FLOOD RISK ASSESSMENT



Chartered Building Engineers
5, Victor Way,
Cherry Holt Road, Bourne, Lincs PE10 9PT
Tel 07778 297733 jda@ndirect.co.uk

Proposal : Demolition of Class Q Consented Agricultural Buildings and Erection of Three Dwellings, Associated Hard and Soft Landscaping and Creation of a Re-wilding Area at Witteman Nurseries South Drove, Spalding. Lincs. PE11 3BD

February 2024 V2

Project No JDA/2023/720

This FRA provides an assessment of the proposals by John Dickie Associates for the Demolition of Class Q Consented Agricultural Buildings and Erection of Three Dwellings, Associated Hard and Soft Landscaping and Creation of a Re-wilding Area at Witteman Nurseries, South Drove, Spalding. Lincs. PE11 3BD

This flood risk assessment has been prepared solely to support the planning application for the above development at South Drove, Spalding. The author has made every effort to provide an accurate assessment of the flood risk but accepts no liability should the

information be found to be incorrect or incomplete, or if it is used for any other purposes other than for which it was originally commissioned.

CONTENTS

1. INTRODUCTION

2. LOCATION

3. THE SITE AND SEQUENTIAL TEST

4. FLOOD HISTORY

5. ASSESSMENT OF THE RISK

6. STRATEGIC FLOOD RISK ASSESSMENT

7. SITE LEVELS

8. EXISTING FLOOD ALLEVIATION MEASURES

9. POTENTIAL SOURCES OF FLOODING

10. CLIMATE CHANGE

11. SOUTH EAST LINCS ADVICE MATRIX

12. SUMMARY OF RISK OF FLOODING TO THE SITE

13. SAFE EGRESS/ACCESS

14. CONCLUSIONS

15. RECOMMENDATIONS

APPENDIX A. CLIMATE CHANGE

APPENDIX B. MITIGATION MEASURES

APPENDIX C. THE NPPF

APPENDIX D. SOUTH HOLLAND SFRA

-

1. INTRODUCTION

1.1 A Full planning application is to be submitted by John Dickie Associates on behalf of Mr N. Witteman to seek permission for the Demolition of Class Q Consented Agricultural Buildings and Erection of Three Dwellings, Associated Hard and Soft Landscaping and Creation of a Re-wilding Area at Witteman Nurseries, South Drove, Spalding. Lincs. PE11 3BD

1.2 Planning approval requires a Flood Risk Assessment to be submitted to the LPA as the site, is shown as situated in Flood Zone 3 of the Agency's Flood Zone Maps. The Assessment is to be prepared to meet the requirements and general principles contained in Paragraph 9 of the Technical Guidance to the National Planning Policy Framework (NPPF).

The latest Agency Maps have been created as a tool to raise awareness of flood risk with the public and partner organisations such as Local Authorities, Emergency Services and Drainage Authorities. The Maps do not take into account any flood defences.

The Class Q Planning Application requires a Flood Risk Assessment to be carried out as required in the Planning Practice Guidance to the National Planning Policy Framework.

The site is shown within the defended area of the South Holland District Council's Strategic Flood Risk Assessment (SHDC SFRA) map.

The site is also located in the South Holland Internal Drainage Board district.



It can be seen from the above EA Flood Mapping that this area south west of Spalding is in Flood Zone 3.

1.3 John Dickie Associates was appointed to undertake a Flood Risk Assessment.

-

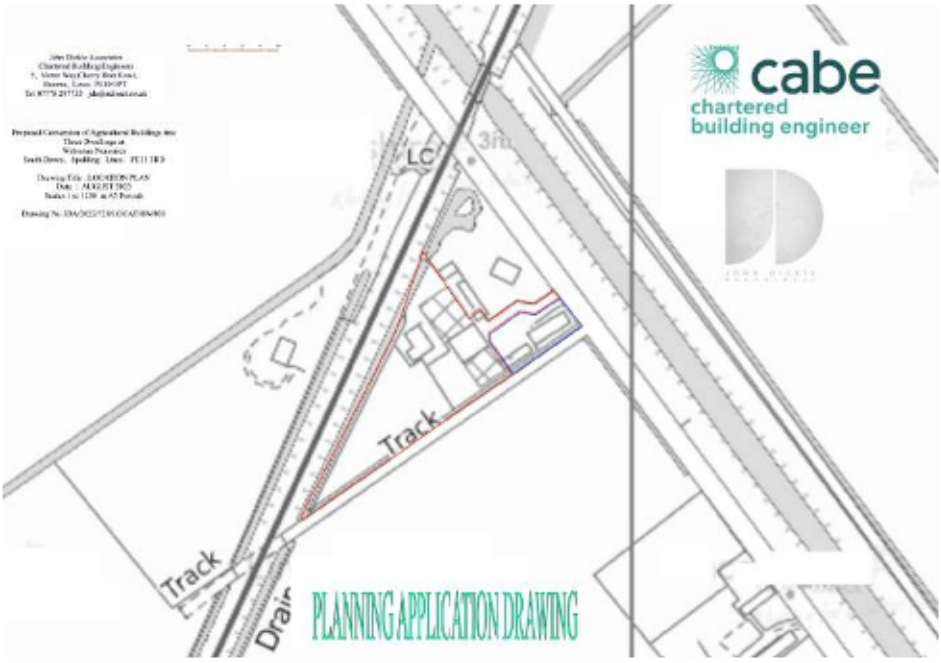
2.0 Location

2.1 The site is located on the South Western side of South Drove land lies on typical flat fenland countryside. Its position means that it will not be subject to rapid inundation from higher land and is not subject to flood flows from elsewhere. Easting 522754 Northing 319804 - TF 22754

2.2 The position and extent of the site are shown on Fig 1 – Site Location and Site Layout Plans at the end of the document.

2.3 The site is shown within Flood Zone 3 as detailed on the Environment Agency Flood Zone Map.

2.4 The site is also located in the North Level Internal Drainage Board district.



3.00. The site and sequential/exception tests
Neither test is applicable in this case due to the extant Class Q permission.

-

4.00 Flood History
From available information there does not appear to be any record of flooding to this site in recent years. The storm events in 2007 had no significant effect.

-

5.0 Assessment of the Risk
Applying the flood risk vulnerability classification in Table 2 of the Guidance, a residential development is classified as “more vulnerable”.

Table 3 of the Environment Agency’s Technical Guidance is set out 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	✓*

Whilst it can be seen that for "More vulnerable" development, the sequential and the exception tests need to be applied to residential development, this process does not apply for the purposes of this FRA, said tests have therefore been scoped out.

-

6.00. Strategic Flood Risk Assessment

Consultants have produced a Strategic Flood Risk Assessment (SFRA) for the South Holland District Council (SHDC). This document provides details of the flood risk in the Council's area. Reference to the maps in this document give the following information for the flood risk and hazard at the site.

The maps illustrate the actual flood hazard for the 1% fluvial event and 0.5% tidal event, and for the 0.1% event.

For the present day Depth of flooding … zero

Extent of flooding .. Low or medium flood probability

Peak Velocity ……. Nil

For year 2115 Depth of flooding … zero

Extent of flooding…. Low or medium flood probability

Peak 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 …500mm – 1.0 metre
Extent of flooding .. High
Hazard rating…… 1.25 – 2.0 (Danger for most)
Peak Velocity .. 0 – 0.3 metres/second
For the year 2115 Depth of flooding … 500mm – 1.0 metre

Extent of flooding .. High
Hazard rating…… 1.25 – 2.0 (Danger for most)
Peak Velocity .. 0 – 0.3 metres/second
Figure 16 of the general maps show that the site is not within the rapid inundation zone for the present day and 2115.

Maximum flood level and bank levels in the River Welland
The maximum levels in the River Welland east of the site are as follows:

	2007	2115
Peak 1 in 100 year level	4.50	4.67
Peak 1 in 1000 year level	4.51	4.67

The defence level (top of left bank of the river) is between 5.85m OD and 6.0m OD.

-

7.00. Site Levels
The level of South Drove on the South eastern boundary of the site varies from 2.41m to 2.48m OD.
The land levels on the site are between 2.2m and 1.54m OD.
A plan showing all these levels is shown on the accompanying topographic Survey.

Surface water run-off from the development represents a significant reduction to the existing impermeable conditions by some 40% ;

-

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

The edge of the site is 26 metres from the top of the bank of the South Drove Drain. The water levels in South Drove Drain are controlled by the Pode Hole Pumping Station, which is maintained by Welland and Deepings IDB.

The site is approximately 600 metres west of the River Welland, which is a 'main river' and maintained by the Environment Agency.

-

9.00. Potential Sources of Flooding
The following sources of flooding have been identified:
1) Due to high water levels in South Drove Drain.
2) Failure or overtopping of the west bank of the River Welland.

3) Failure or overtopping of tidal defences of the River Welland

4) Overtopping of IDB drainage systems.

5) Flooding from local surface water systems.

Examination of flooding sources ;

1. High Levels in South Drove Drain
The water level in South Drove Drain, which is maintained by Welland and Deepings IDB (W & D IDB) is controlled by Pode Hole Pumping Station. There are both electrically operated and diesel powered pumps which are operated at this location to control water levels. W & D IDB have stated that the normal pumping level is -1.20m OD and the maximum design water level in a 1 in 100 year event would be 0.18m OD. With climate change this could increase to around 0.7m OD.

However, one would realistically expect Welland and Deepings IDB to carry out regular improvements to their system to ensure that the present standard of service does not reduce due to climate change over the next one hundred years.

Although the likelihood of water levels rising to 2.00m OD in South Drove Drain is considered remote, if this occurred then low land around Deeping St Nicholas would start to flood and therefore the level in the Drain would be unlikely to increase further.

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

2. Failure or Overtopping of the west bank of the River Welland
The River Welland is located 600 metres east of the site.

The maximum 1 in 1000 design level in the River Welland is 4.67m OD. The minimum level of the west bank of the River Welland at this location is 5.85m OD. It follows that, as long as the bank does not fail there is no danger of this bank overtopping, and causing flooding to the proposed converted buildings.

If the West bank breached at a location due East of the site water would first flow Westwards from the River Welland and would flood the houses on the east side of the B1172. There would be in the order of 1.0 metre depth of flood water when it would then flow over the B1172 road and start to flow into the South Drove Drain, and the level of both South Drove and North Drove Drain would start to increase. Although the IDB would operate as much of their pumping capacity as possible in this situation to alleviate the situation, water levels would likely rise to 2.0m OD in a short time. The land around Deeping St Nicholas would then begin to flood and there would not be a further rapid increase in water levels in the Drain. The flood maps in the SFRA indicate flood water would start to flood South Drove and the area of land west of this road in a 1 in 100 year event in 2115.

As the Environment Agency maintains the banks of the in good condition and the risk of the bank failing is very low, then the possibility of water levels rising to above 3.00m OD and flooding the proposed dwelling must be very low, and very much below 0.1% probability. Therefore the floor levels of the proposed houses will be raised above the predicted level of this flood water.

3. Failure or overtopping of tidal defences of the River Welland
The tidal defences are 8 km north east of the site, to the north of Spalding. It is most unlikely that a breach of these defences would spread this distance inland, and therefore the possibility of flooding from this source can be considered to be remote.

4. Overtopping of IDB Systems

Drainage channels maintained by the Welland and Deeping IDB generally have a 1 in 10 year standard with up to 1.0 metre of freeboard, which generally provides between 1 in 50 and 1 in 100 year standard against flooding. It is almost inconceivable that the South Drove Drain, which has a normal water level of -1.2m OD and a maximum design level of 0.18m OD would reach a level of 3.0m OD and cause flooding to the development site.

5. Flooding from local foul or surface water systems

It is assumed that the foul water from the proposed development will be discharged into a treatment plant which will discharge into the dyke on the Southern boundary of the site. Surface water from the proposed buildings will be discharged into soakaways.

As the floor levels of the proposed houses will be raised at least 500mm above ground level the risk of flooding from the dyke on the southern boundary or from surface water draining off South Drove can be considered to be adequately mitigated against.

Extent of known Flooding
During the preparation of this assessment, no evidence was discovered of the site or any of the adjoining properties having been flooded in the last 50 years.

Probabilities and Trends of Flooding
The probability of this development being flooded from Environment Agency main river is very low.

-

10.00. 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 12 to 15). 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.

-

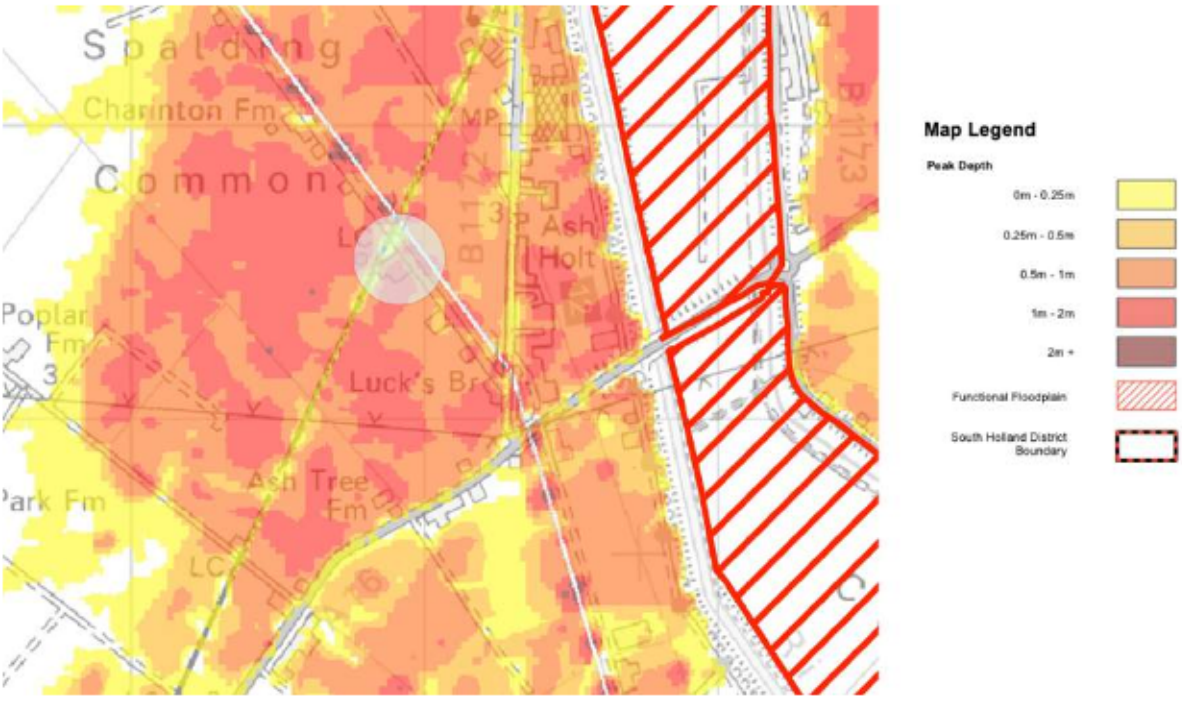
11.00 South East Lincs Advice Matrix
Advice can be found on the recommended mitigation required by referring to a spreadsheet on the South East Lincolnshire website.
As the development is in flood zone 3 and the flood hazard is "Danger for Most" (1.25 - 2.0) reference should be made to Category D8 which states for a predicted flood depth of between 500mm and 1.0 metre:
Finished Floor Levels must be set 1.0 metre above ground level, with flood resilient construction to a height of 300mm above the predicted flood depth.
The conclusions set out below will consider the ground levels on the site and additional information from 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.

-

12.00 Summary of Risk of Flooding to the Site

The main risk of flooding to the site is if a breach or overtopping were to occur in the west bank of the 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 in the updated SFRA showing the predicted peak depths in this area if a breach occurred in the bank of the River Welland in a 1% fluvial and 0.5% tidal event probability in 2115 is shown below ;



The map above predicts flood depths of between 500mm and 1.0 metre over the whole of the site, and for most of the length of the highway in front of the application site.
The land levels on the site vary between 1.53m and about 2.58m OD.

The flood depths predicted on the site will be the result of a breach of the Western bank of the River Welland. Flood water will flow Westwards and flow in to the South Drove Drain, which is of a significant size/volume. Although there will be efforts by the IDB to prevent water levels in the Drain from rising it would soon reach high levels with water flowing South Westwards and flooding onto lower land to the South of Deeping St Nicholas.
The computer modelling seems to show that in a 1 in 100 year event in 2115 the flood water will overflow the South West bank of the South Drove Drain and start to flow over the South Drove and flood water will flow in a South Westwards direction.

Environment Agency advice dated the 15th June 2023 presented the following information and direction ;

"The FRA has used the South Holland residual flood depth maps from the South East Lincolnshire Strategic Flood Risk Assessment to determine the flood depth at this site. The FRA states that the site could experience potential flood depths of 0.5-1 metre arising from a breach in the defence during the 2115 1% fluvial and 0.5% tidal scenario.

We have reviewed the mapping in detail and can confirm that flood depths of up to 1.6 metres could be experienced at the site. However, we are satisfied that the proposed mitigation outlined in the FRA is in

accordance with the requirements of the South East Lincolnshire flood risk standing advice, for the potential flood depths at the site.

We are satisfied with the mitigation proposed, the FRA confirms the dwelling will be two storey, with finished floor levels set 1 metre above the existing ground level, equivalent to 2.68 metres above Ordnance Datum (AOD). The FRA also proposes flood resilient construction to a height of 300mm above the predicted flood depth and the use of demountable defences to a height of 600mm above the finished floor levels.

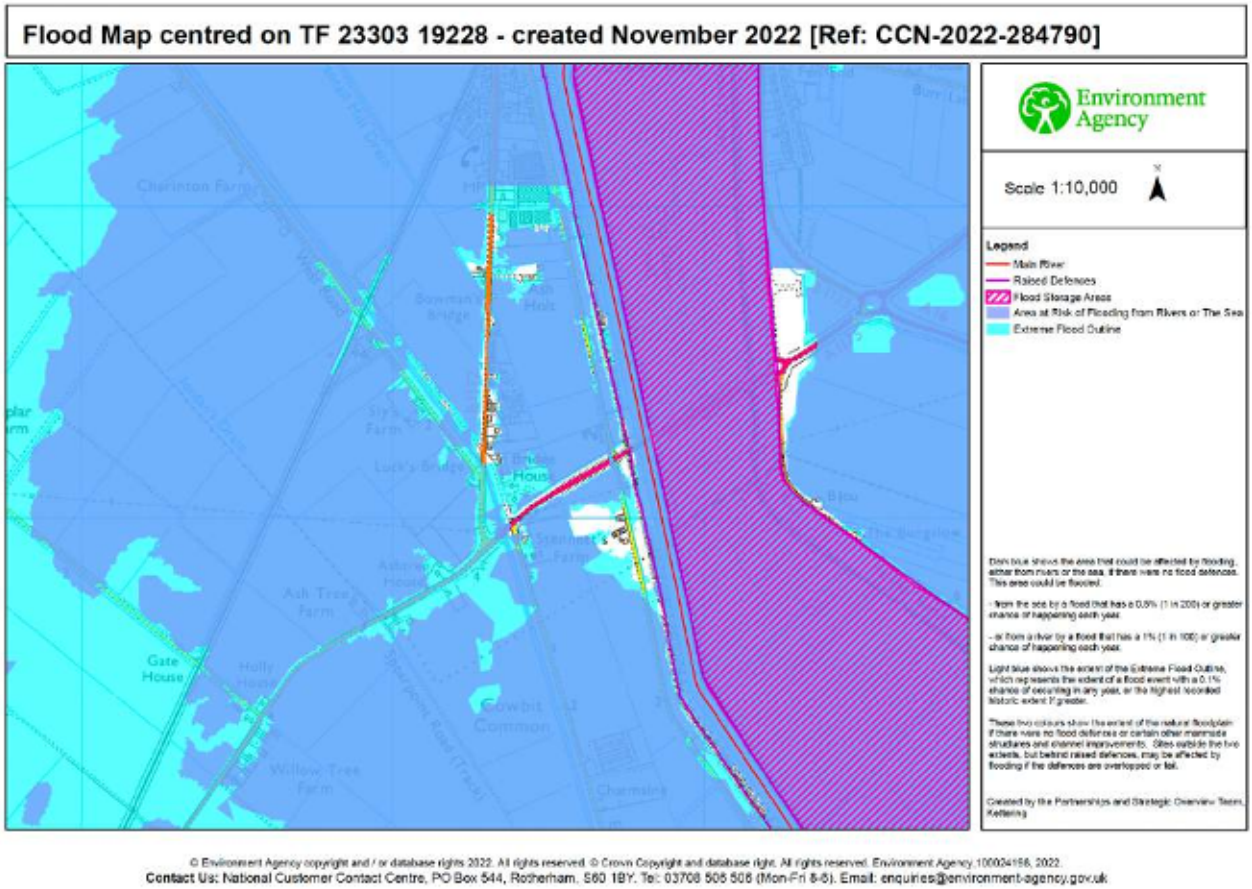
Therefore, although the FRA has identified the incorrect flood depths the proposed flood risk mitigation measures are appropriate and in accordance with the local flood risk standing advice. Based on this we anticipate that we would have no objections to the planning application from a flood risk perspective".

Therefore all buildings should have a minimum finished ground floor level of 2.68m OD with sleeping accommodation on an upper storey.

The Environment Agency CCN Data received on the 9th of November 2022 is attached below.

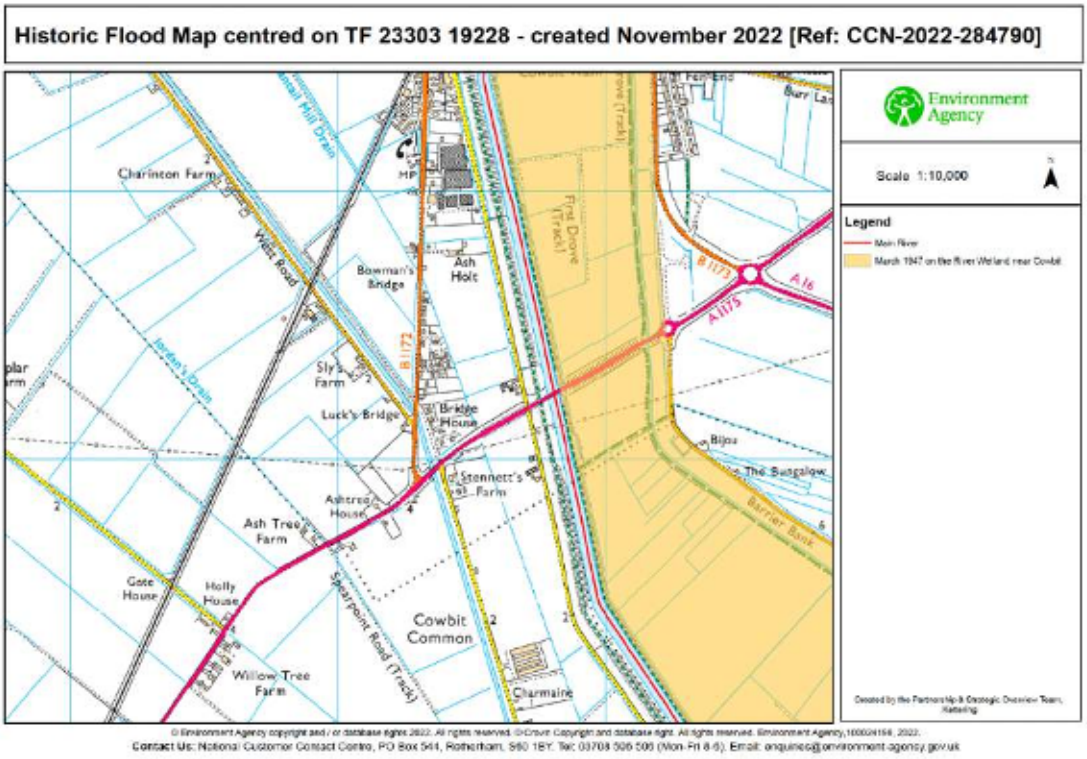
CCN Extract Page 1 ;
"The attached map includes the current Flood Map for your area. The Flood Map indicates the area at risk of flooding, assuming no flood defences exist, for a flood with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater."

CCN Attached Flood Map

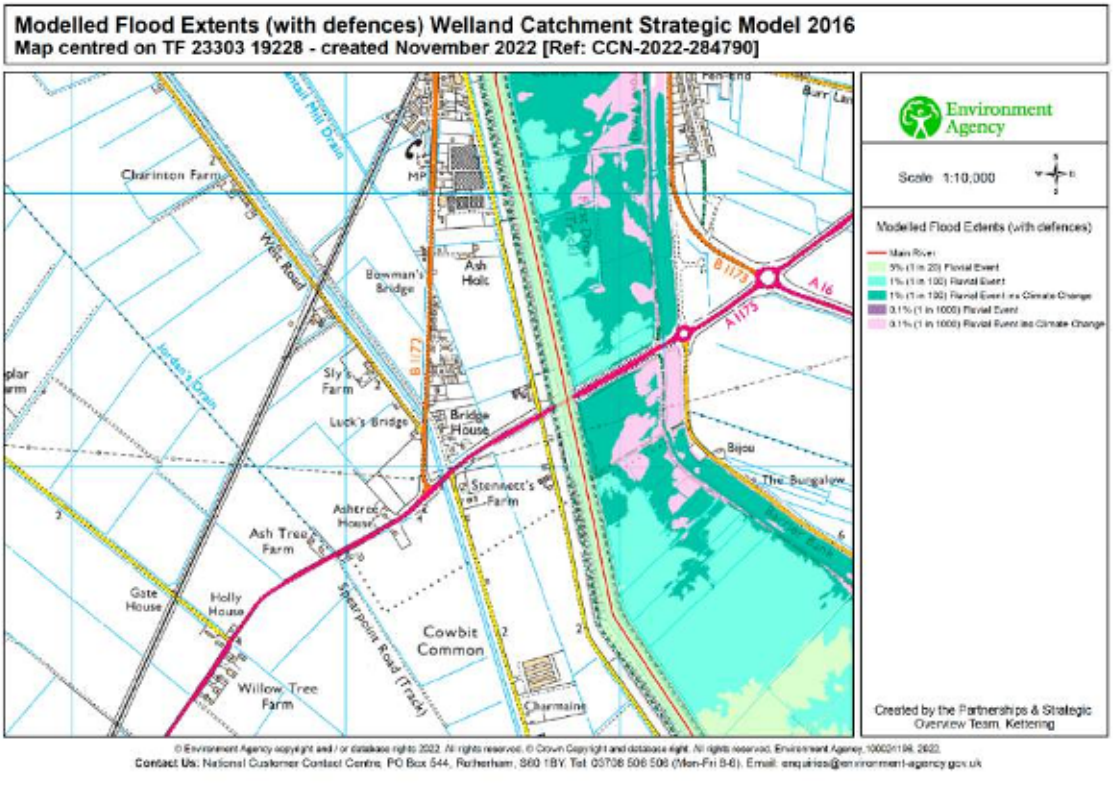


© Environment Agency copyright and / or database rights 2022. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency 100024198, 2022.
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham. S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Historic Flood Map centred on TF 23303 19228 - created November 2022 [Ref: CCN-2022-284790] ;



Modelled Flood Extents (with defences) Welland Catchment Strategic Model 2016 Map centred on TF 23303 19228 - created November 2022 [Ref: CCN-2022-284790]



13.00 Safe egress/access
The site will be registered with the Environment Agency Flood Line Warning Service prior to completion and safe procedure included in the site manual in the event of a flood event requiring emergency evacuation the route will be established on an incident by incident basis and persons withdrawn to. However, the most likely open route will be to South Drove and onwards to the A16.

The general location of the site within the catchment is such that if flooding occurred from the main river systems, then probably 2 to 3 days warning time would be available.

-

14.00 Conclusions
The following conclusions can be made:
The proposed development is not in a functional flood plain as defined by PPS25.
The risk of the site flooding from any Environment Agency watercourse is very low.
The risk of flooding from IDB watercourses is also extremely low.
Velocities, and therefore the hazard of any flood water in the area would be low.
The actual risk is identified as low and its implication for the site should not prevent a planning application being approved.

Attached to this document is a letter from the Environment Agency dated 15th June 2023 (ENVPAC/1/LNA/00179- Review of updated flood risk assessment and revised plans for change of use) supporting the revised design solution and flood risk mitigation measures. The EA confirmed the following in relation to the extant Class Q permission :

"The FRA has used the South Holland residual flood depth maps from the South East Lincolnshire Strategic Flood Risk Assessment to determine the flood depth at this site. The FRA states that the site could experience potential flood depths of 0.5-1 metre arising from a breach in the defence during the 2115 1% fluvial and 0.5% tidal scenario.

We have reviewed the mapping in detail and can confirm that flood depths of up to 1.6 metres could be experienced at the site. However, we are satisfied that the proposed mitigation outlined in the FRA is in accordance with the requirements of the South East Lincolnshire flood risk standing advice, for the potential flood depths at the site.

We are satisfied with the mitigation proposed, the FRA confirms the dwelling will be two storey, with finished floor levels set 1 metre above the existing ground level, equivalent to 2.68 metres above Ordnance Datum (AOD). The FRA also proposes flood resilient construction to a height of 300mm above the predicted flood depth and the use of demountable defences to a height of 600mm above the finished floor levels.

Therefore, although the FRA has identified the incorrect flood depths the proposed flood risk mitigation measures are appropriate and in accordance with the local flood risk standing advice. Based on this we anticipate that we would have no objections to the planning application from a flood risk perspective".

-

15.00. Recommendations
In an area where there is a flood risk it is recommended that all new dwellings should be of two storey construction designed with all sleeping accommodation located on an upper storey.

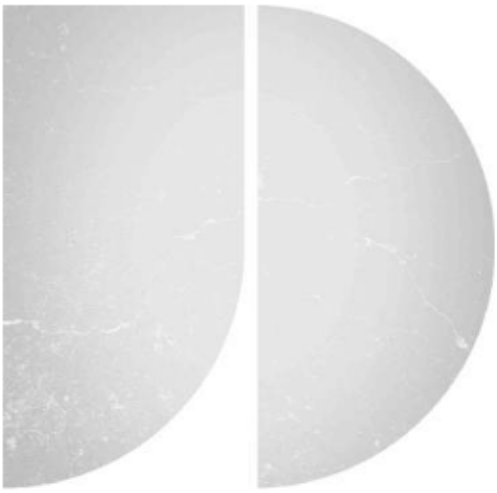
The ground floor level of the proposed buildings should be at a minimum level of 2.68m OD. Flood resilient construction should be included to a height of 300mm above the predicted flood depth.

Occupiers of the all of the new properties should register with the Environment Agency's Floodline Warnings Direct Service to receive automated early warnings of potential flooding. Although the risk of flooding is extremely low, if through a set of circumstances acting together any flooding were to begin to occur, residents would have adequate time to evacuate the area and remain safe.

It is our conclusion that the development complies with NPPF and passes, or is not required to pass, the sequential and exemption tests and should therefore be permitted with the condition of a detailed drainage scheme to be submitted for approval before of development.



John Dickie C. Build E MCABE
Chartered Building Engineer



-

Appendix A Climate Change

Currently the assumption is that climate change will impact on global sea levels and impact subsequently on surge tides and an increase in significant storm events. The future risk is therefore increased. The design of any drainage system should have a 30% allowance for climate change.

The site is within a defended Floodplain, as defined in Appendix 1 of the Environment Agency's Policy for the Protection of Floodplains and is considered to be passive until such time as a flood greater than that for which defences were designed occurs. The likelihood of flooding due to overtopping or failure of a flood defence embankment is considered to be small.

The development site is within the South Holland Internal Drainage Board jurisdiction - current maintenance standards within the SHIDB and the EA defences are generally very good.

The Strategic Study has concluded that improvement works are cost effective to meet Department of the Environment, Food and Rural Affairs (Defra) guidelines in order to sustain the existing tidal defences over the 50 year appraisal period up to a 1 in 200 year standard.

During the operation and maintenance of its pumping stations, associated structures and channel systems, particularly those that could affect property, the Board seeks to maintain a general standard capable of providing flood protection to its district. A routine maintenance programme is in place to ensure that the Boards assets are commensurate with the standard of protection that is sought. However, bank slips, blocked culverts etc. may occur from time to time and these matters are usually dealt with promptly.

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 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 & has been withdrawn (19

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
Fluvial Flooding from River Welland.

Effects on Predictions of Flood Risk in FRA
Fluvial Flooding from River Welland.

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 Welland. If there are additional flows along this part of the 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.

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 Welland is an embanked watercourse between Spalding and Market Deeping. There are flood reservoirs on the east side of the River called the Cowbit and the Crowland Washes. Excess water would flow into these Washes through two large syphons. In this scenario the Washes would fill up and also water would be flooding over lower banks of the River. The increases in rainfall leading to this would also lead to significant flooding in the upper part of the River Welland Catchment. It is unlikely that there will be any significant increase in the water level in the River. Therefore the consequence will not be significantly different to the maps produced in the SFRA.

Effect on IDB Systems
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 are necessary 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 ground floor level of the proposed dwellings should be a minimum level of 2.60m OD is satisfactory and that furthermore, sleeping accommodation will be provided on an upper storey.

-

Appendix B Mitigation Measures
Given the Zone 3 low risk of the site there are no specific mitigation measures required apart from provision of an adequate drainage system.

It is recommended that the project proposals are drained, with roof water and clean areas being discharged to surface water soakaways. As there is low risk of the site being flooded, there are no particular measures proposed after the management of surface water flows and compliance with Environment Agency standing advice.

The proposal is that the ground floor level be set at 2.68m OD and that sleeping accommodation will be provided on an upper storey.

Flood resilience techniques applied. The premises are advised to register for the EA early warning service.

It is recommended that flood resilient construction techniques be adopted as set out below ;

Pollution Mitigation
Construction
Construction sequence, temporary bundage and settlement tanks should be considered and implemented during the works. Full reference should be made to PPG 6 Working on Construction and Demolition sites and Environmental Good Practice on Site 3rd Edition 2010. The selection of a contractor to carry out the works must show consideration of the contractors proposals for pollution control during the works. A detailed spill action plan will be required to be put in place prior to construction.

Post Construction
Proposed Drainage: Clean and Foul Water
The proposed drainage will be clean water drainage restricted to flows from roof and discharged to soakaways.
Foul water will be dealt with via a connection to the AW mains drainage system if available/ a compliant FW sewage treatment package or re-use of the existing FW drainage system.

The developer will ensure that the eventual occupiers of the dwellings are sufficiently aware of the risk of flooding and the standard of the existing defences. The Environment Agency provides a Flood Warning Service which includes Flood Warning Codes and uses direct warning methods where the risk and impacts of flooding are high. Indirect warnings are provided to all flood risk areas, even those at low risk of flooding. The main method is media broadcasts via local radio and also by television including teletext. In addition to direct and indirect flood warnings, the Environment Agency operate 24 hours a day Floodline Service providing advice and information on flooding contact tel no. 0845 988 1188.

CONSTRUCTION TECHNIQUES

93. There are two basic approaches that may be appropriate for the protection of buildings against the effects of flooding:

101. Dry proofing aims to prevent flood water from entering a building. It relies on the use of waterproof barriers integral to the structure, across entrances and non-return valves on drains. Dry proofing a building however can be difficult and is unlikely to work if buildings are subject to flooding for long periods. Simple measures are unlikely to prevent water penetration for more than a few hours while more complex solutions may protect the building for a day or two.

Wet proofing assumes water will enter the building and is based on the use of water resistant and resilient materials within the building and the raising of electrical wiring and sockets above the maximum flood level. This is the most practical approach and there are a number of ways to limit the damage from flooding. Wet proof construction should also allow water to drain easily from the building following a flood and not retain it in walls, floors and air pockets within the building footprint.

Figure 2: Wet proofing – measures to make the building more resilient to flooding

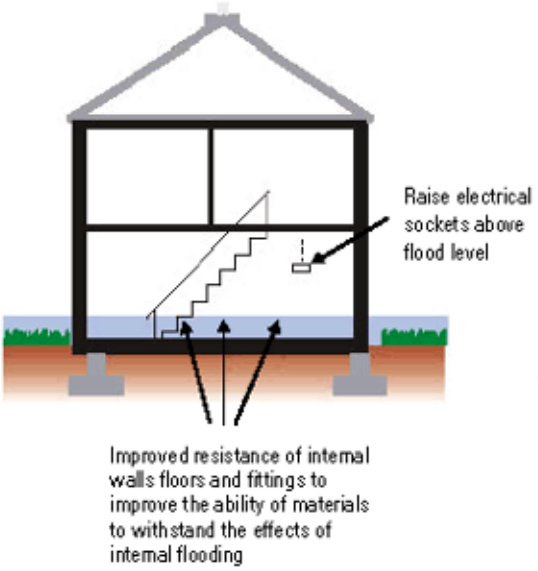
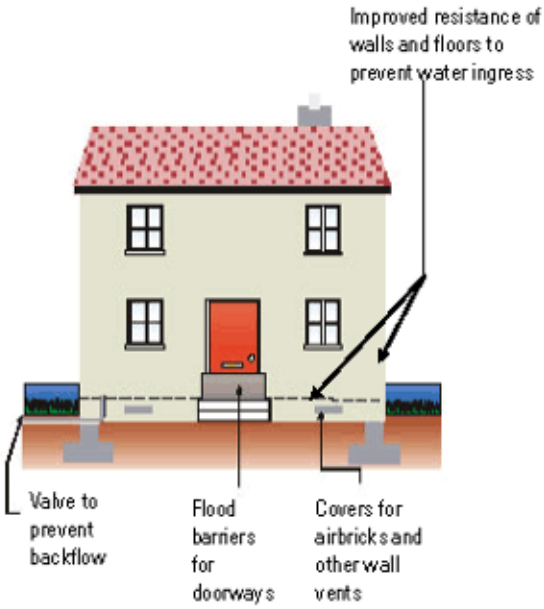


Figure 3: Dry proofing – measures to keep water out of building



Building components

Component	Most suitable	Suitable	Unsuitable
Flooring	Concrete, pre-cast or in situ	Timber floor, fully sealed, use of marine plywood.	Untreated timber Chipboard
Floor covering	Clay tiles Rubber sheet floors Vinyl sheet floors	Vinyl tiles Ceramic tiles	
External walls (to maximum flood level)	Engineering brick Reinforced concrete	Low water absorption brick	Large window openings
Doors	Solid panels with waterproof adhesives Aluminium, plastic or steel	Epoxy sealed doors	Hollow core plywood doors
Internal partitions	Brick with waterproof mortar Lime based plasters	Common bricks	Chipboard Fibreboard panels Plasterboard Gypsum plaster
Insulation	Foam or closed cell types	Reflective insulation	Open cell fibres
Windows	Plastic, metal	Epoxy sealed timber with waterproof glues and steel or brass fittings.	Timber with PVA glues and mild steel fittings

BUILDING AND FLOODING CHECK LIST:

Factors to consider before building in areas where flood risk is an issue

Background information

If flooding is an issue:

- Is the source of floodwater from watercourses, coastal waters, groundwater or sewers?

- If the source of flooding is from watercourses or coastal waters, is the annual probability of flooding greater than 0.5% (1:200)?
- What is the maximum flood level in the 0.5% event?
- Would the site be inundated rapidly, for example due to a breach in a flood defence, or slowly, for example in the case of groundwater flooding?

General issues (adapted from ABI, Assessment of the cost and effect on future claims of installing flood damage resistant measures)

- Records of previous flood levels.
- Ground conditions – e.g., permeability and provision of field drains.
- Floodwater pathways into the building – e.g., poorly maintained masonry, ventilation grilles, doors.

3. Floors

- Where possible use dense concrete screeds on solid concrete floor slabs.
- Use treated timber to protect it from rotting if exposed to standing water.
- Use steel joists and wall plates rather than timber.
- Use a damp proofing material around the ends of floor joists.
- Use a sump and pumping system in buildings at risk of groundwater flooding.
- Replace expensive flooring, such as Oak floorboards with treated timber boards.
- Raise floor levels – see foregoing text on finished floor levels.

4. Walls

- Install air bricks above expected flood level and duct down to solum.
- Use close cell insulation.
- Replace gypsum plaster with more water resistant materials.
- Fix plasterboard horizontally.

5. Interiors

- Replace door hinges with butt hinges that allow door to be removed and placed in a dry area prior to a flood.
- Fit kitchen units with extendable plastic or stainless steel feet so that they will not be damaged by shallow flooding.
- Use raised fitted ovens and fit above highest expected flood level.

-

Appendix C - NPPF

11. National Planning Policy Framework

NPPF and its associated Technical Guidance replaces Planning Policy Statement 25 and provides guidance on how to evaluate Sites with respect to flood risk.

A summary of the requirements of NPPF is provided below.

Sources of Flooding

NPPF requires an assessment of flood risk to consider all forms of flooding, and lists six forms of flooding that should be considered as part of a flood risk assessment. These forms of flooding are listed in Table 1, along with an explanation of each form of flooding.

Table 1 – Forms of Flooding

Flooding From Rivers (Fluvial Flooding)
Watercourses flood when the amount of water in them exceeds the flow capacity of the river channel. Flooding can either develop gradually or rapidly, depending on the characteristics of the catchment. Land use, topography and the proposed development can have a strong influence on flooding from rivers.
Flooding From the Sea (Tidal Flooding)
Flooding to low-lying land from the sea and tidal estuaries is caused by storm surges and high tides. Where tidal defences exist, they can be overtopped or breached during a severe storm, which may be more likely with climate change.
Flooding from Land (Pluvial Flooding)
Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding. In developed areas, this flood water can be polluted with domestic sewage where foul sewers surcharge and overflow. Local topography and built form can have a strong influence on the direction and depth of flow. The design of development down to a micro-level can influence or exacerbate this. Overland flow paths should be taken into account in spatial planning for urban developments. Flooding can be exacerbated if development increases the percentage of impervious area.
Flooding from Groundwater
Groundwater flooding occurs when groundwater levels rise above ground levels (i.e., groundwater issues). Groundwater flooding is most is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). Chalk is the most extensive source of groundwater flooding.
Flooding from Sewers
In urban areas, rainwater is frequently drained into sewers. Flooding can occur when sewers are overwhelmed by heavy rainfall, and become blocked. Sewer flooding continues until the water drains away.

Flooding from Other Artificial Sources (i.e., reservoirs, canals, lakes and ponds)
Non-natural or artificial sources of flooding can include reservoirs, canals and lakes. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

Flood Zones

For river and sea flooding, NPPF uses four Flood Zones to characterise flood risk. These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and are detailed in Table 2.

Table 2 – Flood Zones

Flood Zone	Definition
1	Low probability (less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%))
2	Medium probability (between 1 in 100 and 1 in 1,000 annual probability of river flooding (1%-0.1%)or between 1 in 200 and 1 in 1,000 annual probability of sea flooding(0.5%-0.1%) in any year).
3a	High probability (1 in 100 or greater annual probability of river flooding (>1%) in any year or 1 in 200 or greater annual probability of sea flooding (>0.5%) in any given year).
3b	This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5%), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

Vulnerability

NPPF classifies the vulnerability of developments to flooding into five categories. These categories are detailed in Table 3.

Table 3 – Flood Risk Vulnerability Classification

Flood Risk Vulnerability Classification	Examples of Development Types
Essential Infrastructure	- - Transport Infrastructure - - Utility Infrastructure (e.g., water treatment works and wind - turbines)
Water Compatible	- - Flood Control Infrastructure - - Water and Sewerage Infrastructure - - Navigation Facilities
Highly Vulnerable	- - Emergency Services - - Basement Dwellings - - Mobile home parks
More Vulnerable	- - Hospitals and other health services - - Residential Establishments - - Educational Establishments
Less Vulnerable	- - Commercial Establishments (e.g., shops, restaurants and offices)

Based on the vulnerability of a development, NPPF states what Flood Zone(s) the proposed development is appropriate within. The flood risk vulnerability and Flood Zone 'compatibility ' of developments is summarised in Table 4.

Table 4 – Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	**1**	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test	✓	✓
	3a	Exception Test	✓	X	Exception Test	✓
	3b	Exception Test	✓	X	X	X

Hydrogeology
Based on the Environment Agency's online mapping, the Site is not located within a Ground Water Source Protection Zone (GWSPZ), above an aquifer, nor in an area designated as a Groundwater Vulnerability Zone (GVZ).

Artificial Water bodies
There are no artificial water bodies located within the boundary of the Site.

Historic Flooding
The Environment Agency Historic Flood Extent Map shows that the Site is not located within an area which has historically been reported to have flooding.

Ordinary Watercourses
There are a number of Ordinary Watercourses (drainage ditches) operating in the general vicinity of the proposed Site. These are controlled by the Welland and Deepings Internal Drainage Board.

Planning Advice Note PAN 69

Building design can incorporate materials that are either flood resistant (i.e., unaffected by flood water), such as plastics, or materials that are resilient (i.e., they recover relatively undamaged from flooding) . Some materials, such as concrete, can be both resistant and resilient, for example solid concrete floors can provide an effective seal against water rising up through the floor, provided they are adequately designed. In addition, solid concrete floors generally suffer less damage than suspended floors and are less expensive and faster to restore following exposure to floodwater.

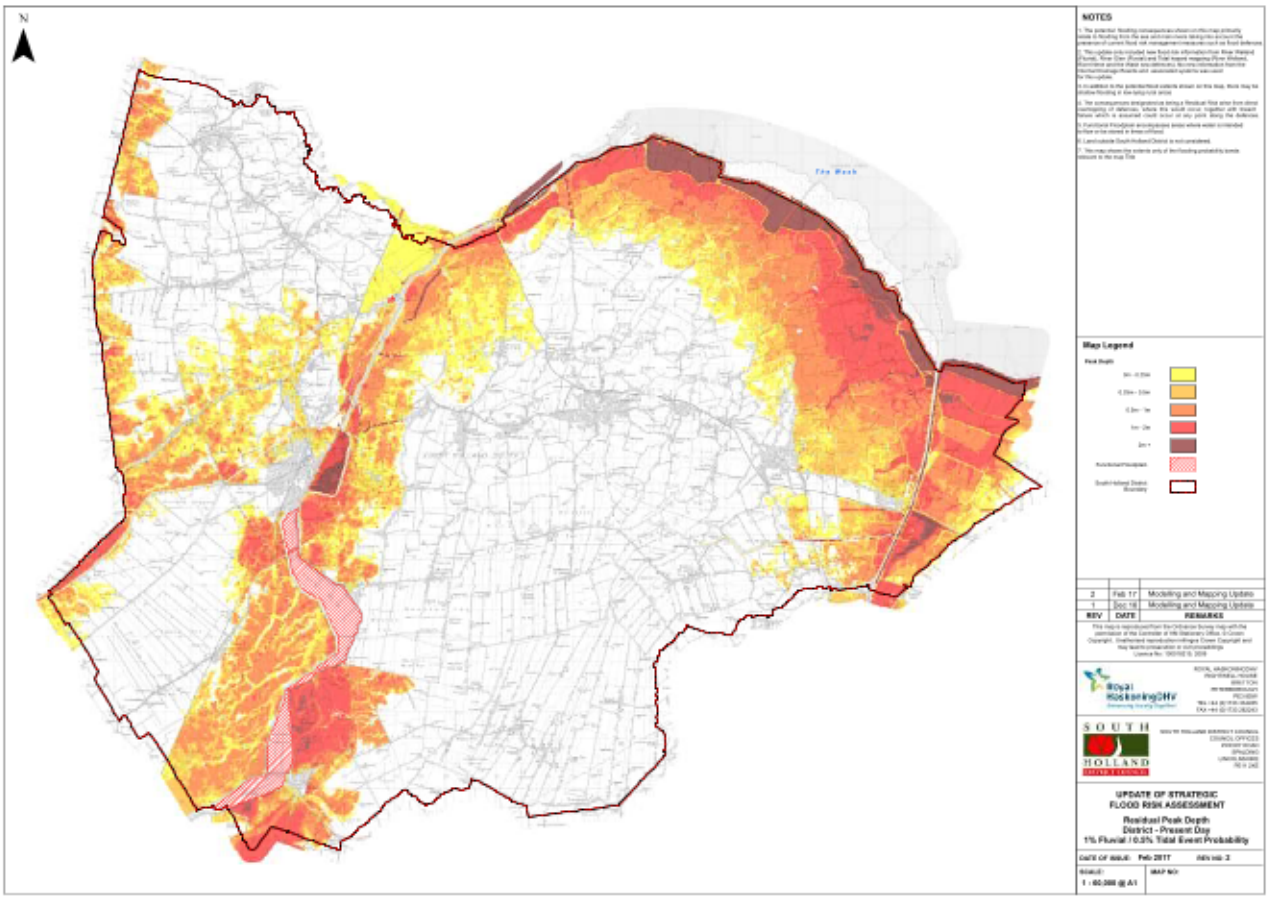
86. Good workmanship and maintenance will limit the amount of water that can seep through masonry walls. Re-pointing may be needed. Water-resistant coatings applied to porous surfaces will also fill any cracks in the masonry or the joints. To avoid trapping water in the wall however, any such coatings should be micro-porous to allow the wall to 'breathe'.

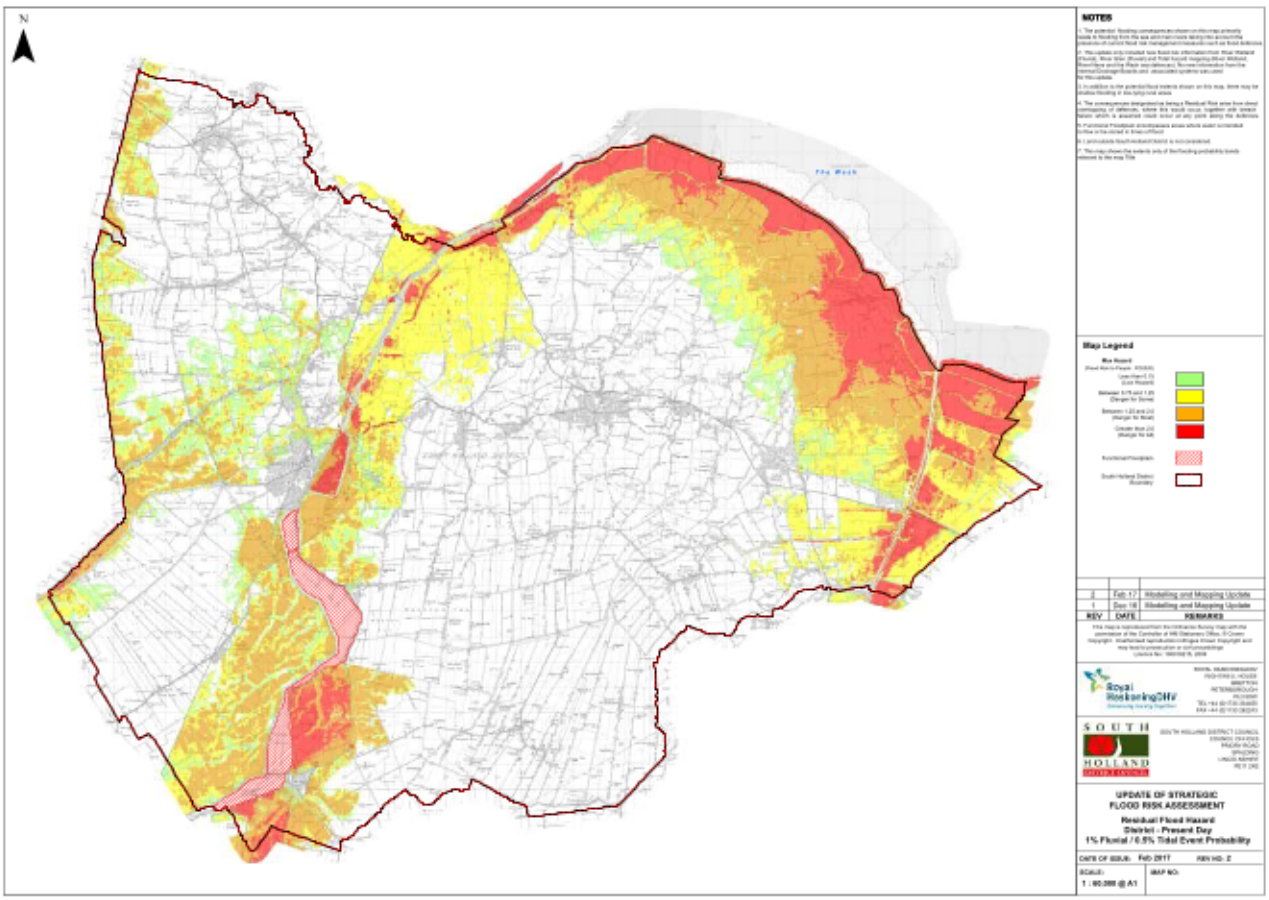
Table 2: Summary of the potential effects of exposure to flood water

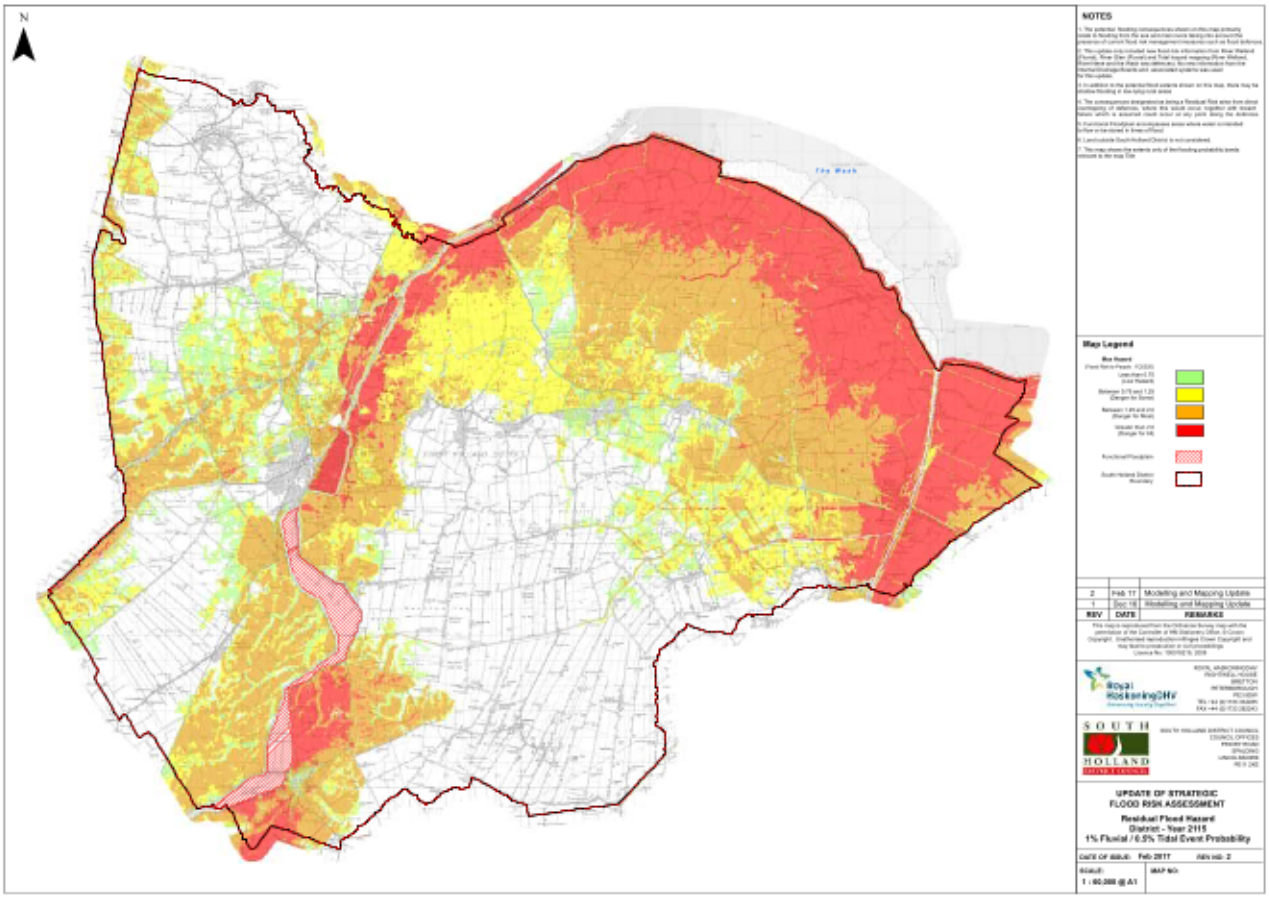
Material	General Effects
Masonry, Concrete and Brick	In general masonry and concrete are unlikely to be severely damaged by contact with floodwater. In the case of coastal flooding, salt water may cause surface powdering and flaking of soft brickwork. Lightweight concrete may expand and contract depending on moisture content so wetting and drying may cause some cracking.
Timber	Timber swells and may distort on wetting. In timber framed buildings, swelling of immersed members could cause damage in other parts of the structure, e.g. through stresses on external cladding. Timbers that become wet and cannot dry may be at risk of decay in the long term. Guidance on the selection of timber preservatives is provided in BS5268: Part 5:1989 for structural timber and BS 1186 Part1:1991 for joinery.
Wall finishes	Renderings containing cement are unlikely to suffer damage. Lime based plasters are preferable to gypsum which softens when wet. Similarly, following flooding, any plasterboard will probably be damaged beyond repair and require to be removed.
Metals	Metals are affected by the corrosive effects of sea water so resistant metals rather than mild steel should be used in coastal areas where flood risk is an issue.
Insulation	Close cell insulants will not absorb water but may restrict drying out of a cavity wall. Mineral fibre and other absorptive insulants will retain water and can lose their insulating properties or disintegrate over time.

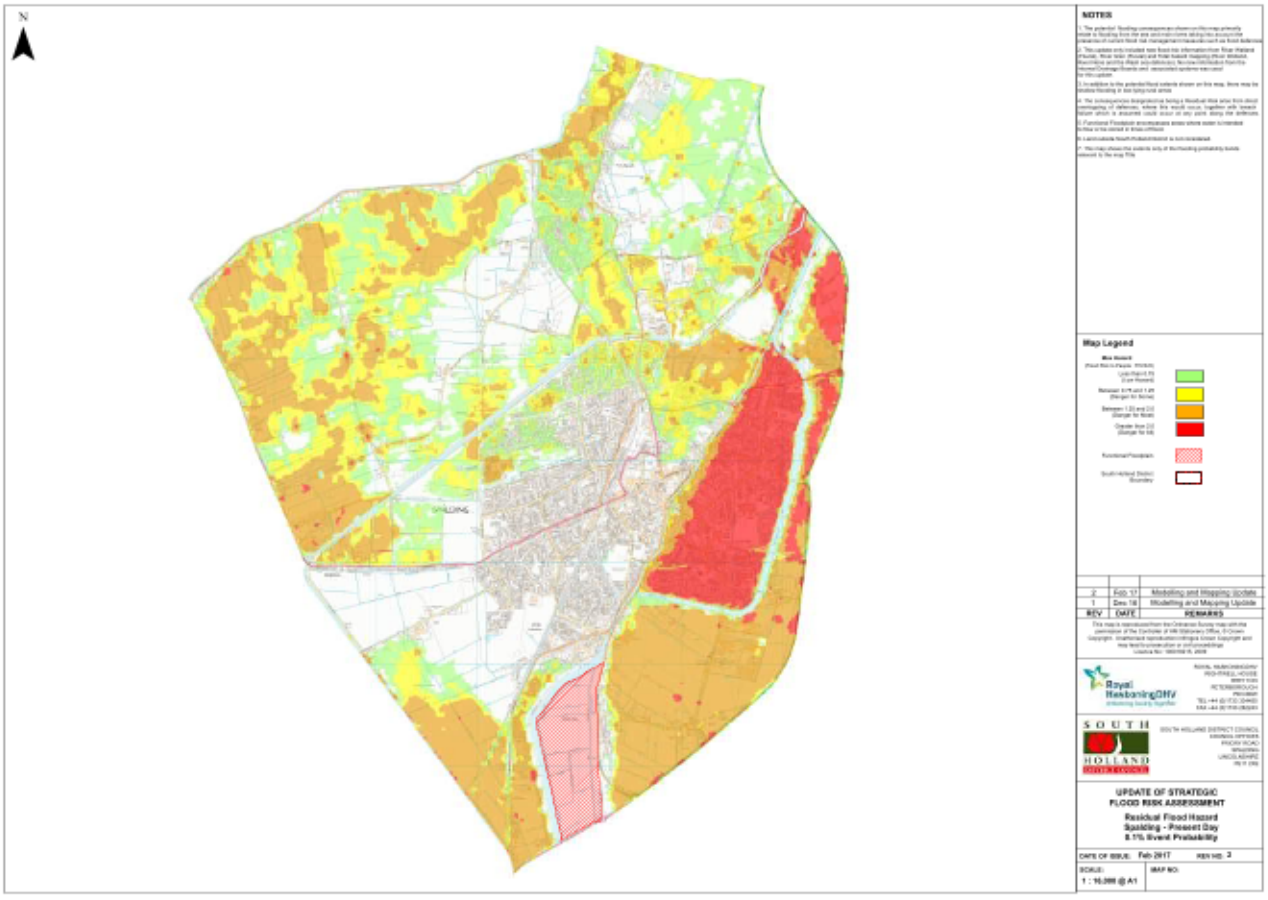
Source - Design Guidance on Flood Damage to Dwellings, The Scottish Office, 1996

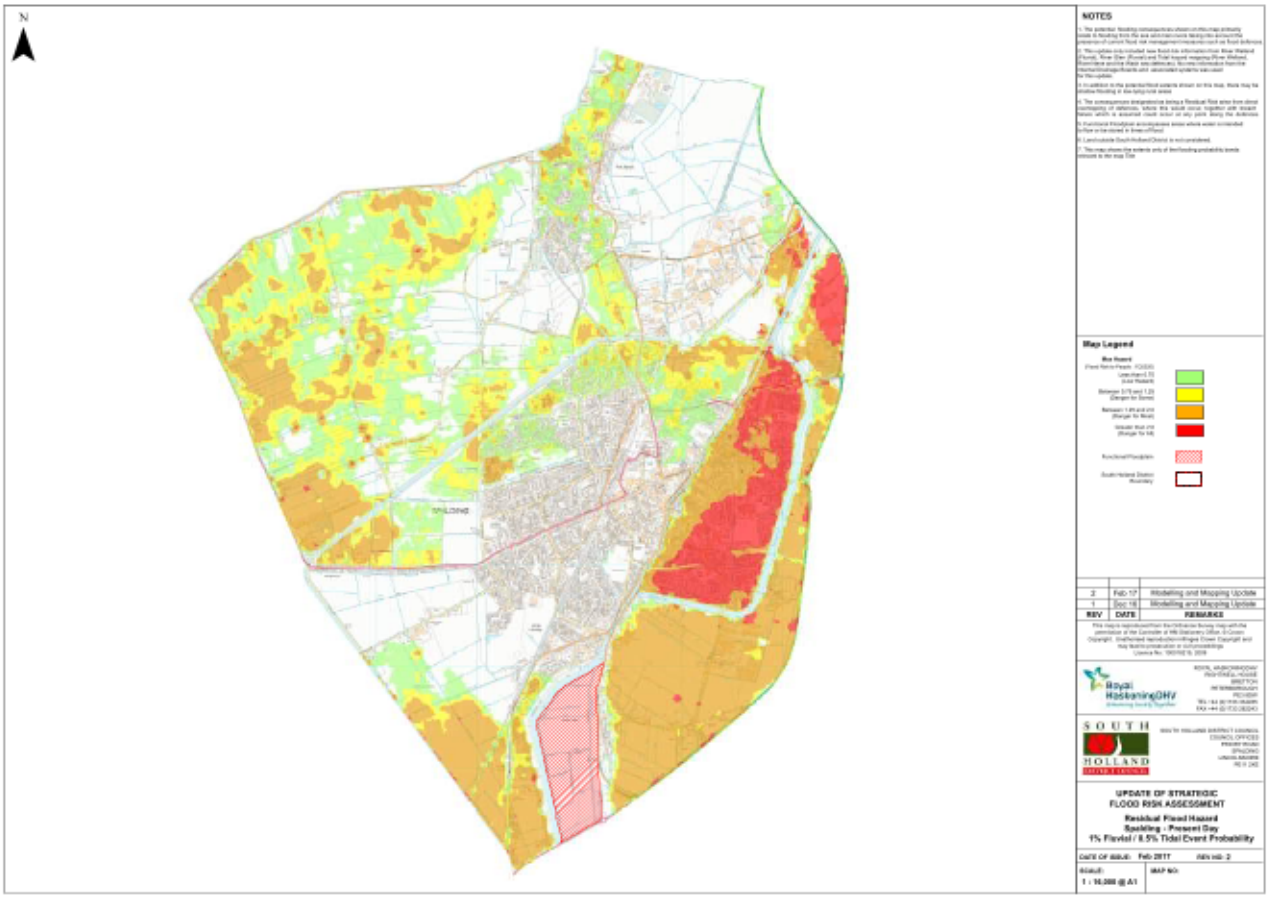
Appendix D – SFRA Documents/Maps

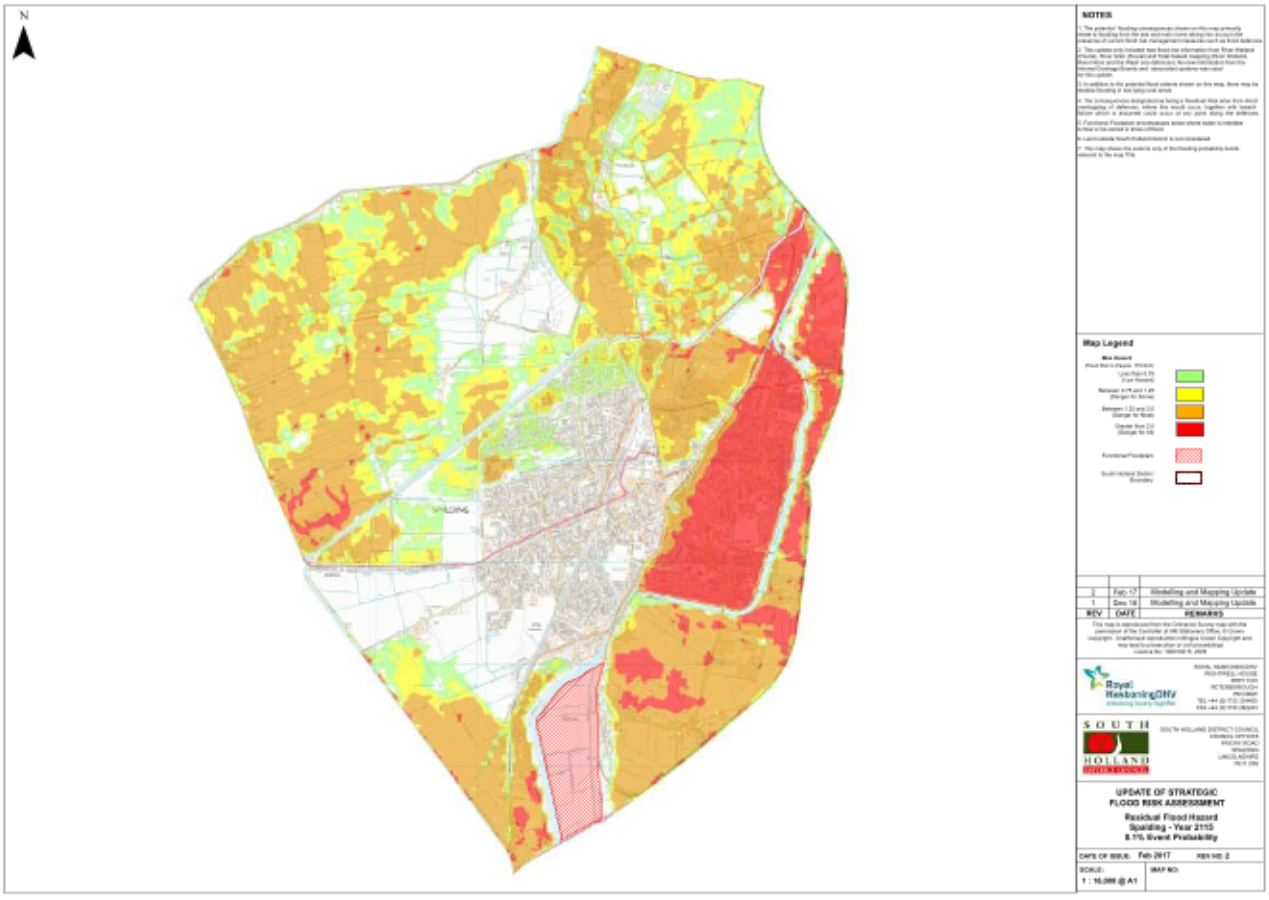


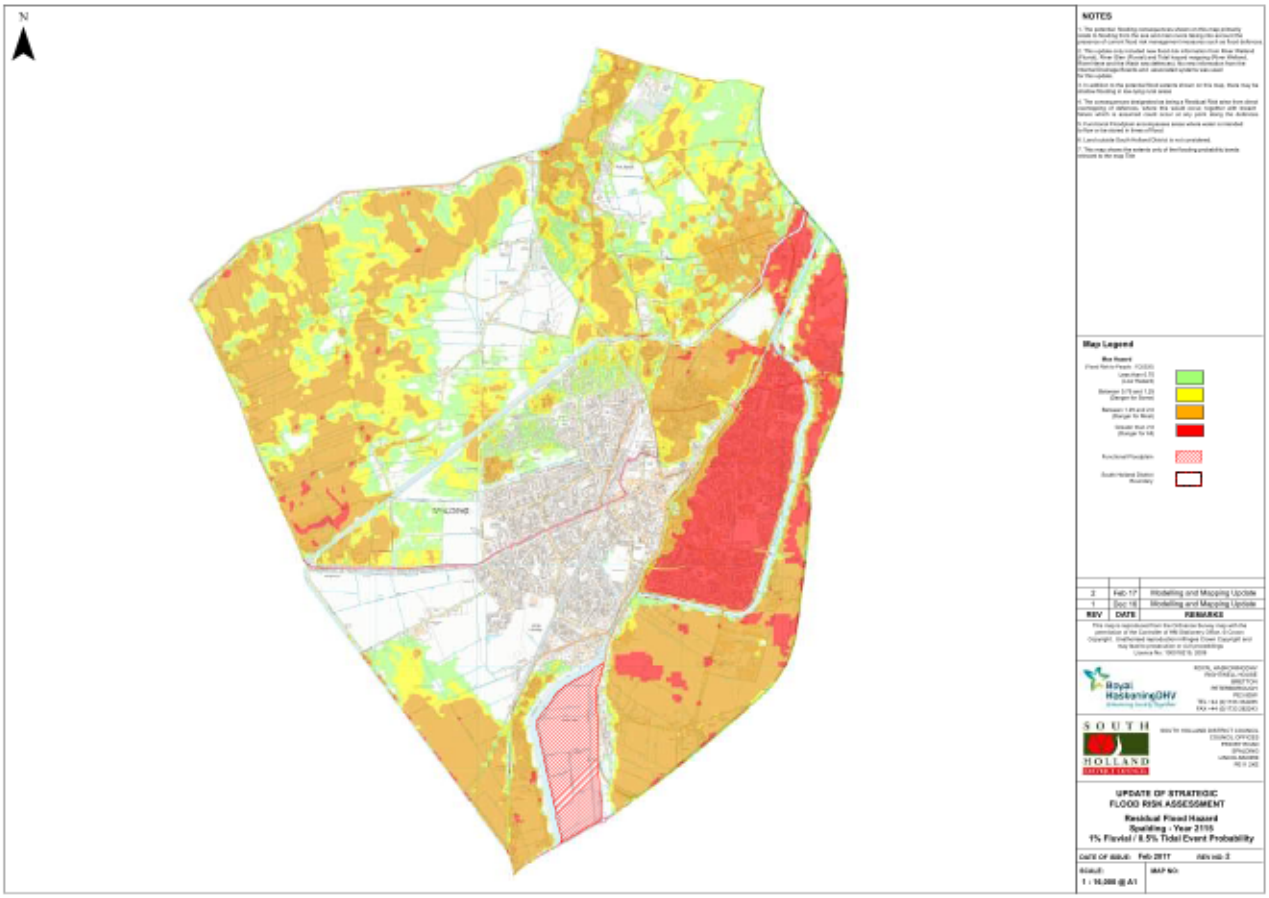



N
NOTES
Map Legend
2 Feb 17 Modelling and Mapping Update
1 Dec 16 Modelling and Mapping Update
REV DATE REMARKS
Royal HaskoningDHV
SOUTH HOLLAND
UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT
Residual Flood Hazard
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability
DATE OF ISSUE: Feb 2017
SCALE:
1 : 60,000 @ A1
MAP NO:

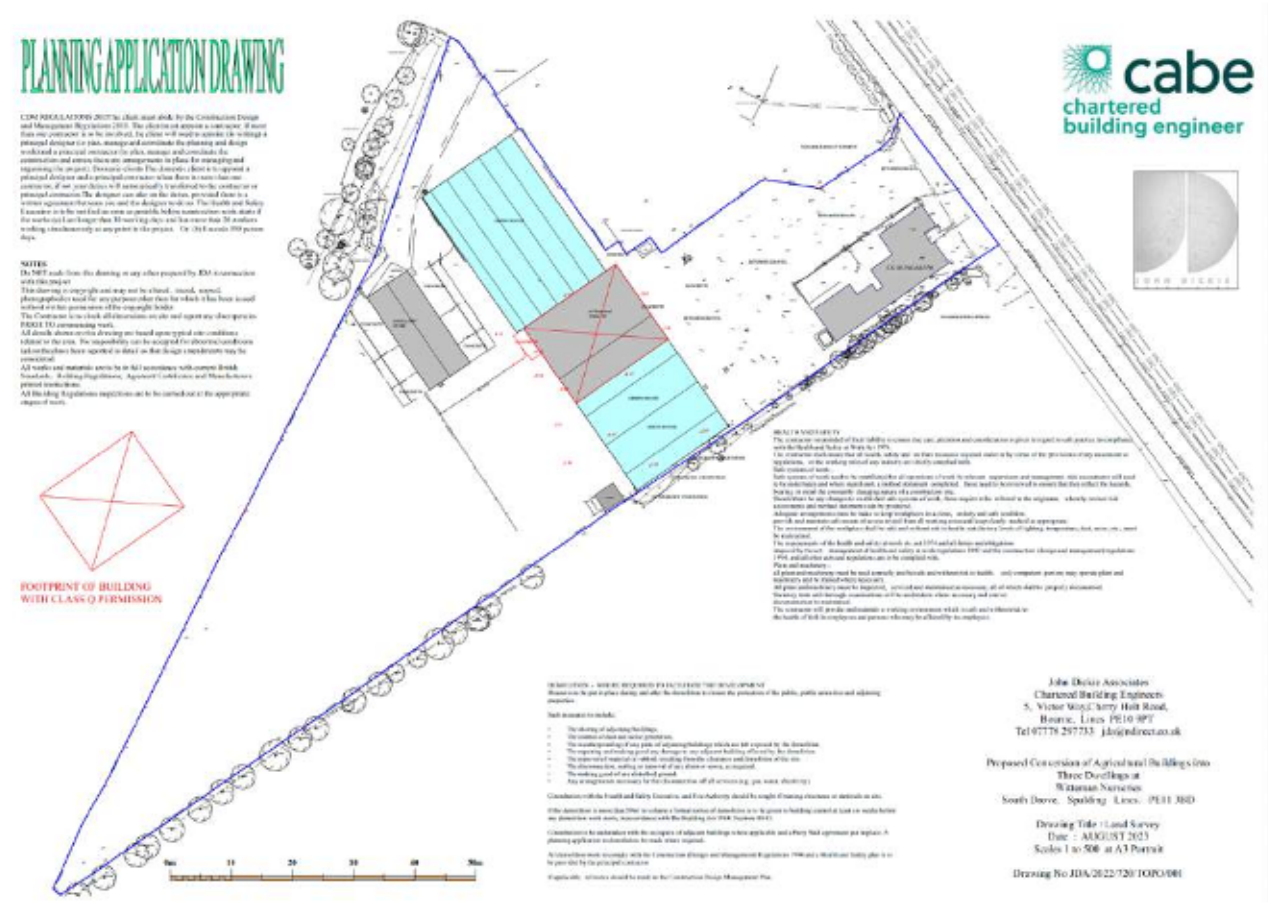

N
NOTES
Map Legend
2 Feb 17 Modelling and Mapping Update
1 Dec 16 Modelling and Mapping Update
REV DATE REMARKS
Royal HaskoningDHV
SOUTH HOLLAND
UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT
Residual Flood Hazard
Spalding - Present Day
0.1% Event Probability
DATE OF ISSUE: Feb 2017
SCALE:
1 : 10,000 @ A1
MAP NO:


N
NOTES
Map Legend
UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Flood Hazard
Spalding - Present Day
1% Fluvial / 0.5% Tidal Event Probability
SOUTH HOLLAND

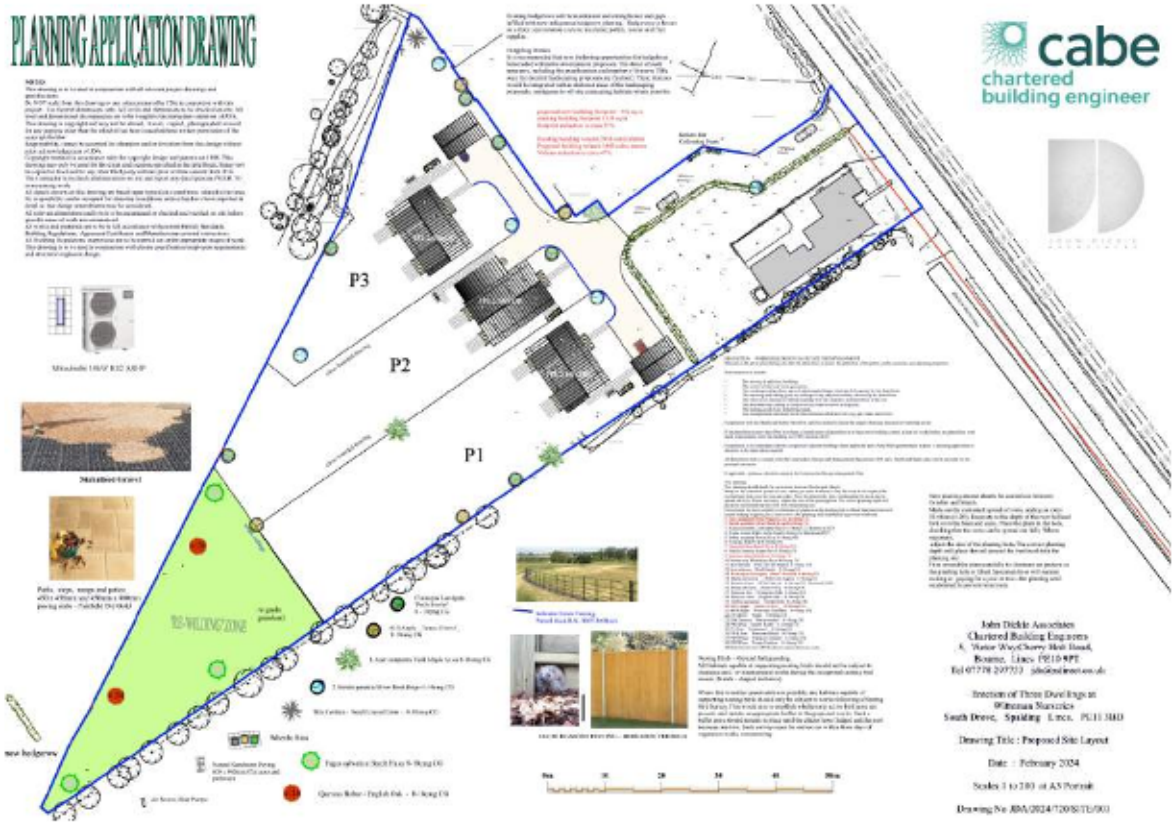

N
NOTES
Map Legend
UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Flood Hazard
Spalding - Year 2115
0.1% Event Probability
SOUTH HOLLAND

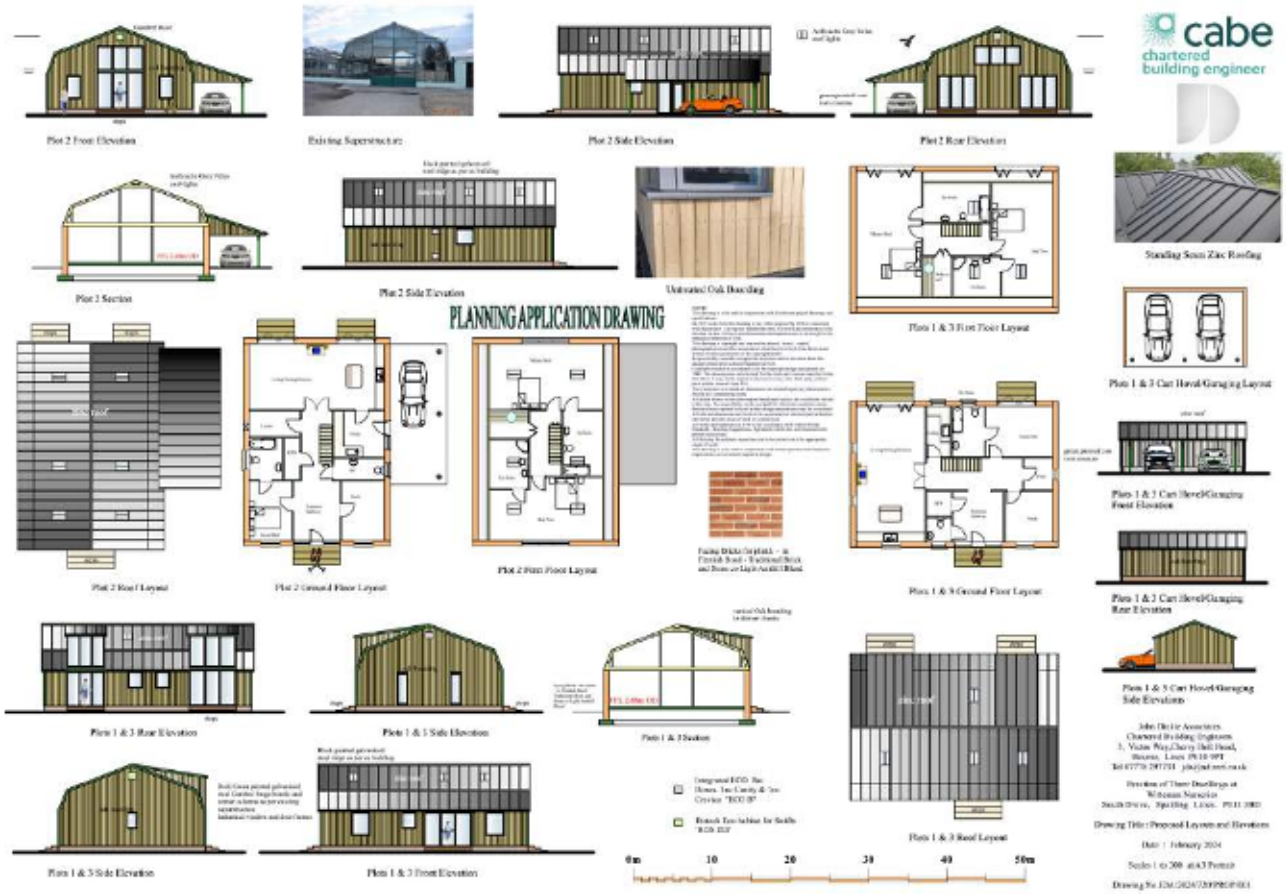


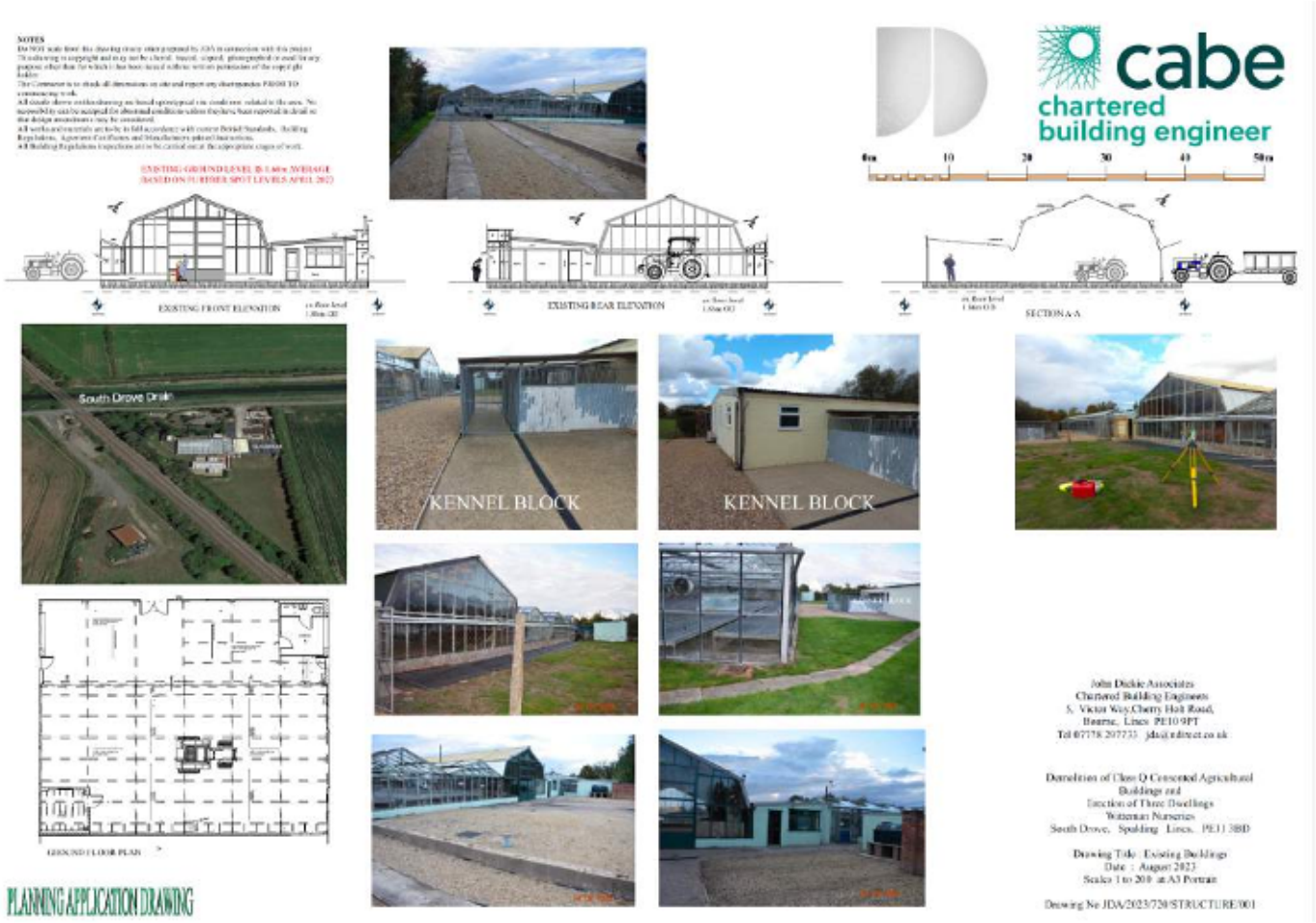
Appendix E. Topographic Survey



Appendix F. Scheme Drawings







DISCLAIMER

This document has been prepared solely as a Flood Risk Assessment in support of a Full planning application for a proposed Residential Development at South Drove, Spalding

John Dickie Associates accepts no responsibility or liability whatsoever for any use made of this document other than by the client "Mr N. Witteman" for the purposes it was originally commissioned and prepared. All comments and opinions made are based upon information available to John Dickie Associates during the necessary investigative process, and the conclusions and recommendations could therefore, differ in the event of material subsequently being found erroneous, incomplete or misleading. John Dickie Associates therefore, accepts no liability should this prove to be the case.

John Dickie Associates
Chartered Building Engineers
5, Victor Way,
Cherry Holt Road, Bourne, Lincs PE10 9PT
Tel 07778 297733 jda@ndirect.co.uk

cabe
chartered
building engineer

DOCUMENT END