PROPOSED DEVELOPMENT AT RAVENS BANK, WHAPLODE ST CATHERINE, SPALDING, PE12 6SH

FLOOD RISK ASSESSMENT



View of site looking south west from Ravens Bank

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This flood risk assessment has been prepared solely to support the planning application for a residential development at Ravens Bank, Whaplode St Catherine. 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

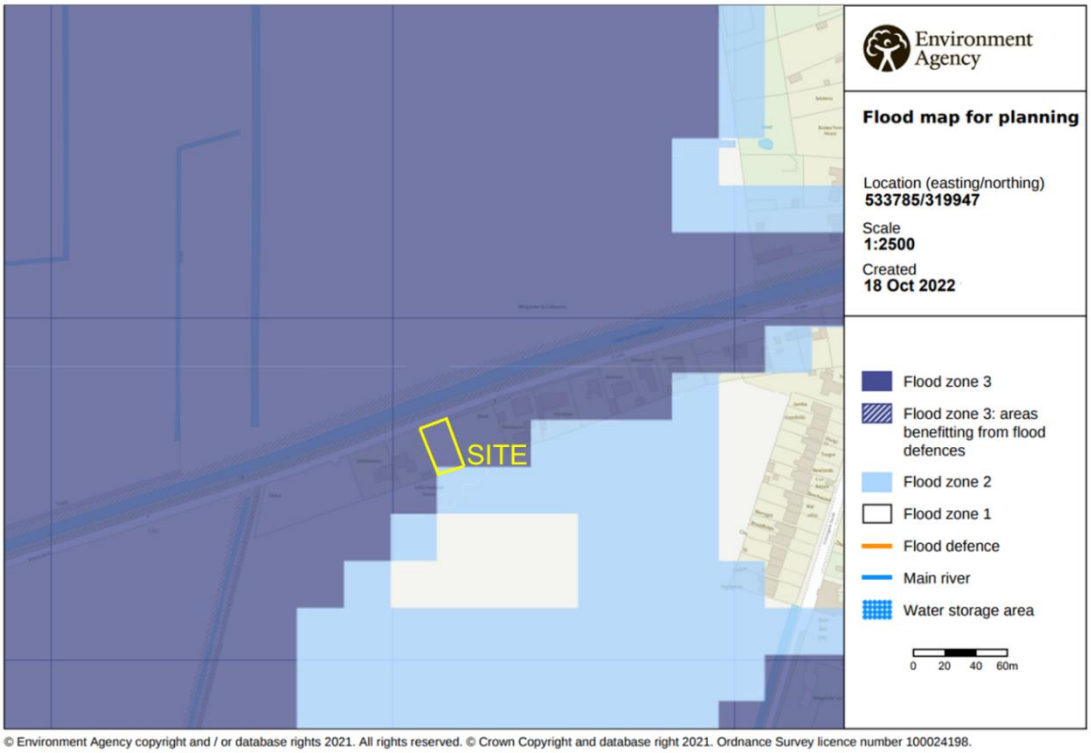
A planning application is due to be submitted to South Holland District Council for permission to construct a single storey dwelling east of the property named Little Holland House at Ravens Bank, Whaplode St Catherine, Spalding, PE12 6SH. The site is an unused plot of land between a number of houses and bungalows on the south side of this section of Ravens Bank.

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 Planning Application requires a Flood Risk Assessment to be carried out as specified in the Practice Guidance to the National Planning Policy Framework Development and Flood Risk. 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 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.



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It can be seen that the site is within flood zone 3. The field south of the site is within flood zones 1 and 2 and all the area north west of the Little South Holland Drain on the north side of Ravens Bank is within 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 533780 319961.

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 categorised as within Flood Zone 3(a) as detailed on the Environment Agency's flood zone maps without defences, as defined in Table 1 of the Technical Guidance.

Applying the flood risk vulnerability classification in Table 2 of the Guidance, a residential development 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	✓*

Therefore it can be seen that for "More Vulnerable" development to be satisfactory in flood zone 3(a) the sequential and exception test should be passed.

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.

In this area of Whaplode St Catherine there are no available sites for this type of development within flood zones 1 and 2 and any available land is within flood zone 3(a).

The South East Lincolnshire Local Plan adopted in March 2019 recognises in paragraph 5.3.5 that infill and speculative applications will come forward within the

South Holland District Council area. It states that there will be numerous opportunities for infill developments which it is not practical to identify, and the plan encourages these type of developments provided that the material considerations of the Local Plan and particular sites are met.

The safety of the development will be delivered by ensuring the floor level of the proposed new dwelling is above the predicted residual flood levels for this area in a 1 in 1000 year fluvial or tidal event in 2115.

Therefore it is considered that the sequential test is 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 Strategic Flood Risk Assessment (SFRA) written for the South Holland District Council (SHDC) in 2010 provides details of the actual flood risk in the Council's area. This information has not been updated and reference to the maps in this document give the following information for the actual flood risk and hazard at the site for the 1% fluvial event and 0.5% tidal event.

For the present day	Depth of flooding …	zero
	Extent of flooding ..	Low or medium
	Velocity …….	zero
For year 2115	Depth of flooding …	zero
	Extent of flooding ..	Low or medium

Peak Velocity …… zero

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 ..	zero
	Extent of flooding …	low or medium
	Hazard ……	zero
	Velocity …….	zero

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

Maximum flood level and bank levels in the River Welland

The maximum levels in this fluvial section of the River Welland 9.0km west of the site are as follows:

	2007	2115
Peak 1 in 200 year level	4.65m OD	4.74m OD
Peak 1 in 1000 year level	4.67m OD	4.74m OD

The defence level (top of Barrier Bank) at chainage 6.8km is between 5.80m and 6.10m OD.

Maximum flood level and bank levels in the River Nene

The maximum levels in this tidal section of the River Nene 13.0km east of the site are as follows:

	2007	2115
Peak 1 in 200 year level	5.79m OD	6.93m OD
Peak 1 in 1000 year level	6.13m OD	7.27m OD

The defence level (top of left bank) at chainage 7.8km near the outfall of the North Level Main Drain is between 7.00m and 7.30mOD.

Maximum flood level and bank levels in the River Welland

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 A16 road bridge and 2.7km west of the development site, between chainage 19.8km and 20.8km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.98m OD	6.31m OD	7.12m OD
Peak 1 in 1,000 year extreme tide level	6.27m OD	6.60m OD	7.41m OD

With an average defence crest level between 7.80 and 7.90 m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1870mm	1540mm	730mm
Peak 1 in 1,000 year freeboard	1580mm	1250mm	440mm

Maximum flood level and bank levels in the Coronation Channel

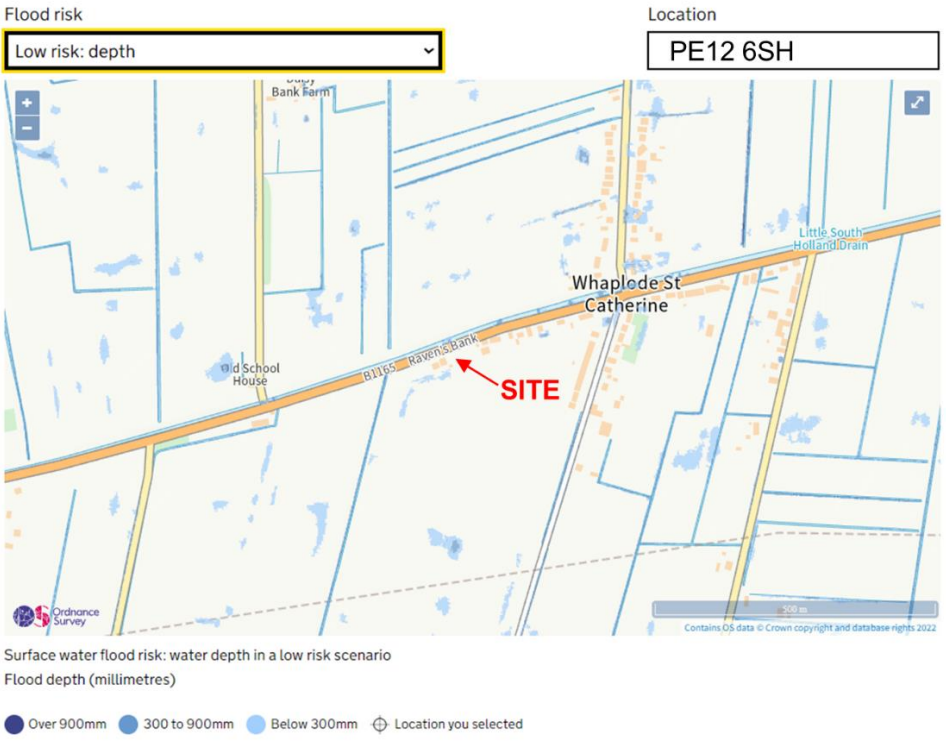
Tables in the SFRA show the following details for the defence bank on the east side of the Coronation Channel at chainage 1.5 km which is 2.7km west of the site.

	2007	2115
Peak 1 in 100 year flood level	4.34m OD	4.69m OD
Peak 1 in 1,000 year flood level	4.37m OD	4.69m OD

The bank levels on this section vary between 5.50m OD and 6.0m OD. Therefore it can be seen there is a minimum freeboard of 800mm to the predicted design maximum levels in 2115.

Information on Surface Water Flooding on Environment Agency Website

The map below shows areas around the site where there is a low risk of surface water flooding.



The light blue areas indicate the low risk of up to 300mm of surface water flooding, and the darker blue areas indicate that between 300mm and 900mm of surface water flooding could occur.

It can be seen the map does not predict any significant surface water flooding on the site.

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 7.9 km from the Barrier Bank on the eastern side of the Cowbit Washes.

The site is located approximately 9.0 km from the nearest tidal section of the River Welland north of Spalding, which is maintained by the Environment Agency.

The site is located approximately 13.0 km from the tidal section of the River Nene, which is maintained by the Environment Agency.

The site is located approximately 8.4 km from the Coronation Channel, which is maintained by the Environment Agency.

The site is located approximately 3.7km north of the South Holland Main Drain, which is maintained by South Holland IDB.

The main watercourses in this area around Whaplode St Catherine are maintained by South Holland IDB.

Existing Ground Levels

The road (Ravens Bank) north of the proposed site has a level of approximately 3.00m ODN.

The existing ground level on the site is approximately 2.40m ODN and the field south of the site is approximately 300mm below the level of the site.

The water level in this section of the Little South Holland Drain on the north side of Ravens Bank is normally retained at approximately 0.0m ODN.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Welland.
2. Failure or overtopping of fluvial defences of the River Welland (Barrier Bank).
3. Failure or overtopping of tidal defences of the River Nene.
4. Failure or overtopping of banks of the Coronation Channel
5. High water levels in IDB drainage channels.
6. Localised surface water flooding.

1. **<u>Failure or overtopping of tidal defences of the River Welland</u>**

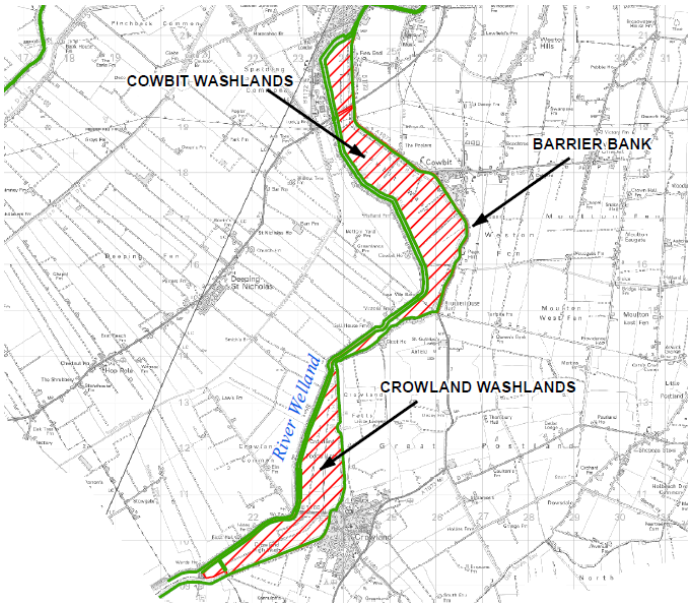
The east bank of the tidal section of the River Welland is approximately 9.0 km north west of the site of the proposed development.

The maps available on the South East Lincolnshire Local Plan website show that there is no predicted risk of flooding in the Whaplode St Catherine area in a 1 in 200 year event in 2115.

Adequate mitigation against the risk of flooding from this source will be provided by raising the ground floor level of the proposed dwelling by a minimum of 300mm above the existing ground level.

2. **Overtopping of the Barrier Bank.**

The section of the River Welland from south of Crowland to the southern outskirts of Spalding has two washlands located on the east side of the River, called Crowland Washlands and Cowbit Washlands. These areas are designed to alleviate very high water levels in the River Welland. When the water level in the River Welland reaches a level of approximately 5.00m OD large syphons are activated which discharge excess water onto the Washes. The Barrier Bank is located on the east side of the Washes to contain the water in the Washlands and is the main flood defence bank on the east side of the river.



The Washes are only flooded in extreme conditions (around 1 in 50 years) and are used the rest of the time as agricultural land. If a breach occurred in the Barrier Bank in this scenario then flood water would flow eastwards towards the proposed development.

The risk of flooding from this source, as the site is 7.9km from the Barrier Bank, can be considered to be very low. Adequate mitigation against the risk of flooding from this source will be provided by raising the ground floor level of the proposed dwelling by a minimum of 300mm above the existing ground level.

3. **Failure or overtopping of tidal defences of the River Nene**

The west bank of the River Nene is approximately 13.0 km east of the site of the proposed development.

The maps available on the South East Lincolnshire Local Plan website show that there is no predicted risk of flooding in the Whaplode St Catherine area in a 1 in 200 year event in 2115.

Adequate mitigation against the risk of flooding from this source will be provided by raising the ground floor level of the proposed dwelling by a minimum of 300mm above the existing ground level.

4. **Failure or overtopping of the banks of the Coronation Channel**

The SFRA states that the maximum design level in the Coronation Channel is 4.69m OD. The minimum crest level of the east bank of the Channel is 5.14m OD, which gives a minimum freeboard of 450mm. However, generally there is a freeboard of 600 mm along this bank of the Channel.

If the Channel were to breach water would flow eastwards towards the site. However, it would be retained for a short time by the A16 which is higher than the surrounding land.

With the site being 8.4 km from the Coronation Channel the risk from this source can be considered to be low and adequate mitigation will be provided by raising the proposed floor level of the annex above the predicted maximum flood level.

5. **High Water Levels in IDB drains**

Although the whole of this area is below high tide level in the Wash and the River Nene, the retained water levels in the drainage channels ensure that the risk of flooding is extremely low. South Holland IDB maintains a system of sluices, pumping stations, and drainage channels which convey surface water into the River Nene and the Wash and control water levels throughout the South Holland IDB area.

The site is within the catchment area of Little Holland Pumping Station, which controls the water level in the catchment. The main drainage channel is the Little South Holland Drain which is located immediately north of Ravens Bank and conveys the water to the pumping station which is located 5km east of the development site. The normal water level in the Little Holland Drain is 0.00m ODN, and this will control the water level in the smaller drains in the catchment.

Little Holland Pumping Station pumps the water into the South Holland Main Drain. The water level in this drain is controlled by a sluice alongside Nene Way 1.5km south of Sutton Bridge, where the water discharges into the tidal River Nene at low tide.

There are possibilities of failure of outfall sluices, but these are mitigated by the high level of maintenance given to these structures by the IDB. If a failure did occur the IDB would immediately be warned of the problem by their telemetry system and take action to repair the fault or to bring in temporary pumps to reduce the risk of any

flooding in the area. Similarly any failures of culverts or other blockages would be dealt with immediately.

IDB systems are designed to provide a freeboard of between 600mm and 1000mm to all land in a 1 in 10 year return period rainfall event. This normally provides a standard of service of between 1 in 50 years and 1 in 100 years against flooding. In an extreme event water levels will rise but this will be a slow process and it would be at least 24 hours before levels were high enough to begin to flood low land in the area.

South Holland IDB have a policy of monitoring standards of protection in all their catchments and will carry out improvements to pumping stations, sluices and drainage channels to ensure they continue to provide satisfactory standards of protection with higher run-offs predicted with climate change.

It is unlikely that any failure of assets such as pumping stations, sluices or drainage channels would lead to overtopping of the watercourse because South Holland IDB have an excellent maintenance regime and monitor all assets with a modern telemetry system.

Adequate mitigation against the risk of flooding from this source will be provided by raising the ground floor level of the proposed dwelling by a minimum of 300mm above the existing ground level.

6. **Localised Flooding due to failure of local drainage systems**

The maps on the Environment Agency website do not predict any surface water flooding on the site. Any localised flooding that could occur on the site will be adequately mitigated by raising the floor levels of the proposed dwelling by 300mm above the existing ground level.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of this field or any of the adjoining land having been flooded in the past fifty years.

Probabilities and Trends of Flooding

The probability of this development flooding 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 people on the site to make arrangements to protect the dwelling and 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 a breach or overtopping of the tidal defences

The risk of this happening in this case is low and the hazard from any flooding is also low.

Climate Change

The predictions of flood depths for this flood risk assessment use information provided by the Environment Agency which was produced in 2006. The EA have issued new guidance on recommended contingency allowances for predicted sea level 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.

South East Lincs Advice Matrix

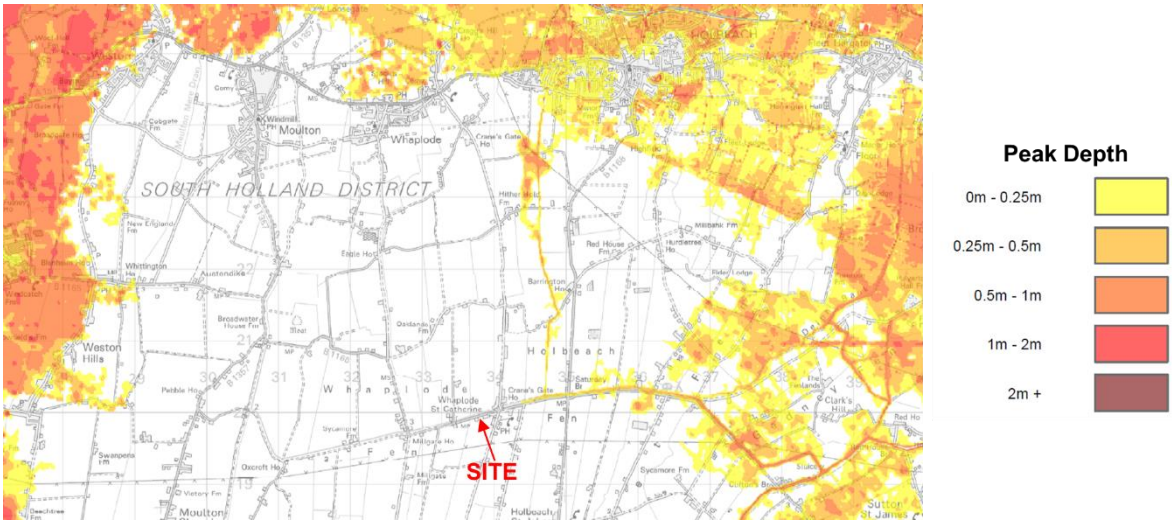
Advice can be found on the recommended mitigation required by referring to a spreadsheet on the South East Lincolnshire website.

As the proposed development is in flood zone 3 and there is no flood hazard reference should be made to Category G8 which states “No Comment”

Summary of Risk of Flooding to the Site

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

The relevant part of the map showing the predicted peak depths in this area if a breach occurred in either the east bank of the River Welland in 2115 in a 0.5% tidal event probability or a breach occurred in the Barrier Bank of the River Welland in a 1.0% fluvial event is shown below.



It can be seen that there is no predicted flooding in a large area north west of the site in a 1 in 100 year fluvial event or a 1 in 200 year tidal event in 2115. The maps available for the Whaplode and Holbeach area show that there is only a small increase in the extent of flooding in a 1 in 1000 year event in 2115 when compared with the map above. Therefore it can be concluded that there is no predicted risk of flooding in a 1 in 1000 year event on this site.

The risk of flooding from high water levels in the IDB system is extremely low.

Recommendations

In any area at risk of flooding it is preferable that proposed buildings in a defended area should be of two storey 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. However as the hazard in this area is low and there is no predicted flood risk in a 1 in 1000 year event in 2115 then it is considered that a dwelling with bedrooms on the ground floor will be satisfactory at this location.

In any area at risk of flooding it is recommended that a new residential building should be raised a minimum of 300mm above the existing ground level.

The owners of the proposed dwelling should register with the Environment Agency's Floodline Warnings Direct Service.

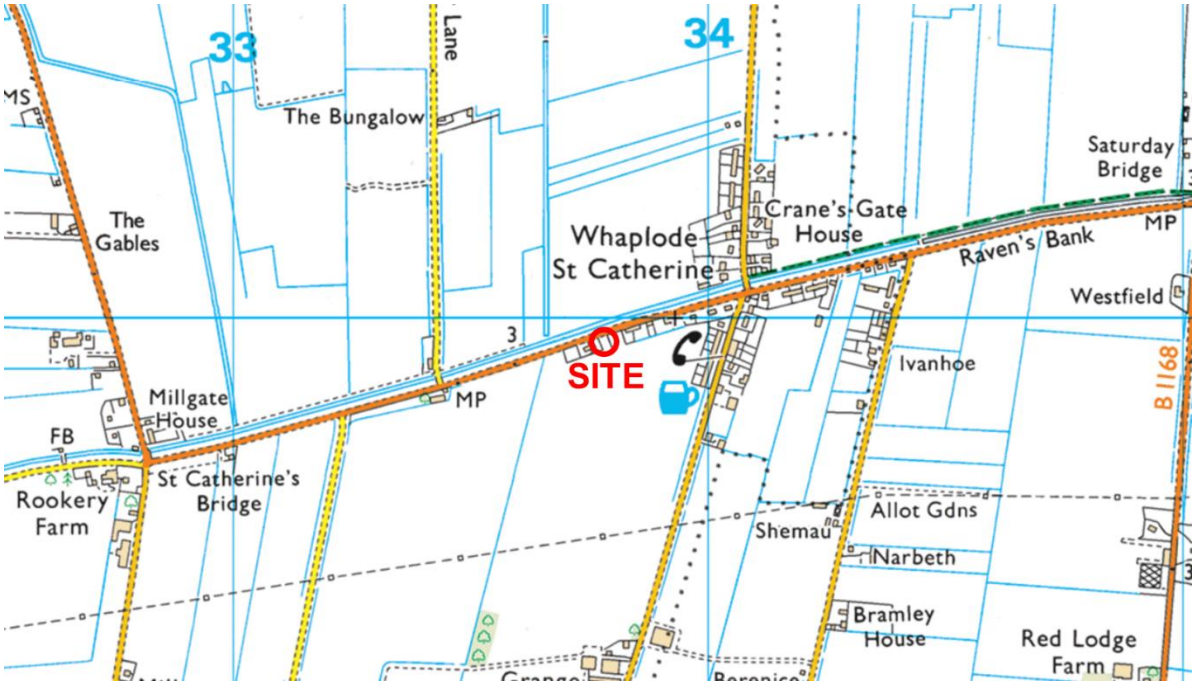
Surface water from the roofs of the proposed building should be discharged into a soakaways.

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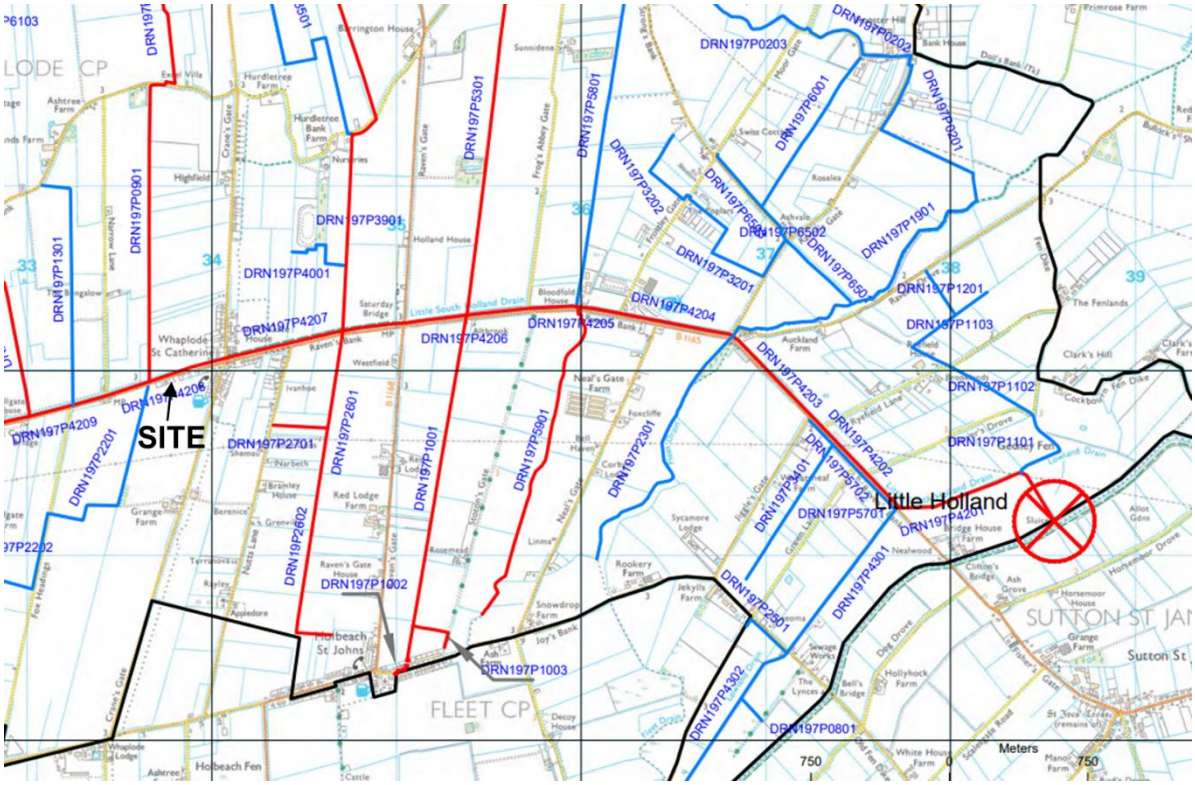
stuart.hemmings@btinternet.com

26th October 2022

LOCATION PLAN



PLAN OF IDB DRAINS



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 the 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

1) Flooding from Tidal River Welland

The FRA has identified the first 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 or River Nene.

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 that are available on the South East Lincolnshire website.

2) Flooding from Coronation Channel, Barrier Bank and the IDB drainage system

As the development is in flood zone 3 and is classed as more vulnerable, the central climate change allowance, which is 35%, should firstly be considered. After considering the effects of this increase the higher central, 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% and 65% will not significantly change the conclusion in the SFRA of what might happen if a breach occurred in the bank of the Coronation Channel. If there are additional flows along the Coronation Channel and 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.

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 it is considered that the mitigation proposed for the development, with the recommendation that the floor level of the proposed dwelling should be raised a minimum of 300mm above the existing ground level, is satisfactory.