PROPOSED RESIDENTIAL DEVELOPMENT AT COALBEACH LANE SOUTH, SURFLEET, SPALDING

FLOOD RISK ASSESSMENT



View from southern boundary of site

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

This flood risk assessment has been prepared solely to support the planning application for the development at Coalbeach Lane South, Surfleet. The author has made every effort to provide an accurate assessment of the flood risk but accepts no liability should the information be found to be incorrect or incomplete, or if it is used for any purposes other than for which it was originally commissioned.

Introduction.

A planning application is due to be submitted to South Holland District Council to carry out a residential development on a site with an area of 2.3 hectares west of Coalbeach Lane South, Surfleet, Spalding.

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

For the Planning Application to be valid a flood risk assessment needs to be carried out to conform with the requirements of the Technical Guidance to the National Planning Policy Framework Development and Flood Risk. The site is within a defended area as specified in the South Holland District Council's Strategic Flood Risk Assessment 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.



Application Site

The development site is located north of the River Glen in the village of Surfleet. The National Grid Reference of the site is 526120 328900.

The location 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 †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

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.

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.

All of the available land in the village of Surfleet is within flood zone 3. It is not possible, consistent with wider sustainability objectives, for all new housing within the South Holland area to be delivered within an area of no flood risk and this location is within the existing built up area of Spalding. This site has been allocated in the South Lincolnshire Local Plan 2011 to 2036 to be brought forward for development. The safety of the development will be delivered by ensuring the floor level of the proposed new dwellings are above the predicted residual flood levels for this area.

Therefore I consider that the sequential test has been passed.

Exception Test

The Sequential Test has demonstrated that it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower

probability of flooding. Therefore the Exception Test must be applied and for this to be passed:

- It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risks, informed by the Strategic Flood Risk Assessment; and
- A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking into account of the vulnerability of its users, without increasing flood risk elsewhere, and where possible will reduce flood risk overall.

Both parts of this test must be satisfied in order for the development to be considered appropriate in terms of flood risk. There must be robust evidence in support of every part of the test.

The first section will be demonstrated by the Supporting Planning Statement and compliance with South Holland District Council's planning policies.

This flood risk assessment will demonstrate that the development will be safe for its lifetime and it will not increase flood risk elsewhere.

South Holland DC Strategic Flood Risk Assessment (2010)

Consultants produced a Strategic Flood Risk Assessment (SFRA) in 2010. The modelling and the maps were updated in February 2017 and the SFRA has been rewritten as the South East Lincolnshire SFRA available on the South East Lincolnshire Planning website. These documents provide details of the flood risk in the Council's area. Reference to the maps in the 2010 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, which were not updated in 2017.

For the present day	Depth of flooding … zero
	Extent of flooding .. zero
	Hazard …. Nil
	Velocity … Nil
For year 2115	Depth of flooding … zero
	Extent of flooding …zero
	Hazard … Nil
	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 … zero
	Hazard … Nil
	Velocity .. Nil
For the year 2115	Depth of flooding..... 0 – 250mm

Extent of flooding .. High probability

Hazard … Less than 0.75 (low hazard)

Velocity .. 0 – 0.3m/sec

The hazards are as follows for the 0.1% fluvial or tidal event probability:

For the year 2115 Depth of flooding..... 0 – 250mm

Extent of flooding .. High probability

Hazard … Less than 0.75 (low hazard)

Velocity .. 0 – 0.3m/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.

Tables in the SFRA show the following details of the defence bank on the east side of the tidal section of the River Welland north of the River Glen outfall sluice, between chainage 15.0km and 16.1km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.99m OD	6.32m OD	7.13m OD
Peak 1 in 1,000 year extreme tide level	6.32m OD	6.65m OD	7.46m OD

With an average defence crest level between 7.50 and 7.70 m OD, apart from one low recorded level of 7.30m OD, the minimum freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1510mm	1180mm	370mm
Peak 1 in 1,000 year freeboard	1180mm	850mm	40mm

Tables in the SFRA show the following details for the predicted flood levels in the River Glen at chainage 1.8 km.

	2007	2115
Peak 1 in 100 year flood level	4.16m OD	4.65m OD
Peak 1 in 1,000 year flood level	4.24m OD	4.68m OD

The bank levels on this section vary between 4.57m OD and 5.35m OD on this length of the River Glen. Therefore it can be seen there is a risk of overtopping of the lower lengths of the River Glen overtopping in the 1 in 100 year event in 2115.

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 2007.

	2007	2115
Peak 1 in 100 year flood level	4.17m OD	5.09m OD
Peak 1 in 1,000 year flood level	4.25m OD	5.23m OD

The predicted flood levels for 2115 seem to have been computed ignoring any effect of overtopping that will occur between Bourne and the outfall.

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", which is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding occurring due to overtopping or failures of the defences is considered to be very low.

The site is located approximately 2.1 km from the tidal section of the River Welland, which has a tidal defence bank which is maintained by the Environment Agency.

The site is located 90 metres north of the River Glen which is maintained by the Environment Agency.

There are watercourses in the area that are maintained by Welland and Deepings IDB.

Site Levels

A topographical study has been produced and this drawing will be included with the planning application. A number of these levels have been shown on a plan which can be found on page 12 of this report. Levels on the site vary between 3.22m and 3.70m OD. The lowest land is at the northern end of the site where the lowest level is 3.22m OD. There is a second low area towards the southern end of the site where the lowest land level is 3.33m OD. Most of the rest of the site is higher with levels of between 3.40 and 3.60m OD. The land is slightly higher still with levels between 3.60m and 3.70m OD along the south east boundary behind the existing properties in Coalbeach Lane South.

The road level in Coalbeach Lane South is 3.37m OD adjacent to the eastern side of the site and rises to a level of 4.50m OD where it joins Station Road.

Existing Flood Alleviation Measures

The site is 1.9km 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 and road shown in the tables in the SFRA written in 2010 is between 4.80m and 4.90m OD. The maximum predicted levels in the River Glen at this location in the 2010 SFRA are 4.65m and 4.68m OD

for the 1 in 100 and 1 in 1000 year events in 2115. 4.12m OD for a 1 in 1000. Therefore there is adequate freeboard and a robust bank with a 7.0 metre top on which a tarmaced road is laid, and the risk of a breach occurring at this location can be considered extremely low.

The 2016 EA 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 between 4.80m and 4.90m OD there is a risk of some overtopping in 2115, and it is likely that further flood defences will be required within the next one hundred years.

The proposal that properties will be raised by at least 300mm above existing ground level will mean that this risk will be 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 to be adequately mitigated.

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 1.45 metres 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 approximately 2.0 metres above the predicted maximum flood level in the IDB drain flooding from this source can be considered to be adequately mitigated.

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.

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). Updated SFRA maps were issued on the South East Lincolnshire Local Plan website in March 2017. The modelling and mapping note advises that the new maps do not take into account of the new climate change guidance (February 2016) issued by the Environment Agency. The notes in Appendix A conclude that no extra mitigation measures are necessary to comply with the new guidance on climate change.

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. As the development is in flood zone 3 and the flood hazard is “Low Hazard” (Less than 0.75) reference should be made to Category F9 which states:

The Environment Agency requires direct consultation in this hazard zone. 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) must be informed by the predicted flood depth maps (refer to the relevant 2115 1% fluvial and 0.5% tidal maximum depth map) and set as required below (single storey proposals must set FFL’s above the 0.1% event breach depth in the 2115 scenario).

For predicted flood depths of 0 – 250mm FFL must be set 300mm above ground level.

The flood risk assessment must also include details of surface water drainage arrangements and demonstrate that the proposal will not increase flood risk elsewhere. The LPA should seek the advice of the LLFA with respect to the adequacy of this element of the assessment.

The small areas where the predicted flood depths are between 250mm and 500mm also have a predicted flood hazard of 0.75 – 1.25 (danger for Some). This puts these areas in Category E9 of the matrix which states:

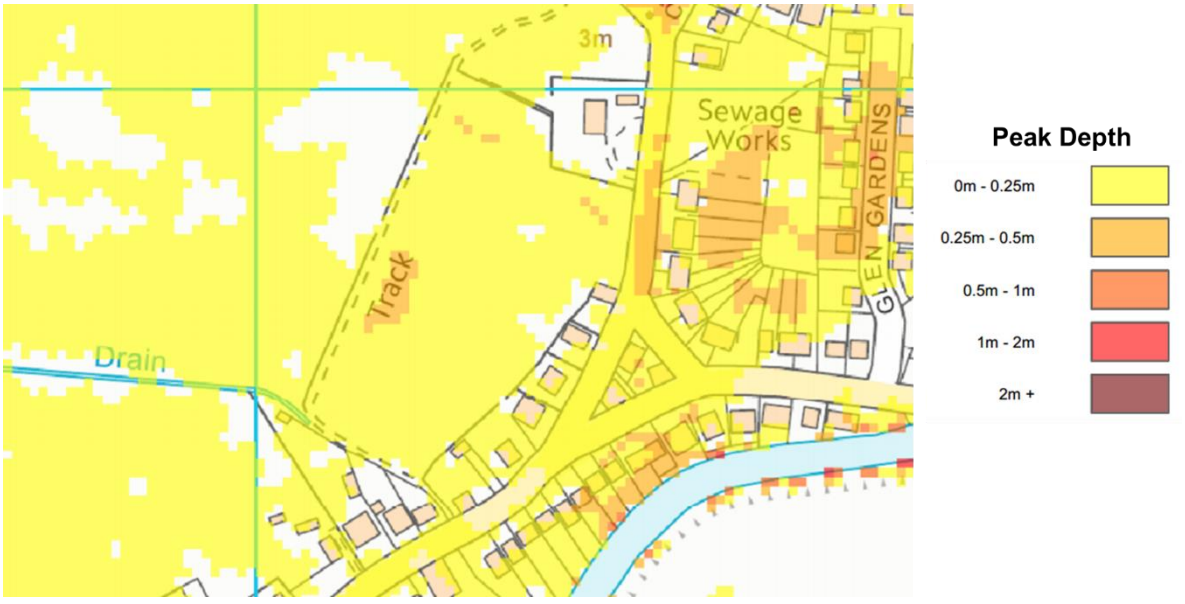
Finished floor levels (FFL) must be informed by the predicted flood depth maps (refer to the relevant 2115 1% fluvial and 0.5% tidal maximum depth map) and set as required below (single storey proposals must set FFL's above the 0.1% event breach depth in the 2115 scenario).

For predicted flood depths of 250mm – 500mm FFL must be set 500mm above ground level with flood resilient construction to a height of 300mm above the predicted flood level.

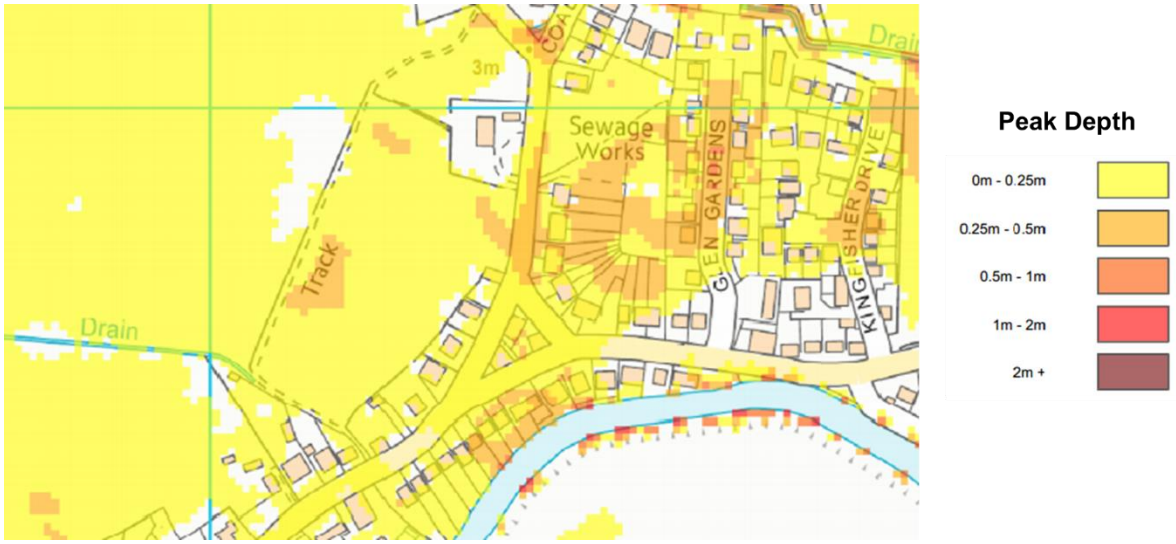
Summary of Residual Risk to the Site

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.

Updated maps showing predicted flood depths were issued on the South East Lincolnshire Local Plan website in March 2017. An extract of the map showing predicted residual flood depths for the 0.5% tidal and 1% fluvial event in 2115 probability on the development site is shown below.



An extract of the map showing predicted residual flood depths for the 0.1% tidal and fluvial event probability in 2115 on the development site is shown below.



Both of the above maps predict similar flood depths in 2115, which is 0 – 250mm depth of flooding over much of the site.

Both of the maps show two small areas where flooding with depths between 250mm and 500mm would occur, and these are in similar locations to where low land levels have been shown on the topographical study. It can be estimated that the boundary between the yellow and the orange zones, where the flood depth is 250mm is approximately 3.40m OD. Therefore the predicted maximum flood level can be estimated to be 3.65m OD, and it is recommended that the ground floor of all of the proposed properties should be at a minimum level of 3.70m OD.

Conclusions

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 watercourse is low.

There is a risk of low level flooding in both the 1 in 100 year and the 1 in 1000 year event in 2115.

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 new dwellings it is preferable that all new buildings should be of two story construction with all sleeping accommodation at first floor level. This is to provide a refuge for residents if the building becomes flooded after a major breach of the tidal or fluvial bank, and ensure there is no danger to residents when they are asleep.

The finished floor level of the all of the proposed buildings should be raised at least 300mm above the existing ground level with a minimum level of 3.70m OD. It is then considered that all of the properties can be considered to be in category F9 of the

matrix (see pages 8 and 9 of this report) and flood resilient construction will not be required.

The developer should advise owners and occupiers of the proposed properties to register with the Environment Agency's Floodline Warnings Direct Service.

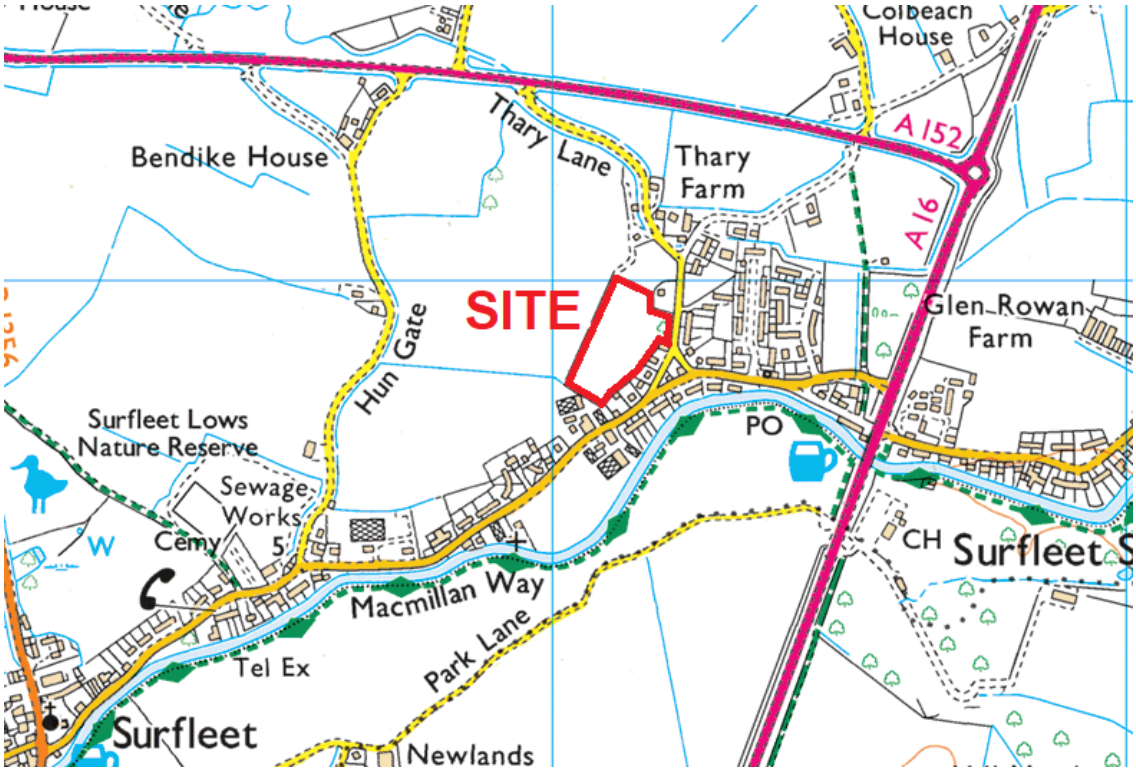
The surface water from the roofs of the proposed buildings should if possible be discharged into soakaways. These should be designed to comply with the recommendations of BRE 365 and approved under the Building Regulations. A separate drainage strategy will accompany the planning application with more details of the proposed method of surface water disposal for this site.

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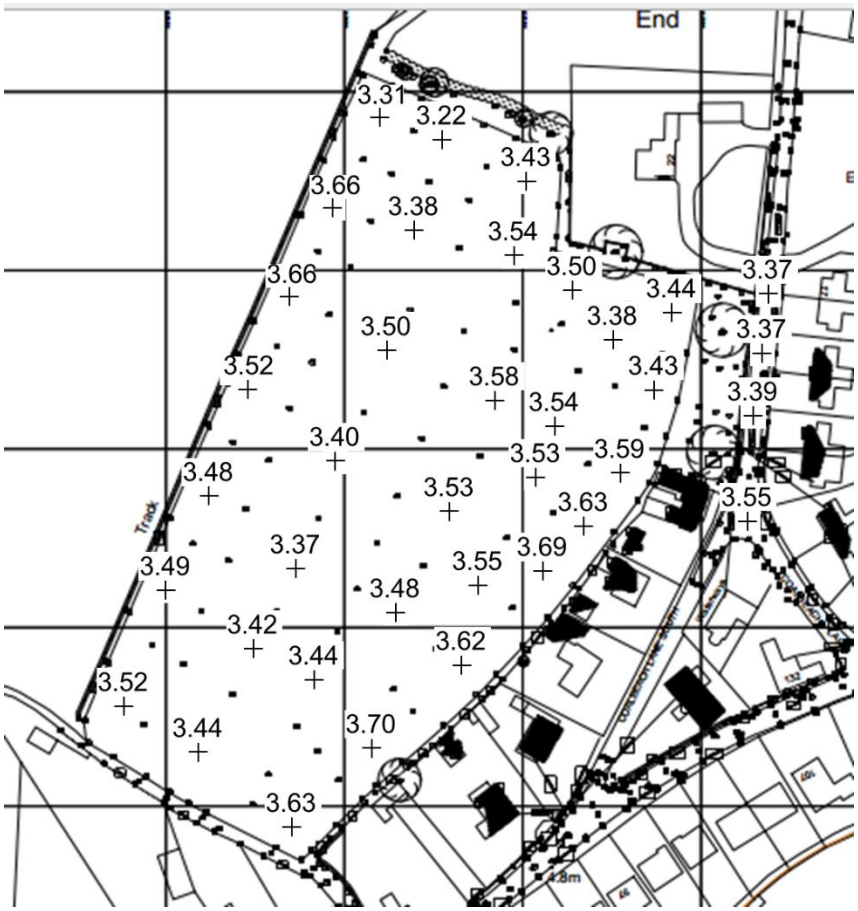
stuart.hemmings@btinternet.com

2nd March 2020.

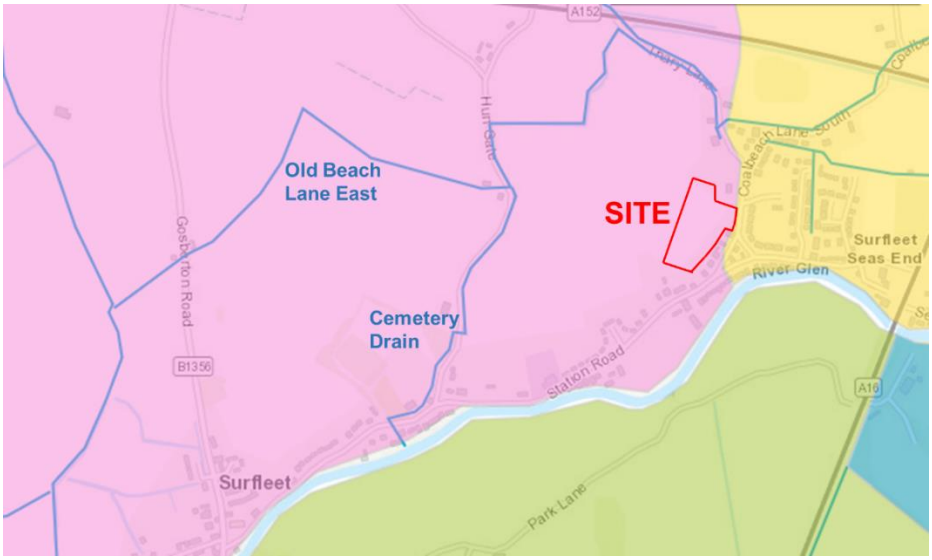
LOCATION PLAN



PLAN SHOWING SITE LEVELS



PLAN SHOWING IDB DRAINS



PLAN OF PROPOSED DEVELOPMENT



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 e.g.

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 three 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 part of the River Welland.
2) Flooding from the fluvial River Glen
3) Flooding from IDB drainage systems.

1) Flooding from the tidal part of the 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 east of the site. However it will not change the conclusions and recommendations in this report.

2) Fluvial Flooding from the River Glen

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 Glen. If there are additional flows along this part of the River Glen it will lead to 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 Glen is an embanked watercourse between Surfleet and Bourne. If these is a 65% increase in flows the River Glen would overtop the banks in numerous places. Most of the banks west of Pinchbeck are earth banks and it is likely that breaches would also occur in these banks flooding mostly agricultural land. Therefore the consequences in Surfleet are not likely to be significantly different to the maps produced in the SFRA.

3) Flooding from IDB drainage systems.

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 conclusion that the proposed minimum finished floor level of the new buildings should be 3.70m OD is satisfactory.