

**PROPOSED DEVELOPMENT ADJACENT TO WAYTMOND AT MAIN
ROAD, GEDNEY DROVE END, SPALDING, PE12 9PA**

FLOOD RISK ASSESSMENT



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**Revision A 2nd August 2022 Reference to outline planning added and site
levels amended**

This flood risk assessment has been prepared solely to support the planning application for the residential development at Main Road, Gedney Drove End. 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

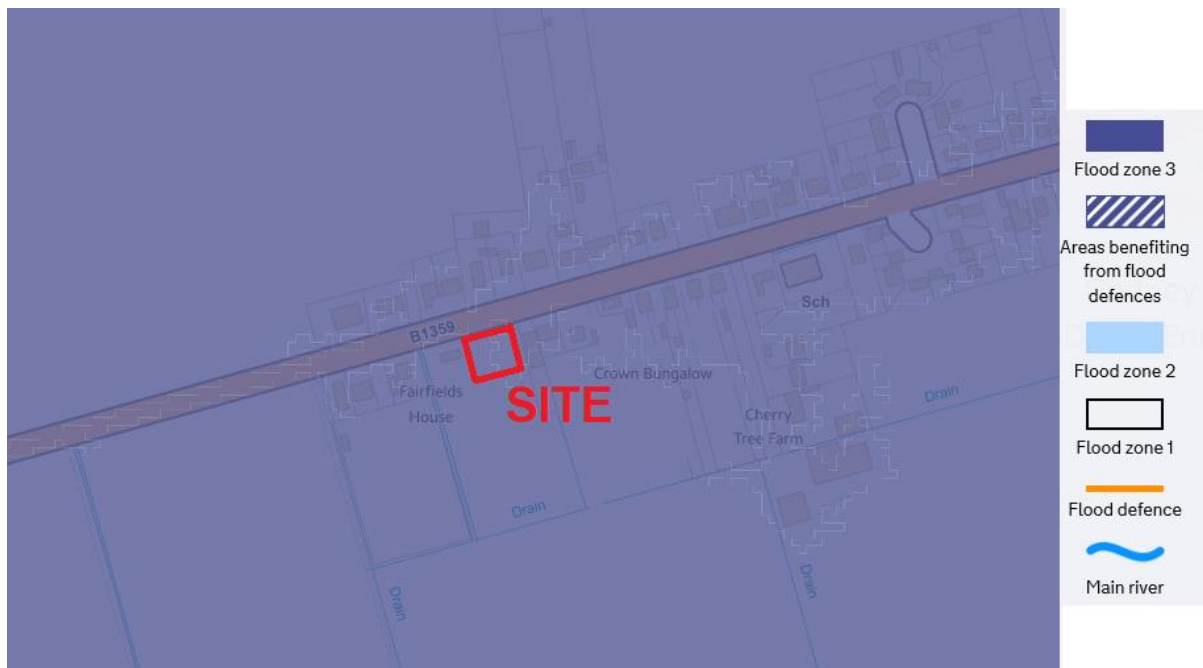
An outline planning application (reference no H06-1185-19) for a residential development east of Waytmond at Main Road, Gedney Drove End, Spalding, PE12 9PA was approved by the Council on 31st January 2020. A full planning application is now due to be submitted to the Council for two three storey dwellings on the site.

The site is within Flood Zone 3 as shown on the Environment Agency's Flood Zone map. These maps do not take into account 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 Development and Flood Risk. The site is within the defended area as specified on 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 Map

The map below is taken from the EA website and shows the whole area to be at risk of flooding from rivers and sea assuming no defences.



Application Site

The development site is located on the eastern edge of the village of Gedney Drove End which is located immediately south of the tidal defences of the Wash. The National Grid Reference of the site is 525473 323072.

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 on the next page:

<u>Flood Zones</u>	<u>Flood Risk Vulnerability Classification</u>				
	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 this area around Gedney Drove End, as can be seen from the map on page 2 of this report, is in 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. It is considered there are no reasonably available alternative sites in Gedney Drove End appropriate for the proposed development located in areas with a lower risk of flooding. 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.

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 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 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 .. zero
	Hazard Nil
	Velocity ... Nil
For year 2115	Depth of flooding ... 0.5 – 1.0 metres
	Extent of flooding ...high
	Hazard ... Significant
	Velocity .. Greater than 0.25 m/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 ...	1.0 - 2.0 metres
	Extent of flooding ..	High probability
	Hazard ...	Greater than 2.0 (danger for all)
	Velocity ..	0.3 – 1.0m/sec
For the year 2115	Depth of flooding.....	1.0 – 2.0 metres
	Extent of flooding ..	High probability
	Hazard ...	Greater than 2.0 (danger for all)
	Velocity ..	0.3 – 1.0m/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.

Figure 16 of the general maps show that the site is not within the rapid inundation zone.

Tables in the SFRA show the following details of the Wash defence banks north east of the site, between chainage 18.0km and 20.0km.

	2007	2055	2115
Peak 1 in 200 year extreme tide level	5.97m OD	6.24m OD	7.05m OD
Peak 1 in 1,000 year extreme tide level	6.64m OD	7.45m OD	7.78m OD

With an average defence crest level between 7.60 and 7.70 m OD the freeboards are as follows:

	2007	2055	2115
Peak 1 in 200 year freeboard	1630mm	1360mm	550mm
Peak 1 in 1,000 year freeboard	960mm	150mm	-180mm

Site Levels

The ground levels on the site were surveyed and a plan showing these is shown on page 11. These levels used a datum level of 3.40m OD on the road north of the site.

The level of the site is approximately 3.00m OD, about 400mm below the level of the road. A level was taken further south in the field which was 200m lower with a level of 2.82m OD. The existing house (Waytmond) west of the site has a ground floor level of 3.25m 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", 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 1500 metres from the coastal defences of the Wash, where the tidal defence bank is maintained by the Environment Agency. There is an Old Sea Bank 850 metres from the site which would hold back water from a breach for a short period of time.

The main watercourses in the area are maintained by South Holland IDB.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of the tidal defences
2. Overtopping of IDB watercourses
3. Blockages or problems in local surface water systems

1. Failure or overtopping of tidal defences

The predicted levels in the SFRA indicate that the tidal defences have a satisfactory height to withstand a 1 in 200 year storm event in 2115, allowing for a 600mm freeboard. However in a 1 in 1000 year event in 2055 and 2115 there is not the required freeboard.

The Environment Agency regularly review the standards of the defences and you would expect that if climate change projections are realised the defences will be raised and improved to retain an adequate standard of defence.

The predicted flood depth in the updated maps available on the South East Lincolnshire website indicate that if a breach occurred in the sea banks in a 1 in 200 year event in 2115 the result could be flood depths of between 1.0 and 2.0 metres on the development site.

Adequate mitigation will be provided by raising the floor levels of all living accommodation above the predicted flood level.

2. Overtopping of IDB watercourses

South Holland IDB maintain the sluices and the major channels in this area. Normal water levels are usually retained at least 1.0 metres below the lowest land level in the area. After heavy rainfall the levels in the drains will increase but on average the IDB drains would prevent flooding of all land and properties in a 1 in 100 year event. However the lowest land in the area is about 3.0m OD and therefore if overtopping of the IDB drains started to occur it would not affect the proposed property. There is a piped IDB watercourse 130 metres east of the site which flows southwards and presumably piped roadside dykes either side of Main Road flow into this drain. The piped drain discharges into open drains which discharge into the Wash through Lutton Sluice. The location of IDB drains are shown on the map on page 12 of this report.

South Holland IDB has a very good maintenance regime for all their structures and watercourses.

Adequate mitigation will be provided by the raising the floor levels of all living accommodation at least 1.7 metres above the existing ground level.

3. Blockages or problems in local surface water systems.

The proposed level of the living accommodation will be raised at least 1.3 metres above the level of Main Road. Therefore there is no risk of surface water systems in the road causing flooding to the proposed living accommodation, and this source can be discounted.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties being flooded.

Probabilities and Trends of Flooding

The probability of this development flooding from the Wash is very low, and less than 0.5% in any year. 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. Tidal flooding, unlike Fluvial Flooding, is predictable well in advance of the event and the site can be prepared to evacuate if advised by the Environment Agency Flood Warning Procedures.

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 13 to 16). 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 "Danger for All" (Greater than 2.0) reference should be made to Category C8 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) should 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).

a) For a predicted flood depth of greater than 1.6 metres:

It is unlikely that mitigation measures would prevent flood water from entering the building at ground level. Therefore, proposals must have a minimum of 2 storeys with no ground floor habitable accommodation. The first floor living accommodation must be above the highest predicted flood depth.

b) For predicted depths of between 1.0 and 1.6 metres

Proposals should have two stories, with FFL set a minimum of 1.0 metre above existing ground level, with flood resilient construction to a height of 300mm above the predicted flood depth, and demountable defences to 600mm above FFL

The conclusions set out below will consider the ground levels on the site and additional information from bank levels and previous FRA's carried out in this area and this will enable a more accurate assessment of the flood level to be made, and a recommended level for the finished floor level of the building.

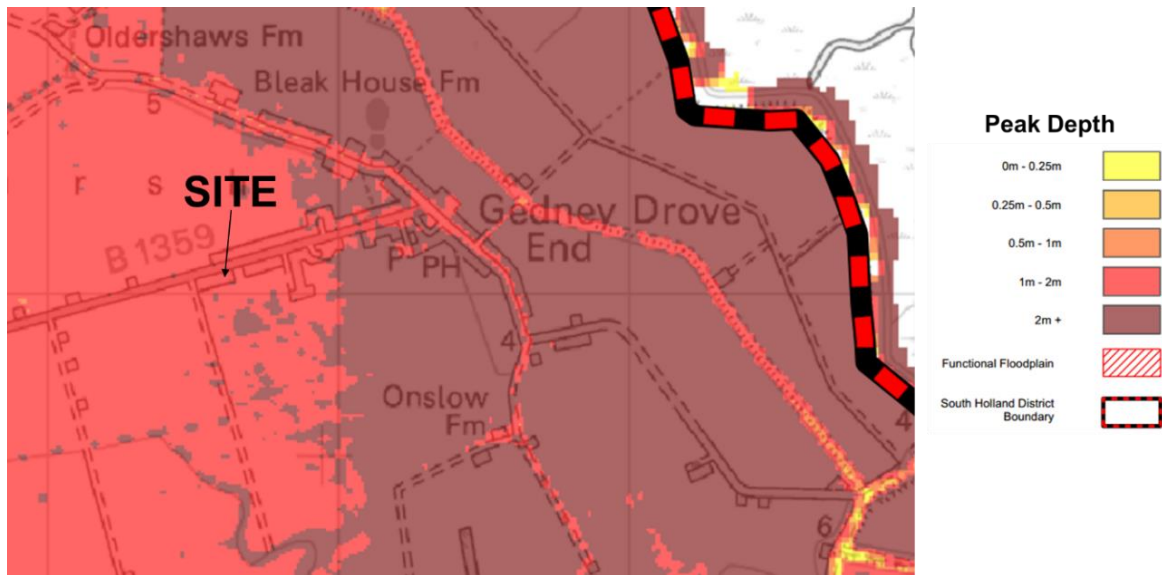
Summary of Residual Risk to the Site

The major flood risk at this location is from a very high tide level in the Wash caused by circumstances that lead to the flooding that occurred in 1953.

If a breach occurred in the sea bank with the tide levels predicted for a 1 in 200 year event, the scenarios indicated on the flood maps in the SFRA would occur.

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 probability on the development site is shown on the next page.



The map predicts that the flood depth on the site would be between 1.0 metres and 2.0 metres if a breach of the sea defences occurred in this scenario. A closer inspection of the map above shows that there are areas of land south of Main Road where flood depths will be greater than 2.0 metres. Levels of 2.93m and 2.82m OD were recorded south of the site and it could be assumed that areas of land where flood depth is predicted to be greater than 2.0 metres will be below 2.70m OD.

If this level is used then a maximum flood level of 4.70m OD can be assumed and therefore the average predicted flood depth on the site will be 1.7 metres.

There is a secondary sea bank which is located approximately 500 metres behind the main sea bank which could reduce the impact and predicted flood depth on the development site. It is not known whether this has been allowed for in the latest modelling.

Conclusions

All of village of Gedney Drove End is at risk of flooding if a breach occurs in the sea bank during a 1 in 200 year tidal flood event.

With present day weather forecasts and communication methods occupants would receive adequate warning of a very severe tidal event and would have time to decide whether to evacuate the area before the tidal event occurred.

During daylight hours residents would be able to keep watch on the situation with the sea defences and if they saw a breach occur they would still have adequate time to evacuate the area.

It should be remembered that the risk of flooding events such as described above would only happen in a once in 200 year event, and the likelihood of this happening would be further reduced if the Environment Agency or another authority or organisation raises and strengthens the sea defences in the next 100 years.

The proposed development is not in a functional flood plain as defined by PPS 25.

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 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 bank, and ensure there is no danger to residents when they are asleep.

The finished floor level of the proposed building should be raised to a minimum level of 4.70m OD which is approximately 1.7 metres above the existing ground level and 1.3 metres above the level of Main Road, with flood resilient construction provided to a height of 300mm above the predicted flood level.

Alternately the building could be designed with only storage areas and garages on the ground floor and all habitable accommodation on the first floor. All electrical, heating and other flood susceptible apparatus should be located above the flood level.

If a severe flood warning were to be issued by the Environment Agency then residents would be able to escape to areas not at risk further west along Main Road towards Gedney Dyke.

Occupiers of the property should register with the Environment Agency's Floodline Warnings Direct Service.

The developer should consider incorporating flood resistant/resilient techniques in the construction of the new properties to allow it to be refurbished after being flooded to a depth of approximately 500mm. Consideration should be given to the electrics and heating pipes being distributed at ceiling level rather than at floor level. Materials used for the floor and walls should be able to withstand flooding for a period of at least a week.

It is recommended that occupiers of the property should consider writing a flood action plan which would include plans of what valuable items to move to the first floor refuge, locations of where the services should be switched off, and how the occupants will evacuate the building if that is required.

On site surface water drainage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

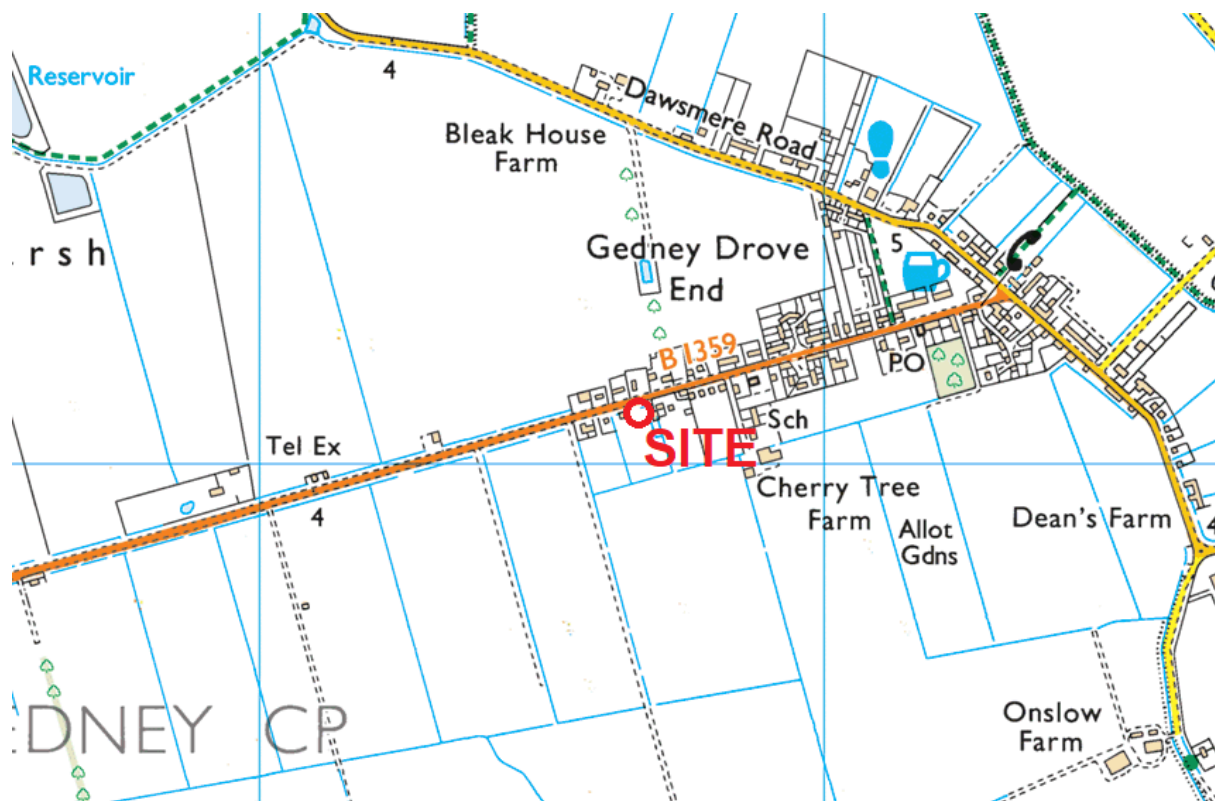
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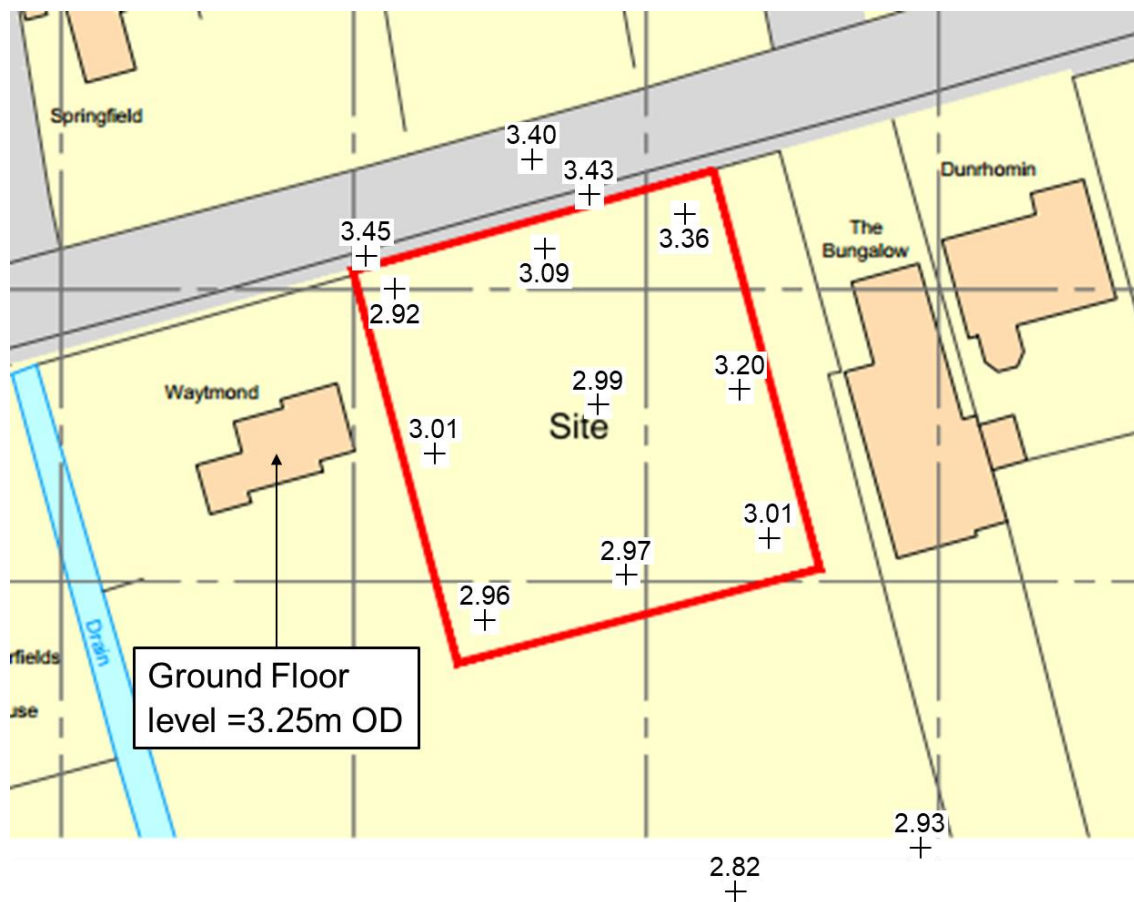
Original report 2nd December 2019

Revision A 2nd August 2022 Reference to outline planning added and site levels amended

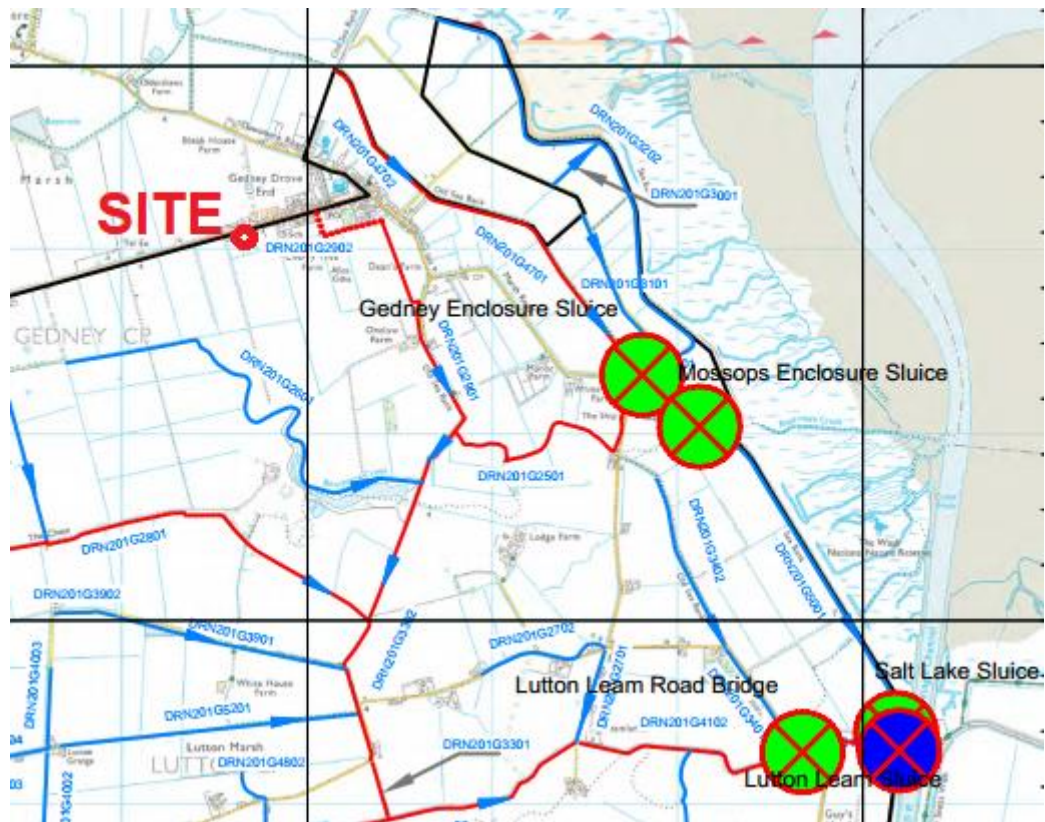
LOCATION PLAN



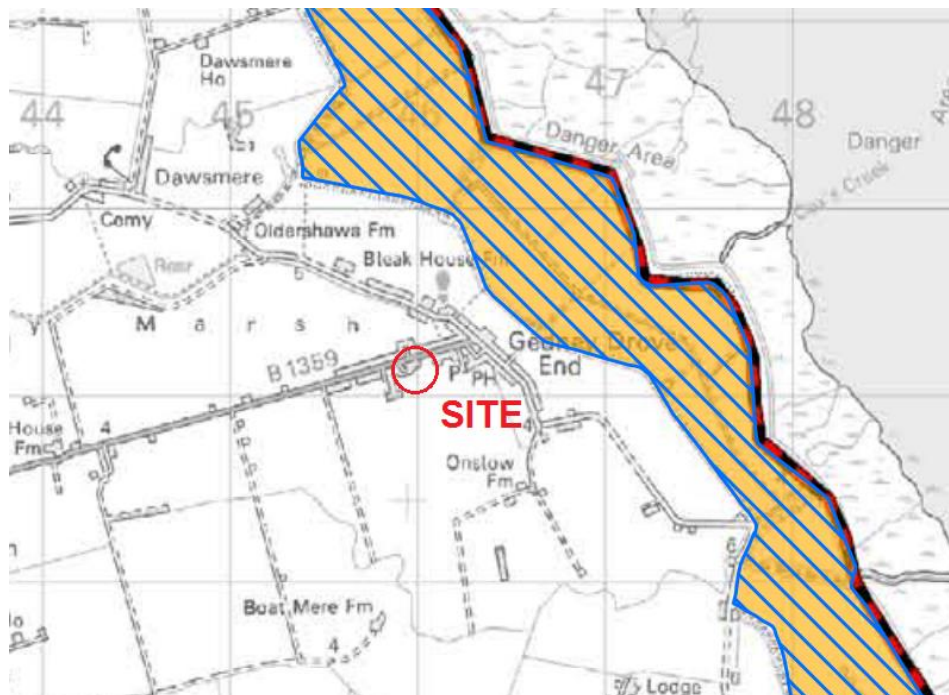
SITE LEVELS



SOUTH HOLLAND IDB WATERCOUSES



RAPID INUNDATION ZONE



APPENDIX A CLIMATE CHANGE

The Environment Agency has issued revised guidance on climate change and have now stated that the new predictions should be considered and incorporated into all flood risk assessments produced after 19th February 2016.

Listed below are the climate change allowances in three documents:

- South Holland SFRA
- EA guidance (2013)
- Revised EA guidance

The recommendations in each document are shown below.

2010 South Holland DC SFRA

The SHDC SFRA states that the the following allowances have been made for climate change:

4.4 Climate Change

Scenarios for the years 2055 and 2115 include for climate change contingency allowances to the amount suggested by PPS25¹. These allowances are expressed in Table 2. Percentage increases are relative to the present-day.

Table 2 – Adopted Climate change contingency allowances

Parameter	Year 2055	Year 2115
Sea level rise (m)	+ 0.33	+ 1.14
Extreme wave height	+ 10%	+ 10%
Peak river flow and volume	+ 20%	+ 20%
Peak rainfall intensity	+ 20%	+30%

Where flows arise from pumping rather than natural run-off, notably in the Vernatt's Drain and for the Fenland subcatchments of the South Forty Foot Drain, peak flow rates for future eras have been taken as equal to current rates since this SFRA assumes all flood risk management measures will remain in their current state.

2013 Guidance to Planners

Guidance to planners was issued by EA in September 2013

Table 1: Recommended contingency allowances for net sea level rises (Net sea level rise (mm per year) relative to 1990)

	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Table 2: Recommended national precautionary sensitivity ranges for peak rainfall intensity, peak river flow, offshore wind speed and wave height

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+5%	+10%	+20%	+30%
Peak river flow	+10%	+20%		
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

Revised 2016 EA Guidance

Table 1 peak river flow allowances by river basin district (use 1961 to 1990 baseline)

River basin district	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper end	25%	35%	65%
	Higher central	15%	20%	35%
	Central	10%	15%	25%

For more vulnerable development in flood zone 3(a) the higher central and upper end should be used to assess the range of allowances.

Table 2 peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

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 Wash.
- 2) Flooding from IDB drainage systems.

1) Flooding from the Wash

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.

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.

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 site in Gedney Drove End 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 conclusion that the proposed minimum finished floor level of the new buildings should be 4.70m OD is satisfactory.