

PROPOSED BARN CONVERSION AT HOLLY TREE FARM,
HALLGATE ROAD, SUTTON ST EDMUND, PE12 0LN.
FLOOD RISK ASSESSMENT



View of barn looking south

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This flood risk assessment has been prepared solely to support the planning application for the barn conversion at Holly Tree Farm, Hallgate Road, Sutton St Edmund. 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

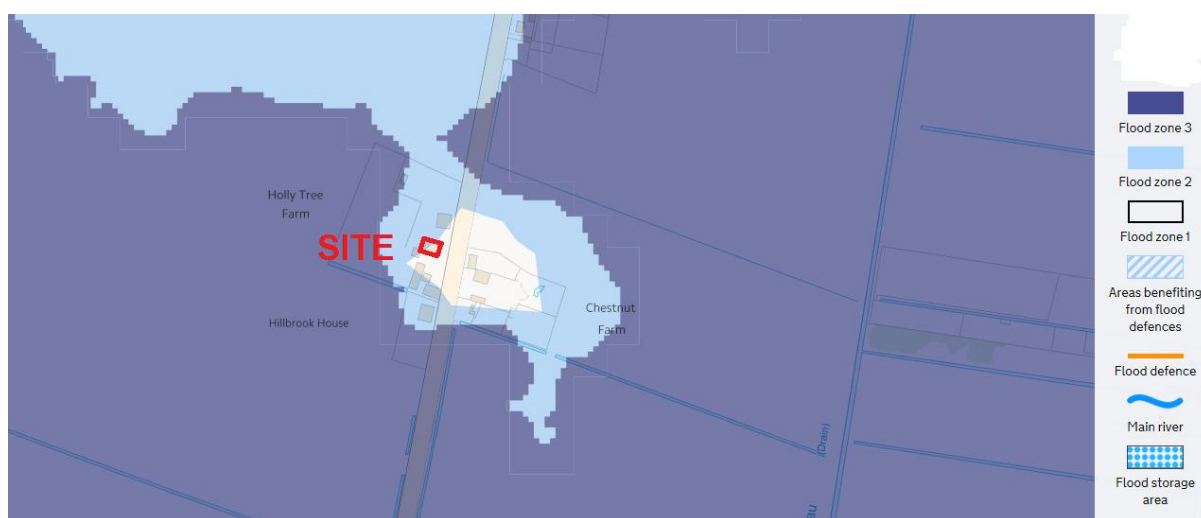
A Planning application is due to be submitted to South Holland District Council to convert an existing barn for residential use to the south of a property called Holly Tree Farm on Hallgate Road, Sutton St Edmund, PE12 0LN.

The site is in Flood Zones 1 and 2 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 North Level 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 half of the site is within flood zone 1 and the western half is within flood zone 2.

Application Site

The development is located 1.1km south west of the centre of Sutton St Edmund. The National Grid Reference of the site is 536000 312490.

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, the development of a dwelling house is classified as “more vulnerable” and Table 3 of the Guidance (see below) states that residential use is satisfactory in flood zones 1 and 2.

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	✓*

Sequential Test

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

The greater part of the area around Sutton St Edmund is within flood zone 3, but the area around Holly Tree Farm is within flood zones 1 and 2 indicating that this area is slightly higher than the surrounding fenland.

Taking into account the guidance, it can be seen that it is extremely unlikely that an alternative site with a lower flood risk could be found in this area. The safety of the development will be delivered by ensuring the floor level of the proposed new refurbished 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. Some greenfield land will need to be identified to enable the Council to meet the RSS and Structure Plan requirement for 2021. Therefore there is a requirement for additional residential development to be provided in the area.

Therefore I consider that the sequential test has been passed.

Strategic Flood Risk Assessment

The following information about the flood risk in the location of this development has been sourced from the maps and reports in the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) dated January 2010, which is the information available on the Council's website at the present date.

Report Maps

Map 3 shows that the site is within flood zone 3.

Map 5 shows that the site is at low or medium risk, but reliant on flood defences for this standard.

Map 6 indicates the peak depth is zero for the present day 1% fluvial and 0.5% tidal event probability.

Map 7 indicates the peak velocity is zero for the present day 1% fluvial and 0.5% tidal event probability.

Map 12 indicates the actual risk is low or medium for the year 2055 1% fluvial and 0.5% tidal event probability.

Map 13 indicates the actual risk is low or medium for the year 2115 1% fluvial and 0.5% tidal event probability.

Map 16 shows that the site is not within a rapid inundation zone.

Flood Maps Table D1

The actual flood hazard for the present day and 2115 is as follows:

Depth of flooding.....	zero
Extent of flooding.....	low or medium, reliant on flood defences
Velocity	nil

The residual flood hazard for the present day and 2115 is as follows:

Depth of flooding.....	zero
Extent of flooding.....	low or medium, reliant on flood defences
Velocity	nil

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 9.3km from the tidal section of the River Nene and at least 21.0km from the Wash defences. The tidal defence banks to both of these are maintained by the Environment Agency.

The site is located approximately 10.6km from the Barrier Bank which is the western defence of the fluvial section of the River Welland.

The major watercourses in the area are maintained by North Level IDB. The Board has carried out improvement schemes over the past fifty years so that IDB watercourses generally provide at least a 1 in 50 year standard against flooding of agricultural land and aim to provide a 1 in 100 year standard to urban areas.

Existing Ground Levels and Proposed Levels of Buildings

The existing house (called Holly Tree Farm) on the northern part of the site has a ground floor level of between 2.70m and 2.80m OD. The ground level slopes downwards and the level of the barn is at approximately 2.00m OD. The levels around the barn vary between 1.60m OD and 2.10m OD which indicates that the barn may well be in one of the lowest part of the area of Holly Tree Farm.

Surrounding field levels are likely to be lower than 2.00m OD. The land levels around the barn will be given further consideration on pages 6 and 7 of this report, and the all of the levels taken on the site are shown on page 11 of this report.

Potential Sources of Flooding

The potential sources of flooding to the site are:-

1. Failure or overtopping of tidal defences of the River Nene or the Wash.
2. Failure or overtopping of fluvial defences of the River Welland.
3. High water levels in North Level IDB drainage channels
4. Localised flooding due to overtopping of dykes adjacent to the property.

1. Failure or overtopping of tidal defences of the River Nene or the Wash

The west bank of the River Nene is approximately 9.3 km east of the site of the proposed development, and the Wash Banks are 21km north of the site. The River Nene defence levels are all above the 1 in 200 predicted levels for 2007 but some lengths of the bank may be overtopped in a 1 in 200 high tide in 2115. Therefore there is a risk of the River Nene overtopping and possibly subsequent breaches if the defences are not raised over the next 100 years.

The latest Environment Agency hazard maps available at the present time indicate that any flooding from this source will not affect the site of the proposed development. Particularly any flood water from the River Nene would be arrested by the North Level Drain. A large area of land east of the site is at a level of between 0.00m and 2.00m OD and this would store a considerable amount of flood water before the development site would be affected. Therefore as the site is 9.3km from these defences the risk to the development site is extremely low, and certainly the predictions are that a 1 in 200 year event in 2115 would not cause flooding to the site.

2. Failure or overtopping of fluvial defences of the River Welland.

The Barrier Bank is the eastern bank of the Crowland Washes, and is 10.6km west of the site of the development. The Washes are only flooded in extreme conditions (around 1 in 50 years) and are used the rest of the time as agricultural land. There are two syphons which operate automatically to allow water to flood on to the Washes and alleviate high water levels in the River Welland. When this occurs the level of water in the washes will quickly rise to around 5.00m OD.

If a breach occurred in the Barrier Bank in this scenario then flood water would flow eastwards towards the development site. However the updated residual flood maps in the updated SFRA do not indicate any flooding in a 1 in 100year event in 2115.

Therefore as this source of flooding is 10.6km from the site the risk of flooding from this source can be considered remote.

3. High Water Levels in North Level IDB drains

Although the whole of this area is below high tide level and the levels in the rivers, the retained water levels in the drainage channels ensure that the risk of flooding is extremely low. North Level IDB control the water levels in the Main Drain with a large pumping station at Tydd Gote where there are both electrically and diesel driven pumps. The water level in the drain is generally retained below -1.0m OD and North Level IDB state that the maximum 1 in 100 year level in the Main Drain at Cloughs Cross is -1.0m OD.

The predicted 1 in 100 year level in 2115 with climate change will probably be 0.0m OD, but it is likely that North Level IDB will continue to model trends in climate change and if required install additional pumping capacity, or provide storage solutions over the next 100 years to ensure the standard of service is kept at the same level as present.

The surface water from the Holly Tree Farm area drains into the IDB drain south of the site and then either flows southwards to discharge into the North Level Main Drain or northwards to Denham's Pumping Station which lifts the water into the Shire Drain which then outfalls into the North Level Main drain downstream of Tydd St Giles.

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.

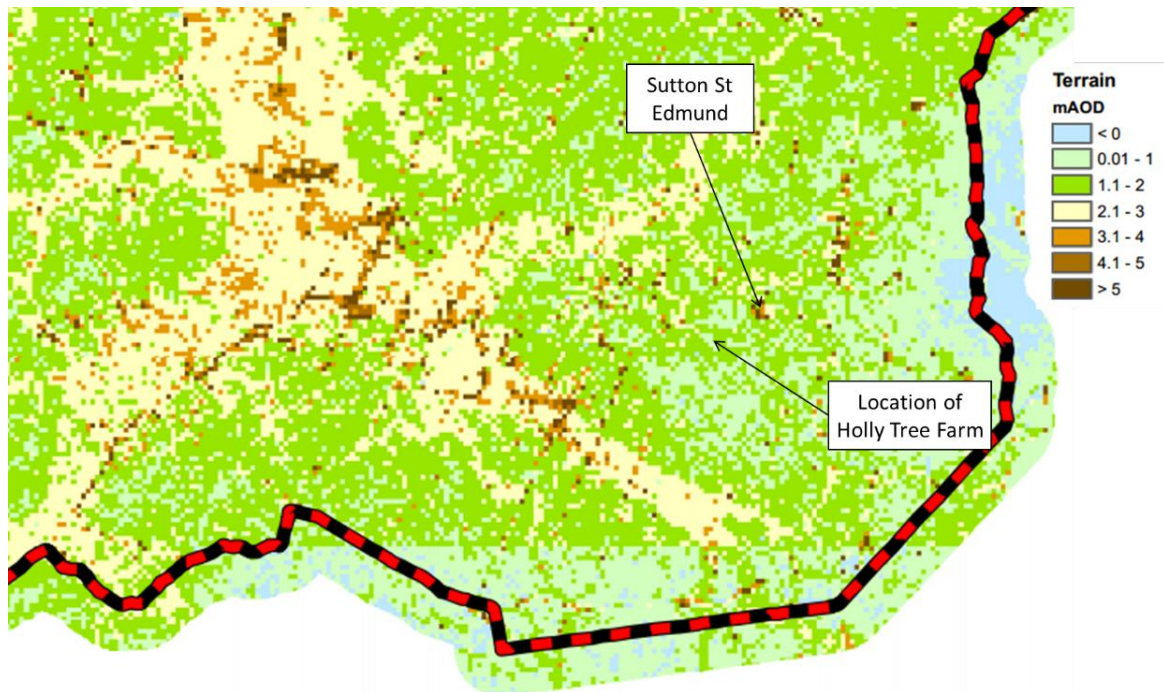
Therefore the risk of flooding from IDB drainage channels can be considered to be extremely low.

4. Localised Flooding in the area

The levels taken in the immediate area of the site indicate that the floor level in the existing barn is lower than some of the surrounding land. Therefore there is a risk that

water could accumulate in this low area and flood into the proposed building. No levels are available of the surrounding fields, or of the whole area of Holly Tree Farm.

Part of a map of the terrain in the South Holland DC area which is taken from the SHDC SFRA is shown below.



This indicates that the land levels are likely to be between 0.0m OD and 2.00m OD, and are probably more likely to be between 0.5m OD and 1.5m OD.

Therefore a precautionary approach is recommended and the ground floor level of the proposed refurbished building should be raised to a level of 2.40m OD. The drawings show a 200mm step down on the outside of the building and the ground level outside the patio doors should be at a level of 2.05m OD.

Extent of known Flooding

During the preparation of this assessment, no evidence was discovered of the existing house or garden or any of the adjoining properties having been flooded in the past.

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 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 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.

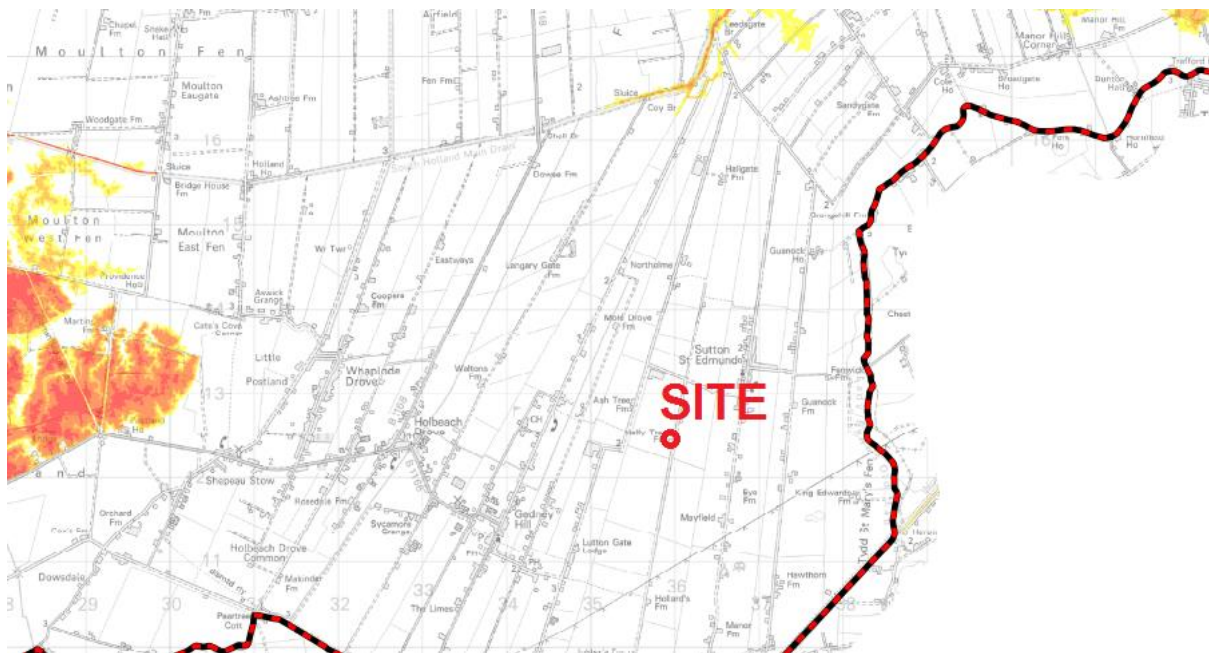
Climate Change

The recommendations for flood depths for this flood risk assessment use information mostly taken from the South Holland DC SFRA which was last updated in 2010. The EA have issued new guidance on recommended contingency allowances for predicted sea rises, fluvial flows and rainfall intensities which from 19th February 2016 needs to be considered in the FRA. The effects of these new recommendations are considered in Appendix A of this report (pages 13 to 16). It is concluded that no extra mitigation measures are necessary to comply with the new guidance on climate change.

Conclusions

The latest SFRA map which has recently been issued onto the South East Lincs website showing 1 in 200 year residual flood depths in 2116 indicate that there is no predicted flooding in the Sutton St Edmund area.

An extract from this map is shown on the below.



The Environment Agency have stated that their policy is to continue to maintain tidal banks in the future with at least a 1 in 200 year standard of service, and therefore the risk of flooding to the site is extremely low.

The risk of flooding to the building from IDB drains can be considered low, especially with the floor level of the proposed building being raised to a level of 2.40m OD.

The IDB have adequate arrangements to bring in contractors and use their own staff if a failure of any part of the sluices occurred. If drains become full any flooding that

occurs would happen very slowly and affect land at levels below 3.0m OD before the site of the proposed development.

The proposed development is not in a functional flood plain.

The site is in flood zones 1 and 2, and the actual risk of the site flooding from any Environment Agency or IDB watercourse is very low. Even if a breach occurs in the east bank of the River Welland or the west bank of the River Nene during a 1 in 1000 year high tide in 2115, it is not likely to reach the site of the development.

If any flooding were to occur in the area it would happen very slowly and local residents would have adequate time to prepare themselves for the event.

Recommendations

In any area at risk of flooding it is preferable that new dwellings should be of two story construction with all bedrooms 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 ground floor level of the proposed dwelling should be raised by approximately 400mm above the existing floor level to a level of 2.40m OD so that it is 400mm above the level of surrounding ground.

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

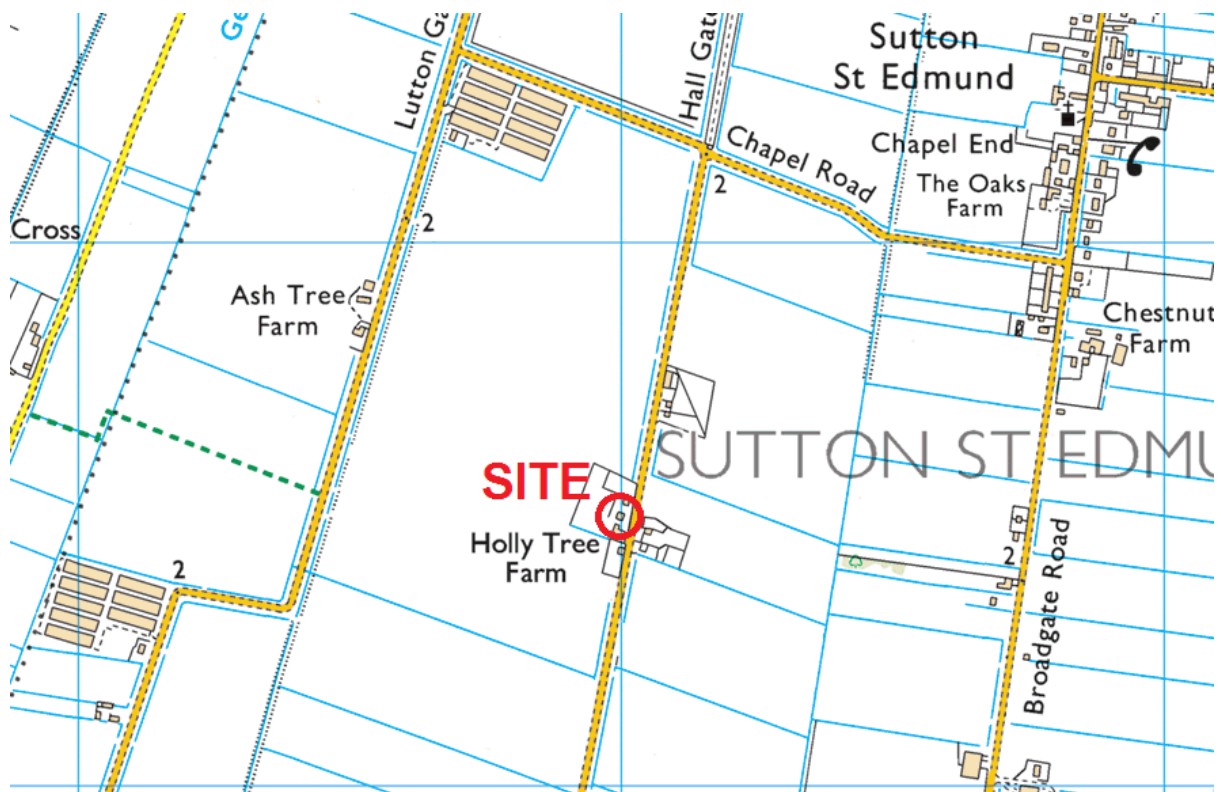
Rainwater from the roof of the house and garage should be discharged into soakaways and these should be designed to BRE Digest 365 and approved under Building regulations.

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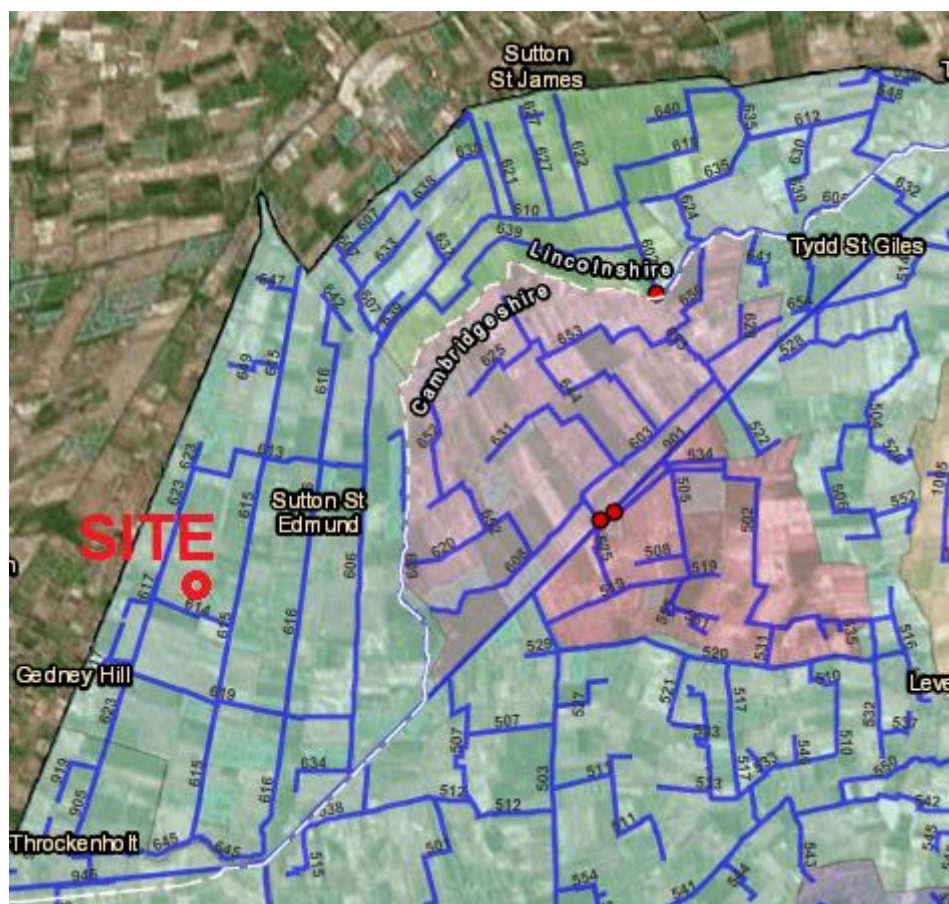
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18th June 2017

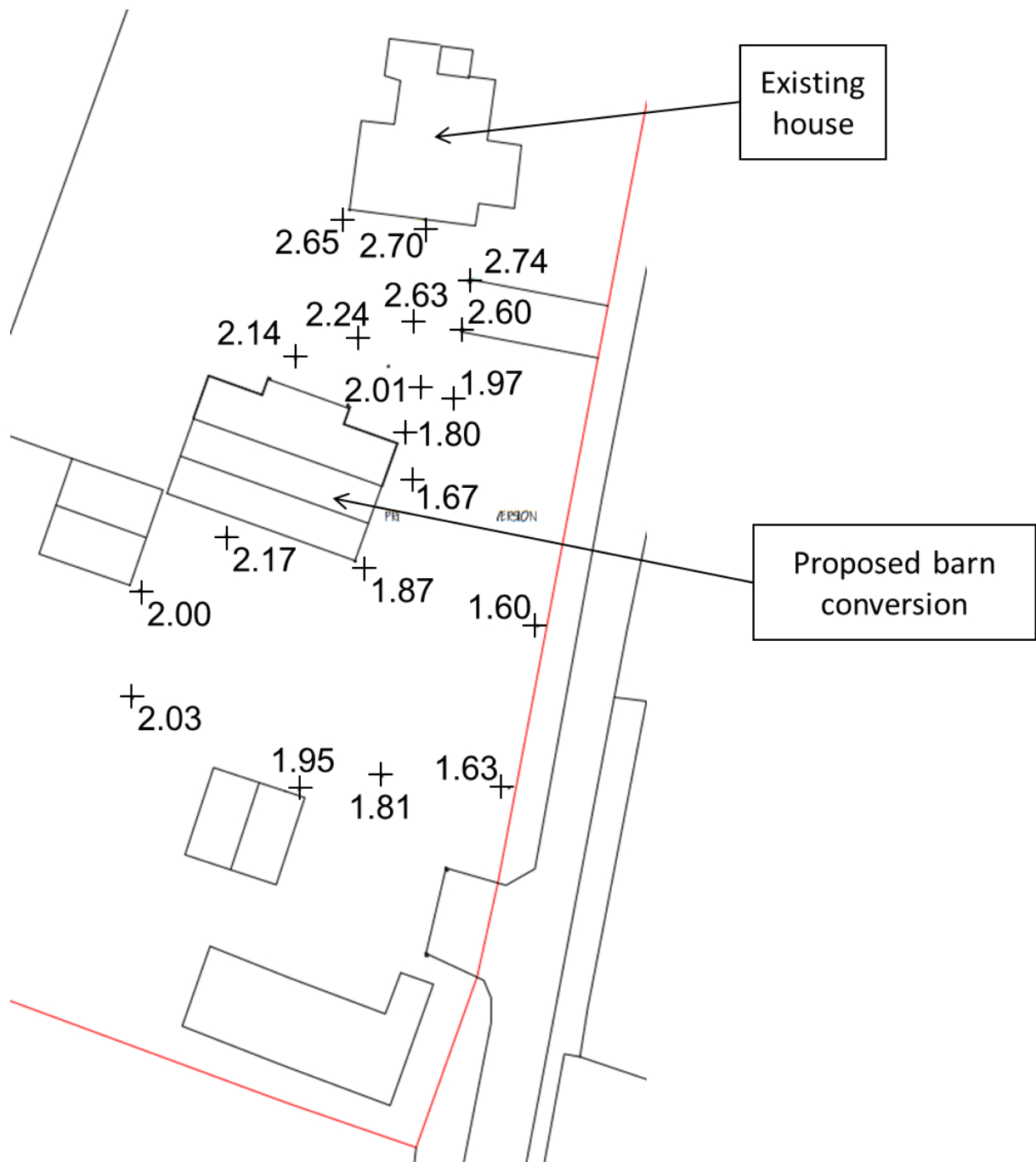
LOCATION PLAN



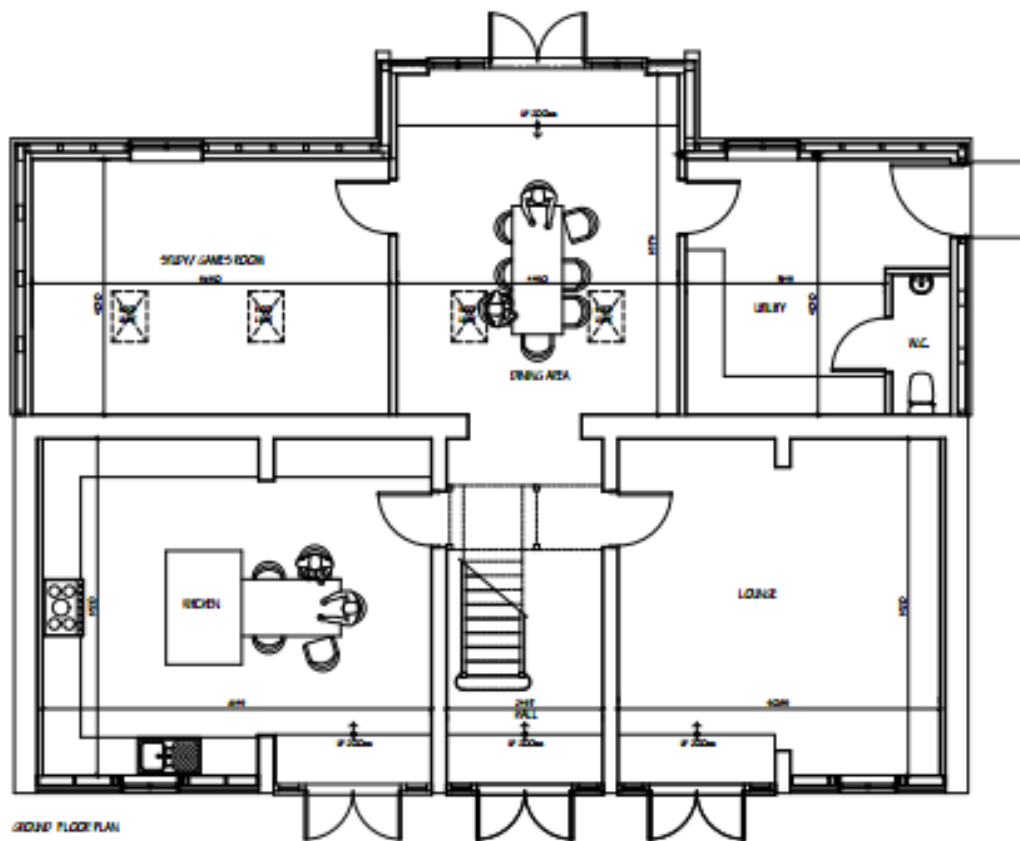
PLAN OF AREA SHOWING IDB WATERCOURSES



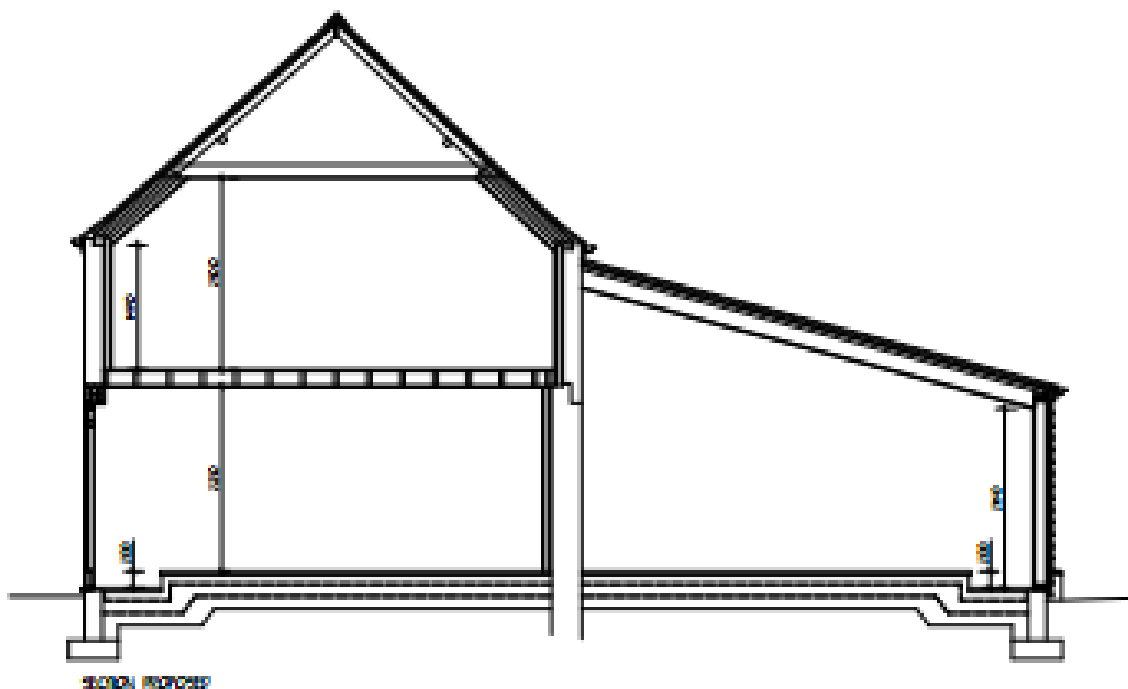
PLAN SHOWING SITE LEVELS



PLAN OF PROPOSED GROUND FLOOR



SECTION THROUGH PROPOSED REFURBISHED BARN



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 zones 1 and 2 the central and higher central figures should be used to assess the range of allowances.

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

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

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

Area of England	1990 to 2025	2026 to 2050	2051 to 2080	2081 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, east midlands, London, south east	4 (140 mm)	8.5 (212.5 mm)	12 (360 mm)	15 (525 mm)	1.24 m

Table 4 offshore wind speed and extreme wave height allowance (use 1990 baseline)

Applies around all the English coast	1990 to 2050	2051 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

Effects on Predictions of Flood Risk in FRA

The FRA has identified two sources of flooding where the new climate change recommendations could affect the predictions of flood levels in 2115 at the development site:

- 1) Flooding from the tidal River Nene, or the Wash.
- 2) Flooding from the River Welland (fluvial)
- 3) Flooding from IDB drainage system.

1) Flooding from a breach in the tidal banks.

The FRA has identified the main source of flooding to be from the tidal River Nene or the Wash. The new climate change recommendations could affect the predictions of flood levels in 2115 at the development site:

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

The new guidance increases the maximum predicted sea level in 2115 by 100mm compared with the allowance made in the SFRA, and in the subsequent maps produced by the Environment Agency and the updated SFRA.

A 100mm increase of maximum tide levels is unlikely to increase flood depths on the site by as much as 100mm. When the flood maps are revised it is unlikely that flood depths are likely to significantly change.

The new guidance on climate change will not change the conclusion that the ground floor of the proposed refurbished barn should be raised to a level of 2.40m OD.

2) Fluvial Flooding from the River Welland.

As the development is in flood zones 1 and 2 and is classed as more vulnerable, the advice from the Environment Agency is that the central climate change allowance, which is 25%, should be firstly 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 Welland will not be increased by the increase in flows projected in the new climate change guidance. If flows increase by between 25% and 35% in this river systems it will have the effect of increased flooding over the long sections of bank between Market Deeping and Spalding and the maximum levels in the River downstream of Crowland will not increase significantly, and the maximum level in the Cowbit Washes are not likely to increase above 5.05m OD.

3) Flooding from IDB watercourses

As the development is in flood zones 1 and 2 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 generally 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 the allowance provides a 1 in 100 year standard to most urban areas.

North Level 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 North Level 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 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 should be a minimum level of 2.40m OD, which is approximately 400mm above the existing ground level, is satisfactory.