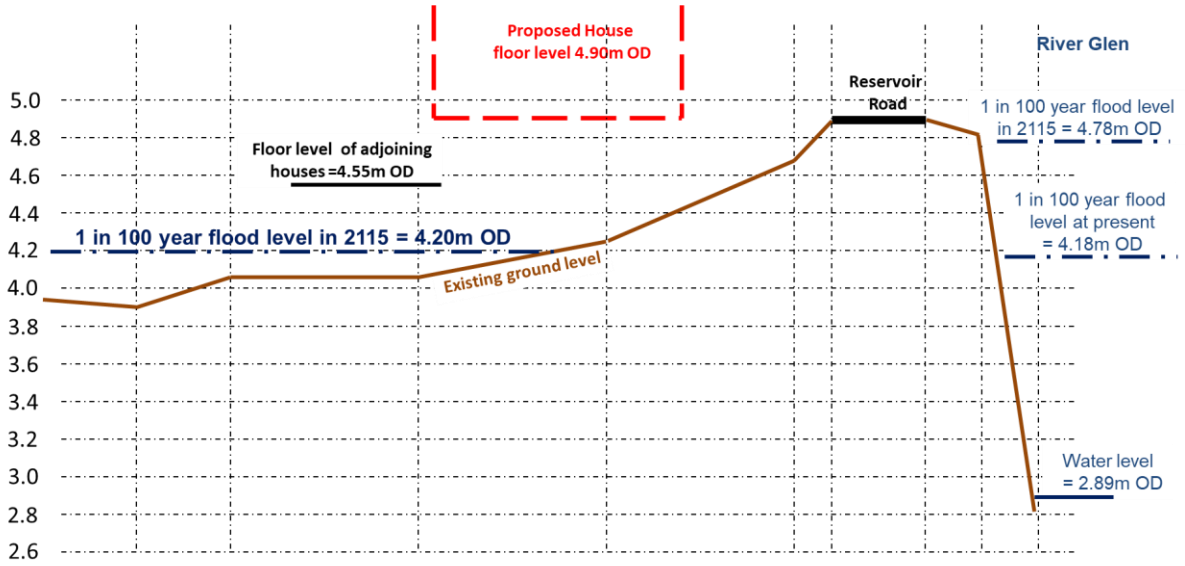
The SFRA indicates that this flood water would be 0 – 250mm depth if a 1 in 100 year event occurred in 2115. The map showing predicted flood depths in 2115 is shown below.



Even if depths in excess of this occurred the proposed house with a floor level of 4.90m OD would be 1.0 metre above the ground level of the field north of the proposed house.

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

There is a risk of some flooding to the site if wave action lead to overtopping of the bank, and if this action caused a breach in the bank. It can be seen from the cross section through the site shown below that even if a breach occurred, the bank would be unlikely to erode below approximately 4.50m OD.



If a breach occurred, then the depth of flood water would not be greater than 500mm in depth and the mitigation of raising the proposed ground floor level of the house to a level of 4.90m OD will adequately mitigate the risk from this scenario.

Conclusions

The site is in flood zone 1.

The Environment Agency mapping only indicates the risk from tidal flooding, and the site is not at risk from any predicted flooding in a 1 in 1000 year event in 2115 from this source.

There is adequate mitigation for the hazard from any possible overtopping or breaching of the north bank of the River Glen. The predicted level in a 1 in 100 year event in 2115 is unlikely to be reached as there are lengths of banks where the risk of breaching is considerable higher than the bank south of the development site.

There is adequate mitigation for the hazard from any possible high levels in the IDB drainage system.

Any flooding that does occur will happen very slowly and residents of the building will have adequate time to monitor the water levels in the River Glen and take appropriate action.

There is a safe route from the site onto land within 50 metres to the east which is at a level of 7.00m OD.

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, even though in this case the risk is extremely low, it is preferable that a proposed new building 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.

The ground floor level of the proposed building should be at least 4.90m OD, which is the same level as Reservoir Road in front of the site.

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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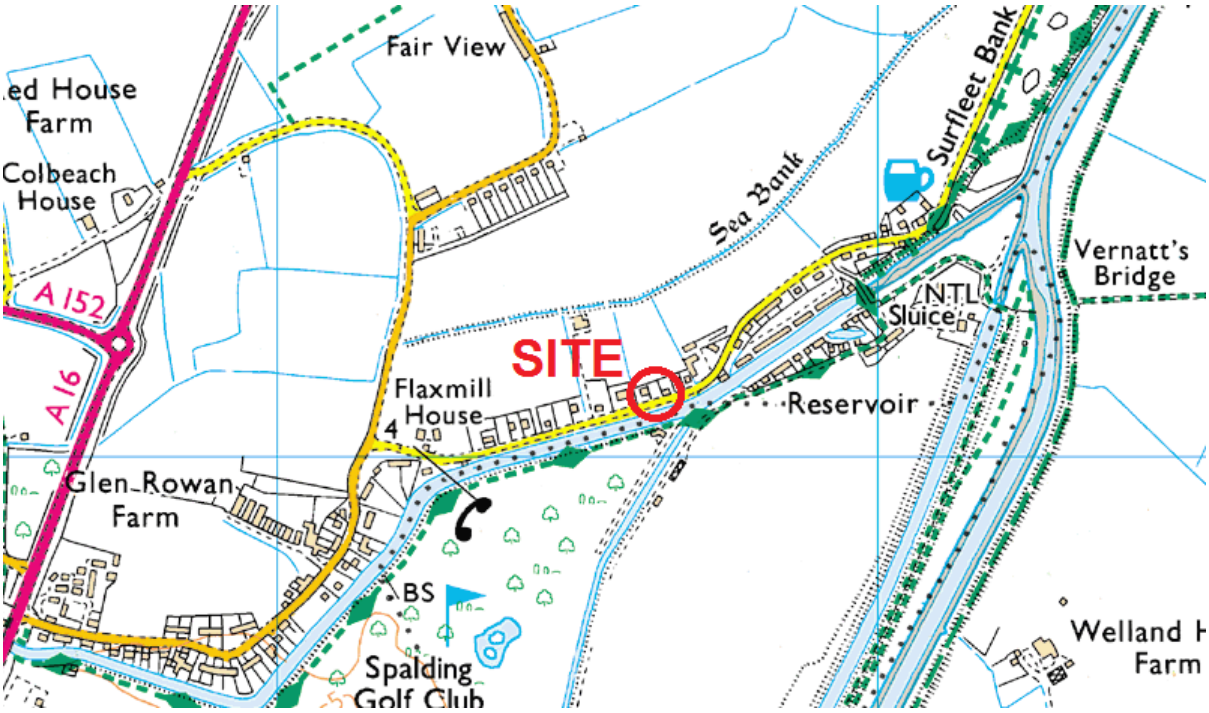
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29th January 2015

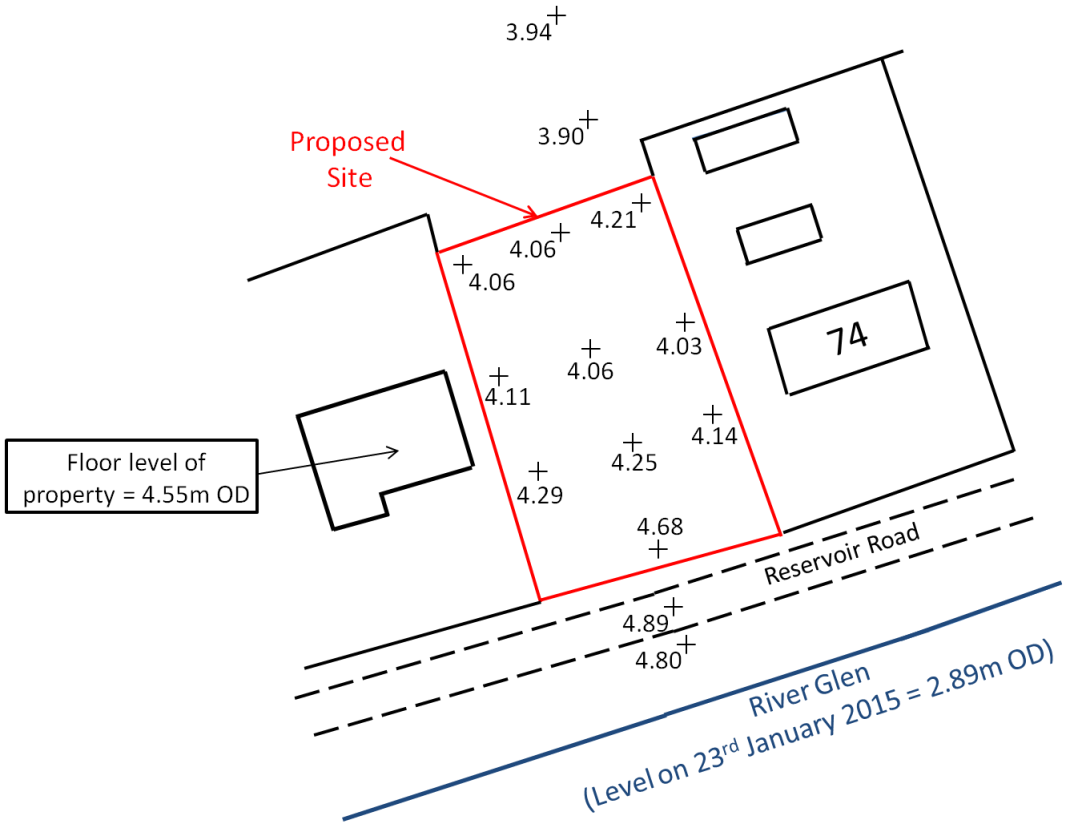
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LOCATION PLAN



SITE PLAN AND 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 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 (19/0

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 category 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 the main 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. This will not have the effect of increasing the predicted flood level at the site in a 1 in 200 year breach event in 2115 by the maximum of 100mm, but it will probably be only between 10mm and 50mm. It is unlikely that this increase will significantly change the maps of flood risk at present issued by the Environment Agency.

Fluvial River Flooding.

As the development is in flood zone 1 and is classed as more vulnerable, the advice from the Environment Agency is that the central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the higher central allowance, which is 35%, should be considered to assess the effect of this.

Maximum flood levels in the River Glen will not be increased by the increase in flows projected in the new climate change allowances. If flows increase by 35% in these systems it will have the effect of flooding over the long sections of bank between Surfleet and Bourne and the maximum levels will not increase significantly.

Flooding from IDB drainage system

As the development is in flood zone 1 and is classed as more vulnerable, the advice from the Environment Agency is that the central climate change allowance, which is 25%, should be considered. After considering the effects of this increase the higher central allowance, which is 35%, should be considered to assess the effect of this.

IDB's have been using an allowance of 20% for climate change over the past few years in their assessments and modelling of their systems. Generally IDB's are happy that their systems provide a 1 in 100 year standard to most urban areas at the present time.

Welland and Deepings IDB, and all IDB's, are aware that climate change will affect the operations of pumping stations, sluices and drainage channels. Pumping stations and sluices only have a 30 year life and will need to be refurbished or rebuilt within this timespan. It is assumed that Welland and Deepings IDB will continue to review the modelling they have already carried out and when the Board consider these refurbishments adequate arrangements will be made to incorporate the latest climate change projections in order that the Board continues to provide the same standard of service as the present day.

Therefore it is considered that the mitigation proposed for the development, with the recommendation that the floor levels should be a minimum level of 4.90m OD, is satisfactory.