Flood Risk Assessment

Laurel Lodge Farm,
Hurn Road,
Holbeach,
Spalding
PE12 8JB

Contact details:
Paul Hands *MSc (Hons), BEng (Hons) EngTech, MICE*
Managing Director
Paul Hands Consulting Ltd
paul.hands@hotmail.co.uk

QUALITY ASSURANCE

DOCUMENT REFERENCE

Document Reference	**LLF-FRA-0001.F01.01**
Job Number	**LLF_2021_001**

DOCUMENT ISSUE RECORD

Status	Revision	Revision details	Date of Issue	Author:	Checked	Approved
Final	00	N/A	July 2021	Paul Hands MSc, BEng (Hons) EngTech MICE	Paul Hands MSc, Beng (Hons) EngTech MICE	Paul Hands MSc, Beng (Hons) EngTech MICE
Final	01	Appendices 1 and 3 removed	July 2021	Paul Hands MSc, BEng (Hons) EngTech MICE	Paul Hands MSc, Beng (Hons) EngTech MICE	Paul Hands MSc, Beng (Hons) EngTech MICE

Notice

This Flood Risk Assessment is an assessment of all sources of flood risk associated with the proposed development. The information presented and conclusions drawn are based on statistical data and are for guidance purposes only. Subsequently, the conclusions drawn could differ if the information is found to be inaccurate, misleading or if additional information exists or becomes available.

This FRA has been prepared using our best engineering judgement, however, there are levels of uncertainty implicit in the historical data and methods of analysis. Subsequently, this report provides no guarantee against flooding of the site or surrounding catchment, nor does it provide guarantees as to the absolute accuracy of water levels, flow rates and associated probabilities quoted. The author of this report therefore accepts no liability should this be the case.

All Environment Agency mapping data used under special license. All data is current as of the date of issue of this document but may be subject to change.

EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) has been carried put in accordance with the requirements of the National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance (PPG). This report is an assessment of all sources of flood risk associated with the proposed development.

The Environment Agency (EA) Mapping shows the site to located entirely within Flood Zone 3. The Environment Surface Water Flood Maps show that much of the site and surrounding catchment is at very low risk of pluvial flooding, however, a small, isolated part of the site is shown to be at low risk of pluvial flooding.

The potential flood risks posed by sewers, reservoirs and groundwater sources are also considered to be low.

The Updated South Holland Strategic Flood Risk Assessment (SFRA) Hazard Mapping suggests:

I. the site has a hazard classification of 'danger for some' in both the 0.5% (1 in 200) and 0.1% (1 in 1,000) year events,
II. the eastern extent of the site may flood to a depth of between 0.00m and 0.25m in the 1.0% Fluvial and 0.5% (2115) Tidal Breach Event.
III. the site is not susceptible to flooding in the event of a flood defence breach in the 1.0% Fluvial and 0.5% (Present day) February 2017 Tidal Breach Event.
IV. the eastern extent of the site has a "Low Flood Hazard, less than 0.75" and the mapping suggests that the Flood Hazard throughout the rest of the site is considered to be less than low in the 2115 Tidal Breach Event.
V. the eastern extent of the site has a "Low Flood Hazard, less than 0.75" and the mapping suggests that the Flood Hazard throughout the rest of the site is considered to be less than low in the 2115 Tidal Breach Event.
VI. the Residual Flood Velocity in the (2115) Tidal Breach Event across most of the site is anticipated to be 0.00 m/s with only the far eastern extents of the site falling within the 0.00 m/s and 0.30 m/s range.
VII. the Residual Flood Velocity in the (Present day) February 2017 Tidal Breach Event is anticipated to be 0.00 m/s.

CONTENTS

LIST OF TABLES 4
LIST OF FIGURES 4
APPENDICES 5
1.0.0 INTRODUCTION 6
2.0.0 SITE LOCATION, DESCRIPTION AND DEVELOPMENT DETAILS 7
3.0.0 NATIONAL PLANNING POLICY FRAMEWORK (NPPF) 9
3.1.0 REQUIREMENTS OF A FLOOD RISK ASSESSMENT 9
4.0.0 POTENTIAL SOURCES OF FLOOD RISK 13
4.1.0 FLUVIAL FLOOD RISK 14
4.2.0 BREACH ASSESSMENT 16
4.3.0 PLUVIAL FLOOD RISK 23
4.4.0 RESERVOIRS AND ARTIFICIAL WATER BODIES 25
4.5.0 SEWER FLOODING 26
4.6.0 GROUNDWATER FLOOD RISK 28
5.0.0 GEOLOGY 30
6.0.0 FLOOD WARNING AND EMERGENCY EVACUATION PLAN (FWaEEP) 31
6.1.0 SOURCE OF FLOODING 32
6.2.0 FLOOD WARNING INFORMATION 32
6.3.0 FLOOD ALERTS 33
6.4.0 EA – FLOOD WARNING 34
6.5.0 EA – SEVER FLOOD WARNING 35
6.6.0 EA – FLOOD WARNINGS NO LONGER IN FORCE 36
7.0.0 FLOOD RISK MITIGATION 38
8.0.0 SUSTAINABLE DRAINAGE STATEMENT 40
9.0.0 FOUL WATER DRAINAGE 42
10.0.0 CONCLUSION 42

LIST OF TABLES

TABLE 1: Site summary

TABLE 2: Flood risk vulnerability classification

TABLE 3: Flood risk vulnerability and flood zone compatibility

TABLE 4: Sources of flood risk

TABLE 5: Environment Agency flood map description

TABLE 6: Surface water flood risk descriptions

LIST OF FIGURES

FIGURE 1 – EA Flood Map for Planning (Rivers and Sea)

FIGURE 2 – EA Flood Map for Planning (Rivers and Sea)

FIGURE 3 – SFRA – Breach Locations

FIGURE 4 – SFRA – Residual Flood Depth2115_1_Fluvial_05_Tidal_2017.02.24_v2

FIGURE 5 – SFRA 3 – Residual Flood Depth Present_Day_1_Fluvial_05_Tidal_2017.02.24

FIGURE 6 – SFRA 4 – Residual Flood Extent 2115 2017.02.24

FIGURE 7 – SFRA Residual Flood Extent Present Day 2017.02.24

FIGURE 8 – SFRA Residual Flood Hazard 2115_1_Fluvial_05_Tidal_20170224

FIGURE 9 – SFRA Residual Flood Hazard Present Day 1_Fluvial_05_Tidal_20170224

FIGURE 10 – SFRA 8 Tidal Fluvial Dominated Extent 2115_1_Fluvial_05_Tidal_20170302

FIGURE 11 – SFRA 9 Fluvial Tidal Source Mapping 2115_1_Fluvial_05_Tidal_2017.02.28

FIGURE 12 – SFRA Residual Flood Velocity 2115_1_Fluvial_05_Tidal_2017.02.28

Figure 13 – SFRA Residual Flood Velocity Present_Day_1_Fluvial_05_Tidal_2017.02.28

Figure 14 – EA Flood Risk from Surface Water Flood Maps

FIGURE 15 – EA Risk of Flooding from Reservoirs Failure Flood Map

FIGURE 16 – Soilscapes Map

FIGURE 17 – BGS 1:50,000 Scale Online Mapping Site Geology

FIGURE 18 – EA Flood Alert – Flood Warning Information

FIGURE 19 – EA Flood Warning – Flood Warning Information

FIGURE 20 – EA Severe Flood Warning – Flood Warning Information

FIGURE 21 – EA Flood Warnings no longer in force – Flood Warning Information

FIGURE 22 – Indicative location of emergency evacuation muster point(s)

APPENDICES

APPENDIX 1 – Topographical Survey

1.0.0 INTRODUCTION

1.1.1 This Flood Risk Assessment (FRA) has been produced for the proposed commercial development at land at Laurel Lodge Farm, Hurn Road, Holbeach, Spalding PE12 8JB.

1.1.2 This report is an assessment of all sources of flood risk associated with the proposed development. The information presented and conclusions drawn are based on statistical data and are for guidance purposes only.

1.1.3 The Environment Agency (EA) Mapping shows the site to located entirely within Flood Zone 3. The Environment Surface Water Flood Maps show that much of the site and surrounding catchment is at very low risk of pluvial flooding, however, a small, isolated part of the site is shown to be at low risk of pluvial flooding.

1.1.4 The potential flood risks posed by sewers, reservoirs and groundwater sources are also considered to be low.

1.1.5 The SFRA Hazard Mapping shows the potential flooding consequences should a breach or overtopping of their sea defences occur. The Hazard Mapping includes an estimation of the likely flood depths, velocities and overall hazard that could impact the site in any one year up to 2115.

1.1.6 The Hazard Mapping suggests:

i. the site has a hazard classification of 'danger for some' in both the 0.5% (1 in 200) and 0.1% (1 in 1,000) year events,
ii. most of the site will not flood during the 1.0% Fluvial and 0.5% (2115) Tidal Breach Event, however, the eastern extent of the site may flood to a depth of between 0.00m and 0.25m in the 1.0% Fluvial and 0.5% (2115) Tidal Breach Event.
iii. the site is not susceptible to flooding in the event of a flood defence breach in the 1.0% Fluvial and 0.5% (Present day) February 2017 Tidal Breach Event.
iv. the eastern extent of the site has a "Low Flood Hazard, less than 0.75" and the mapping suggests that the Flood Hazard throughout the rest of the site is considered to be less than low in the 2115 Tidal Breach Event.
v. the eastern extent of the site has a "Low Flood Hazard, less than 0.75" and the mapping suggests that the Flood Hazard throughout the rest of the site is considered to be less than low in the 2115 Tidal Breach Event.
vi. the Residual Flood Velocity in the (2115) Tidal Breach Event across most of the site is anticipated to be 0.00 m/s with only the far eastern extents of the site falling within the 0.00 m/s and 0.30 m/s range.
vii. the Residual Flood Velocity in the (Present day) February 2017 Tidal Breach Event is anticipated to be 0.00 m/s.

2.0.0 SITE LOCATION, DESCRIPTION AND DEVELOPMENT DETAILS

2.0.1 Table 1 below summarises the sites salient features.

Site Address	Land at Laurel Lodge Farm, Hurn Road, Holbeach, Spalding PE12 8JB
Approximate National Grid Reference (NGR)	537919, 325550
Existing Development	Commercial
Proposed Development	Commercial
Flood Zone(s)	The site is located entirely located within Flood Zone 3
Surface Water Flooding	The EA Surface Water Flood maps suggest the site is considered to be at very low risk of pluvial flooding.

Table 1 – Site Summary

2.0.2 The topographical survey of the site shows the site is generally flat with land levels ranging from between 3.1mAOD and 3.7mAOD and is included as **Appendix 1**. Please note, the topographical survey has been included for reference purposes only and observations **must not** be scaled from the printed topographical survey plan. Should you wish to scale observations or interrogate the survey, an electronic version of the survey can be provided separately in .dxf or .dwg formats.

2.1.0 SOURCES OF INFORMATION / DATA

2.1.1 This FRA is based on the following sources of information:

- Environment Agency online Flood Maps for Planning (Rivers and Sea),
- Environment Agency online Flood Maps (Flood Risk from Surface Water),
- Environment Agency online Risk of Flooding from Reservoirs,
- Environment Agency Product 4 data,
- British Geological Survey maps,
- Updated South Holland Strategic Flood Risk Assessment (SFRA) - Modelling and Mapping Note report reference: WATPB3271R001D01 – Revision: 01 / Final prepared by Royal Haskoning DHV on the 28th February 2017.
- LiDAR data,
- Soilscapes 1:250,000 Cranfield Soil and AgriFood Institute (CSAI), Soil Mapping,
- Site Specific BRE365 Infiltration Testing prepared by Paul Hands Consulting Limited on the 16th June 2021 (report reference: LLF-INF-0001.F01.00).

3.0.0 NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

3.0.1 The National Planning Policy Framework (NPPF) clearly identifies flood risk as a specific material consideration in the Planning Process and in the allocation and release of sites for development or re-development.

3.0.2 The NPPF expects the Local Planning Authority to adopt a risk-based approach at all levels of planning, through the application of the Sequential Test.

3.0.3 The aim of the sequential test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

3.0.4 The Strategic Flood Risk Assessment will provide the basis for applying this test. A sequential approach should be used in areas known to be at risk from any form of flooding.

3.1.0 REQUIREMENTS OF A FLOOD RISK ASSESSMENT

3.1.1 Paragraph 30 of the Planning Practice Guidance to the National Planning Policy Framework (PPG to the NPPF) states:

"A site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk to and from a development site. Where necessary (see footnote 20 in the National Planning Policy Framework), the assessment should accompany a planning application submitted to the local planning authority. The assessment should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users (see Table 2 – Flood Risk Vulnerability)."

3.1.2 Footnote 20 of the National Planning Policy Framework (NPPF) states:

"A site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding."

3.1.3 The objectives of a site-specific flood risk assessment are to establish:

- *"Whether a proposed development is likely to be affected by current or future flooding from any source;*
- *Whether it will increase flood risk elsewhere;*
- *Whether the measures proposed to deal with these effects and risks are appropriate;*
- *The evidence for the local planning authority to apply (if necessary) the Sequential Test, and;*
- *Whether the development will be safe and pass the Exception Test, if applicable."*

3.1.4 Paragraph 31of the PPG to the NPPF states:

"The information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a Strategic Flood Risk Assessment for the area, and the interactive flood risk maps available on the Environment Agency's web site.

A flood risk assessment should also be appropriate to the scale, nature and location of the development. For example, where the development is an extension to an existing house (for which planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, the local planning authority would generally need a less detailed assessment to be able to reach an informed decision on the planning application. For a new development comprising a greater number of houses in a similar location, or one where the flood risk is greater, the local planning authority would need a more detailed assessment."

3.1.5 Table 2 on the following page is a copy of Table 2: 'Flood Risk Vulnerability Classification' taken from of the PPG to the NPPF.

ESSENTIAL INFRASTRUCTURE
• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
HIGHLY VULNERABLE
• Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes, and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
MORE VULNERABLE
• Hospitals, residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill* and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
LESS VULNERABLE
• Police, ambulance and fire stations which are not required to be operational during flooding. • Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill* and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do not need to remain operational during times of flood. • Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
WATER-COMPATIBLE DEVELOPMENT
• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel working. • Docks, marinas and wharves. • Navigation facilities. • Ministry of Defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 2 – Flood Risk Vulnerability classification

3.1.6 With reference to Table 2, it is evident that the proposed development is classified as a 'More Vulnerable' development.

3.1.7 With reference to Table 3 below which is a copy of Table 3: 'Flood Risk Vulnerability and flood zone compatibility' taken from of the PPG to the NPPF. It is evident that the proposed 'More Vulnerable' development located entirely within Flood Zone must pass the Exception Test.

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 †	×	Exception test required	✓	✓
Zone 3b *	Exception test required *	×	×	×	✓

Table 3 – Flood Risk Vulnerability and flood zone compatibility

Key:

- ✓ Development is appropriate
- × Development should not be permitted

4.0.0 POTENTIAL SOURCES OF FLOOD RISK

4.0.1 Table 4 below identifies all of the potential sources of flood risk which may pose a flood risk to the site and the surrounding catchment.

4.0.2 Each source of flood risk is discussed in greater detail in the relevant section of this report and where necessary, appropriate flood risk mitigation measures may be recommended to minimise the likelihood and consequence of flooding and to facilitate a quicker recovery in the event of a flood.

Source of Flood Risk	Risk Potential					Justification
	High	Medium	Low	V. Low	None	
Fluvial – Main River	✓					The site is located within Flood Zone 3 and is susceptible to flooding in the event of a flood defence breach.
Pluvial – Surface Water Runoff				✓		The site is considered to be at very low risk of pluvial flooding.
Reservoirs and Artificial Water Bodies					✓	The EA Risk of Flooding from Reservoirs Flood Maps confirm that in the event of a Reservoir and/or Artificial Water Body breach, the nearby reservoir or water bodies would not impact the proposed development.
Sewer Flooding				✓		The existing surface water sewer system that serves the site will be replaced with a new drainage system which will attenuate runoff via an appropriate sustainable drainage system.
Groundwater					✓	The site is not known to be susceptible to ground water flooding.
Tidal/Coastal Flooding			✓			The site is defended from tidal and coastal Flooding via EA maintained flood defences.

Table 4 – Sources of Flood Risk

4.1.0 FLUVIAL FLOOD RISK

4.1.1 Fluvial flooding occurs when the flows exceed the capacity of the channel, or where a restrictive structure is encountered, which leads to water overtopping the banks into the floodplain. This process can be exacerbated when debris is mobilised by high flows and accumulates at structures.

4.1.2 The Environment Agency Flood Maps for Planning refer to 'Flood Zones' which show the extent of the natural floodplain and ignores the presence of flood defences, manmade structures and channel improvements.

4.1.3 Table 5 details the Environment Agency Flood Map Descriptions:

Annotation	Description
Dark blue shading **(Flood Zone 3)**	**Flood Zone 3** comprises of two elements; **Flood Zone 3A** and **Flood Zone 3B** where: **Flood Zone 3A** shows the area of land that could be affected by flooding from rivers during a 1.0 per cent (1 in 100 year event) and from the sea during a 0.5 per cent (1 in 200 year event). **Flood Zone 3B** denotes the area of land where water has to flow or be stored in times of a flood. It is typically defined as an area of land that has a 5.0 percent (1 in 20 year) or greater chance of occurring each year.
Light blue shading	**Flood Zone 2** Shows the areas which are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000 year) chance of occurring each year.
No blue shading	**Flood Zone 1** Shows the area of land where flooding from rivers and the sea is extremely unlikely and is defined as land having a less than 0.1 per cent (1 in 1,000 year) chance of occurring each year.
Dark blue line	**Main rivers** These are usually larger streams and rivers.
Purple Line (Flood Defences)	The **purple line** shows all flood defences built since 2010 with a standard of protection equal to or greater than 1.0 percent for rivers and 0.5 percent from the sea. Older defences or defences that provide a lower standard of protection may not be shown.
Hatched Areas	The hatched areas identify both the areas of land which are afforded protection from fluvial flooding up to and including the 1 per cent (1 in 100 year) chance of occurring each year, or flooding from the sea in a 0.5 per cent (1 in 200 year) chance of occurring each year.

Table 5 – Environment Agency Flood Map Description

4.1.4 Figures 1 sourced from the Environment Agency online Flood Map for Planning website[1] indicates that the site is located entirely within Flood Zone 3.



Figure 1 – EA Flood Map for Planning (Rivers and Sea)

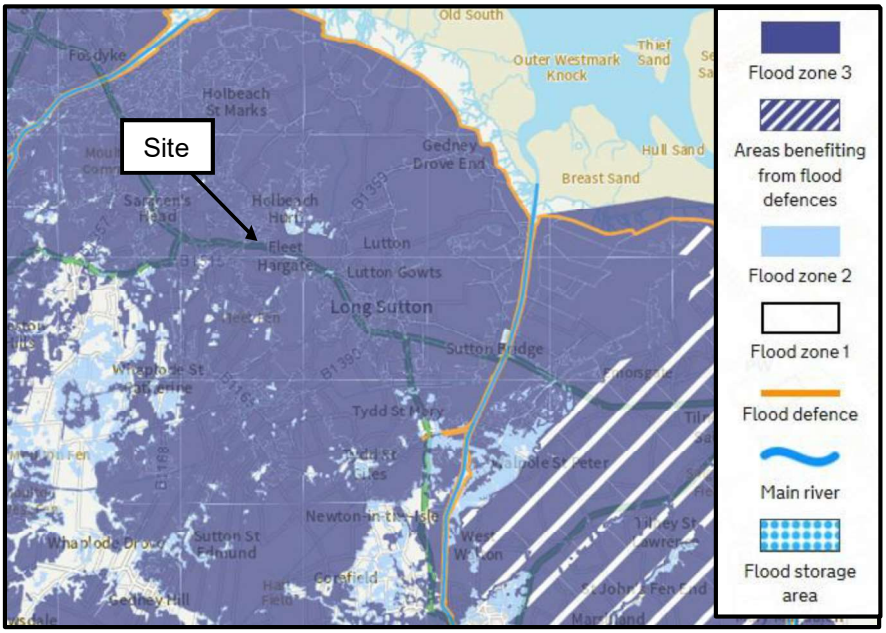


Figure 2 – EA Flood Map for Planning (Rivers and Sea)

[1] Environment Agency Flood Map for Planning http://maps.environment-agency.gov.uk

4.2.0 BREACH ASSESSMENT

4.2.1 The South Holland Strategic Flood Risk Assessment (SFRA) - Modelling and Mapping Note, report reference: WATPB3271R001D01 – Revision: 01/Final was prepared by Royal Haskoning DHV on the 28th February 2017 sets out the process and parameters used in generating additional 2D flood modelling outputs that have been used in the update (2016) of the South Holland Strategic Flood Risk Assessment.

4.2.2 The report is supplementary to the June 2009 Modelling Report of the previous SFRA study. The information presented is supplementary to that in the main SFRA report. The outputs from the modelling study have been used to map maximum flood depth, velocity, hazard and extent for a range of flood probabilities.

4.2.3 To achieve the modelling outputs, two new detailed TUFLOW models were developed to represent the likely flood extents as a result of breaching of the defences from the Crowland and Cowbit Washes and from the River Glen at Surfleet.

4.2.4 Fluvial boundaries were generated utilising the Environment Agency's 2007 version of the MIKE11 River Welland and Glen Catchment Strategic Model.

4.2.5 Screengrabs of the Updated South Holland Strategic Flood Risk Assessment (SFRA) - Modelling and Mapping outputs are shown as **Figures 3 – 13.** To view the full scale Updated South Holland Strategic Flood Risk Assessment (SFRA) - Modelling and Mapping outputs, please refer to the South Holland Strategic Flood Risk Assessment (SFRA) - Modelling and Mapping outputs by clicking this link.

4.2.6 The nearest flood defences are located 9.0 km northeast of the site, approximately 9.0km northwest of the site and approximately 10 km southeast of the site. The modelled breach locations are shown as **Figure 3**.

4.2.7 **Figure 4** shows most of the site will not flood during the 1.0% Fluvial and 0.5% (2115) Tidal Breach Event, however, the eastern extent of the site may flood to a depth of between 0.00m and 0.25m in the 1.0% Fluvial and 0.5% (2115) Tidal Breach Event.

4.2.8 **Figure 5** shows the site will not be susceptible to flooding in the event of a flood defence breach in the 1.0% Fluvial and 0.5% (Present day) February 2017 Tidal Breach Event.

4.2.9 **Figure 6** shows the Residual Flood Extents in the 1.0% Fluvial and 0.5% (2115) Tidal Breach Event.

4.2.10 **Figure 7** shows the Residual Flood Extents in the 1.0% Fluvial and 0.5% (Present day) February 2017 Tidal Breach Event.

4.2.11 **Figure 8** shows the eastern extent of the site has a "Low Flood Hazard, less than 0.75" and the mapping suggests that the Flood Hazard throughout the rest of the site is considered to be less than low in the (2115) Tidal Breach Event.

4.2.12 **Figure 9** shows the Flood Hazard at the site is considered to be less than low in the (Present day) February 2017 Tidal Breach Event.

4.2.13 **Figure 10** shows the Tidal Fluvial Dominated Extents in the 2115 Tidal Breach Event.

4.2.14 **Figure 11** shows the Tidal Fluvial Dominated Extents in the (Present day) February 2017 Tidal Breach Event.

4.2.15 **Figure 12** shows the Residual Flood Velocity in the 2115 Tidal Breach Event across most of the site is anticipated to be 0.00 m/s with only the far eastern extents of the site falling within the 0.00 m/s and 0.30 m/s range.

4.2.16 **Figure 13** shows the Residual Flood Velocity in the (Present day) February 2017 Tidal Breach Event is anticipated to be 0.00 m/s.

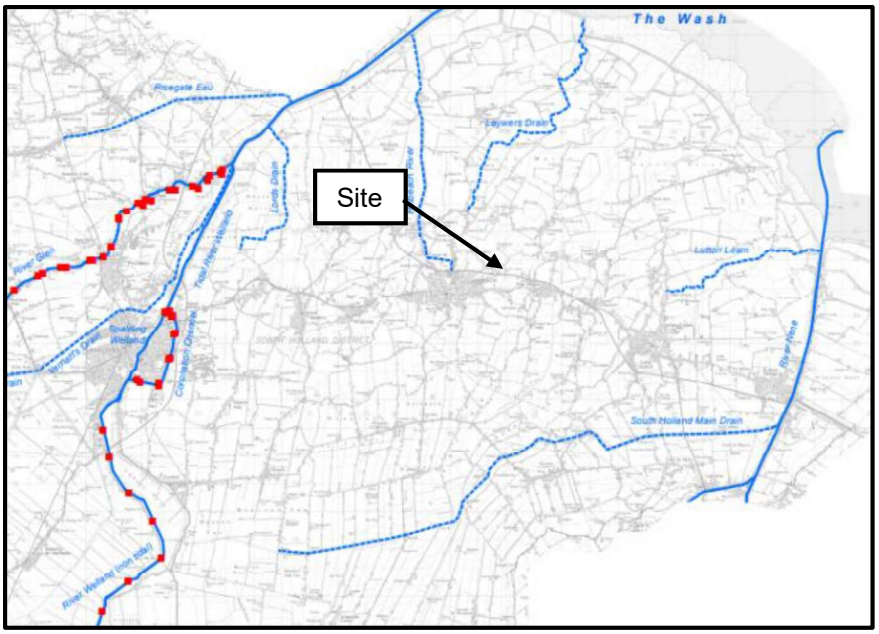


Figure 3 – SFRA – Breach Locations

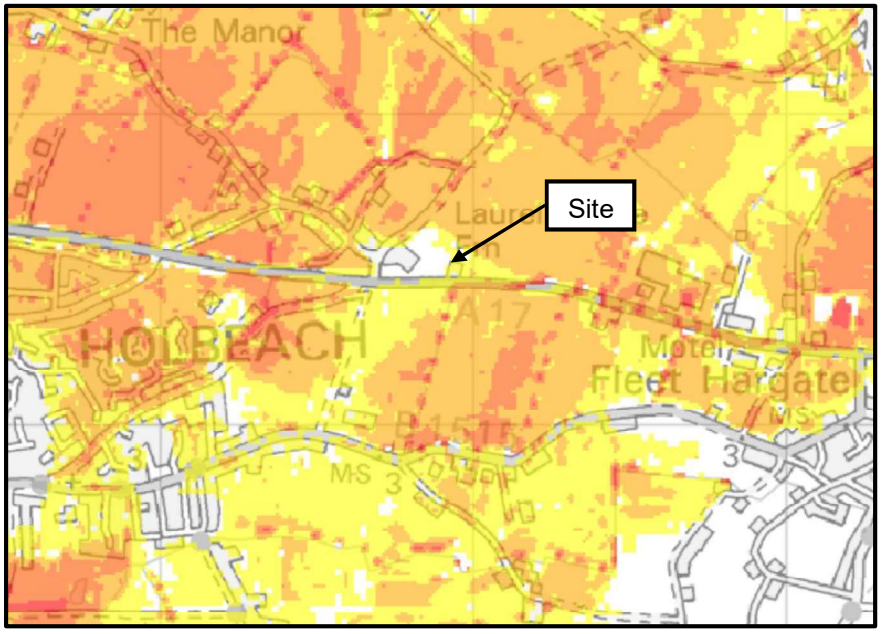


Figure 4 – SFRA – Residual Flood Depth year 2115_1_Fluvial_05_Tidal_2017.02.24_v2

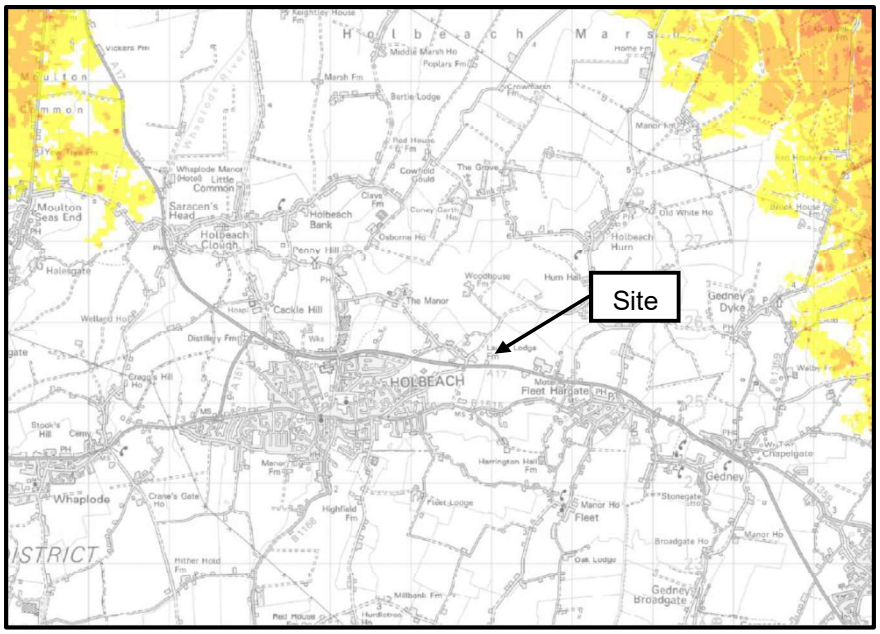


Figure 5 – SFRA 3 – Residual Flood Depth Present_Day_1_Fluvial_05_Tidal_2017.02.24

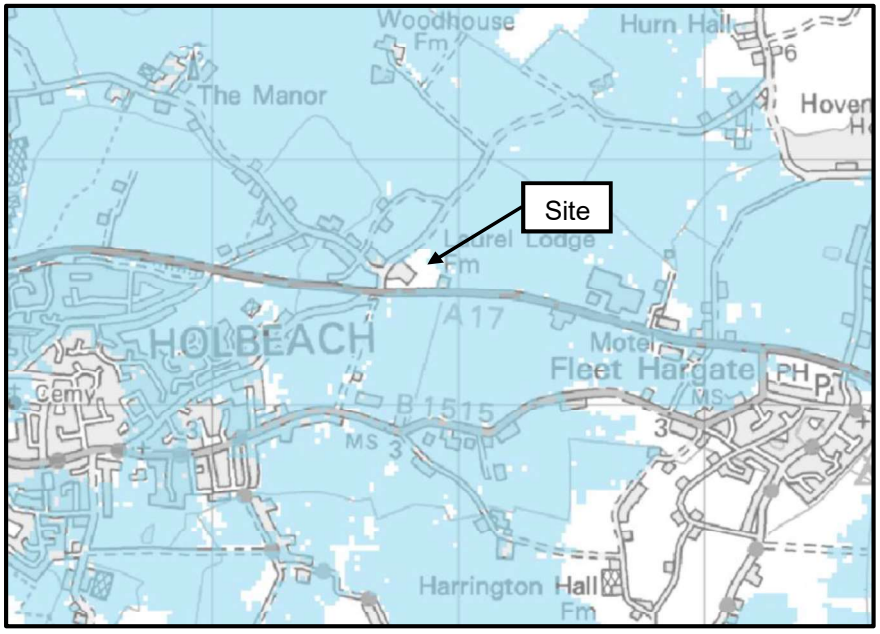


Figure 6 – SFRA 4 – Residual Flood Extent 2115 2017.02.24

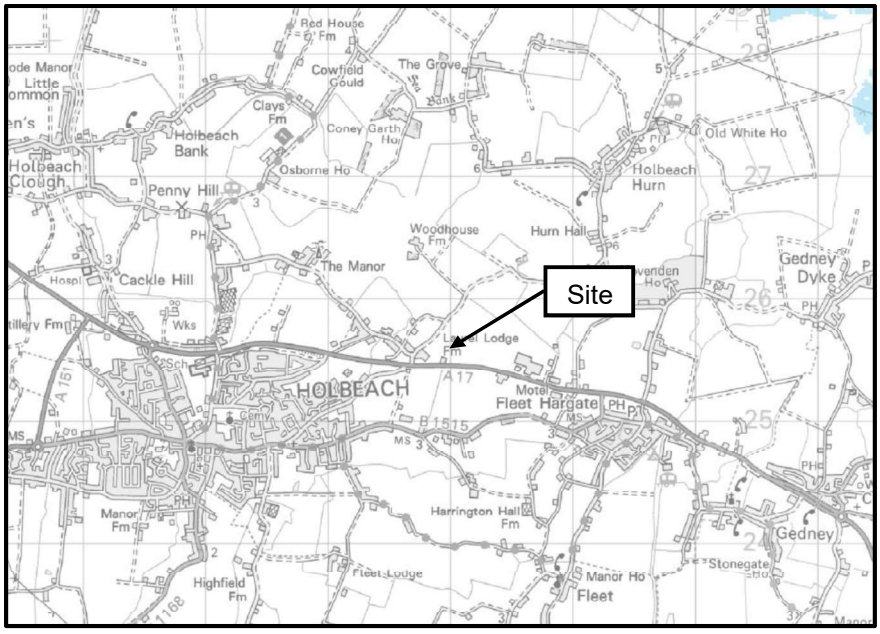


Figure 7 – SFRA Residual Flood Extent Present Day 2017.02.24

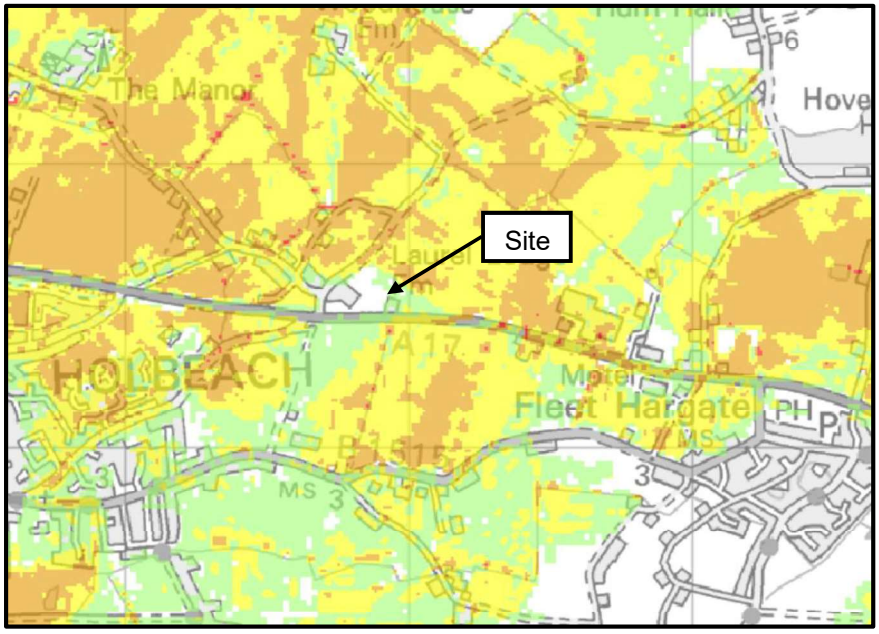


Figure 8 – SFRA Residual Flood Hazard 2115_1_Fluvial_05_Tidal_2017.02.24



Figure 9 – SFRA Residual Flood Hazard Present Day Fluvial_05_Tidal_2017.02.24

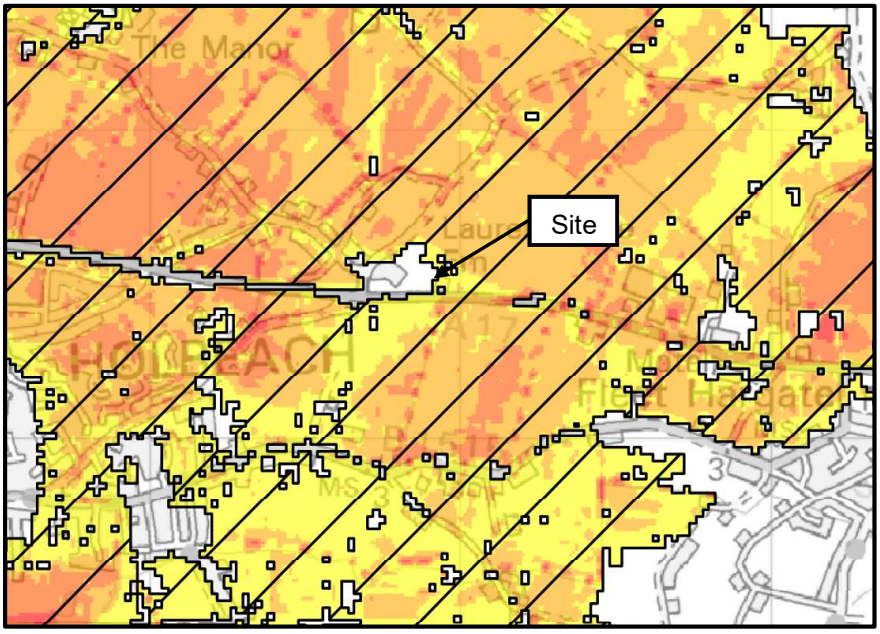


Figure 10 – SFRA 8 Tidal Fluvial Dominated Extent
2115_1_Fluvial_05_Tidal_2017.03.02

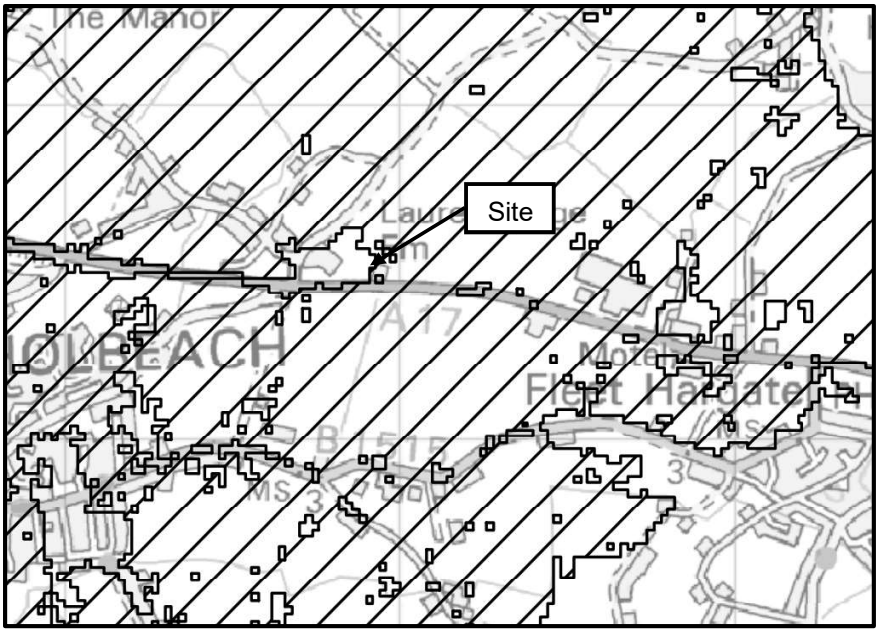


Figure 11 – SFRA 9 Fluvial Tidal Source Mapping
2115_1_Fluvial_05_Tidal_2017.02.28

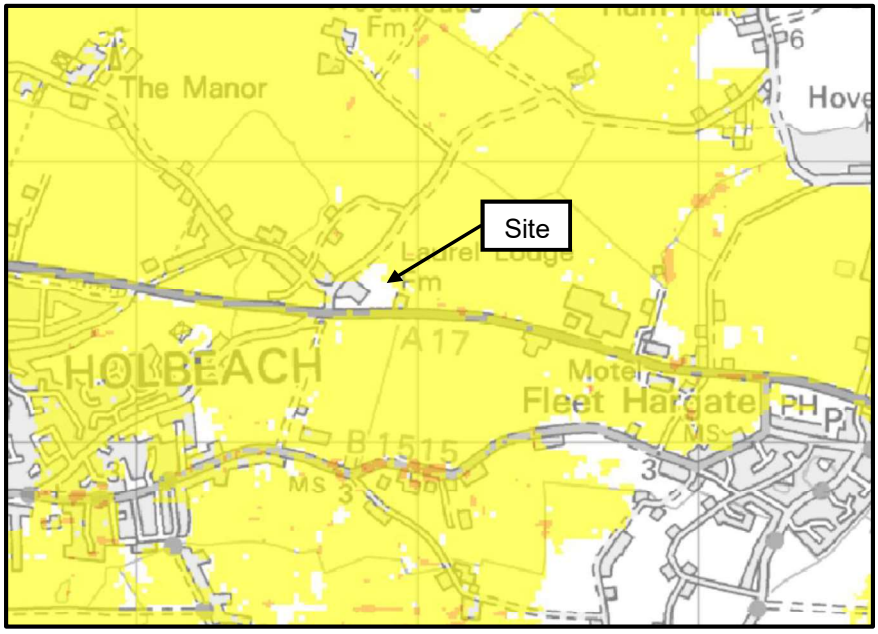


Figure 12 – SFRA Residual Flood Velocity 2115_1_Fluvial_05_Tidal_2017.02.28

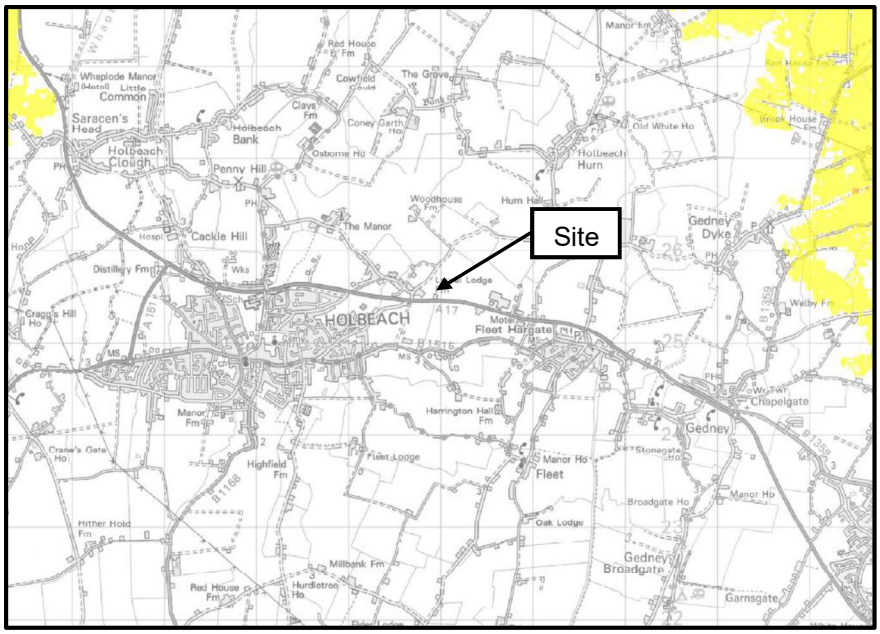


Figure 13 – SFRA Residual Flood Velocity Present_Day_1_Fluvial_05_Tidal_2017.02.28

4.3.0 PLUVIAL FLOOD RISK

4.3.1 The EA website states:

"Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. Because of this, we report the highest risk within 20m of a specific location, such as an individual property. This means reports for neighbouring properties may show different levels of risk."

4.3.2 Table 6 identifies the risk of surface water flooding throughout England as defined by the EA online Surface Water Flood Maps.

Scenario / Annotation	Description
High Risk – Dark blue shading	**High risk** means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
Medium Risk – Blue shading	**Medium risk** means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
Low Risk – Light blue shading	**Low risk** means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
Very Low Risk – No shading	**Very low risk** means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Table 6 – Surface Water Flood Risk descriptions

4.3.3 The Environment Agency Flood Risk from Surface Water Flood Maps (Figure 3) show much of the site and surrounding catchment is at very low risk of pluvial flooding, however, a small, isolated part of the site is shown to be at low risk of pluvial flooding.

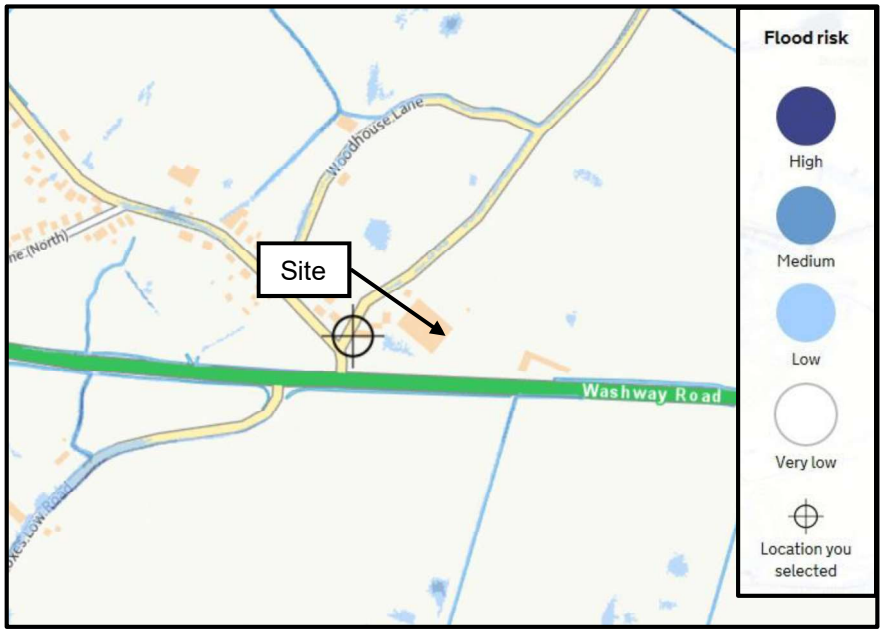


Figure 14 – EA Flood Risk from Surface Water Flood Maps

4.3.4 The proposed development will install a new surface water drainage system and therefore the proposed development will not be susceptible to surface water flooding in all events up to and including the 1%AEP plus CC scenario.

4.4.0 RESERVOIRS AND ARTIFICIAL WATER BODIES

4.4.1 The Environment Agency 'Risk of Flooding from Reservoirs' maps indicate areas where peoples' lives would be in danger as a result of an uncontrolled release of water from a reservoir. This shows that the site could be inundated along the eastern boundary during a reservoir breach.

4.4.2 Dams in England are regulated by the Reservoirs Act 1975, which sets out stringent conditions and requires the inspection and maintenance of reservoirs capable of holding over 25,000 m3 of water above natural ground level. The Environment Agency monitor compliance at such reservoirs and employ a range of enforcement options where necessary. As such the probability of a reservoir breach is deemed to be very low.

4.4.3 With reference to the below online Environment Agency Risk of Flooding from Reservoir Failure Flood Maps, shows parts the site is not be susceptible to flooding in the extremely unlikely event of a reservoir or artificial water body breach.

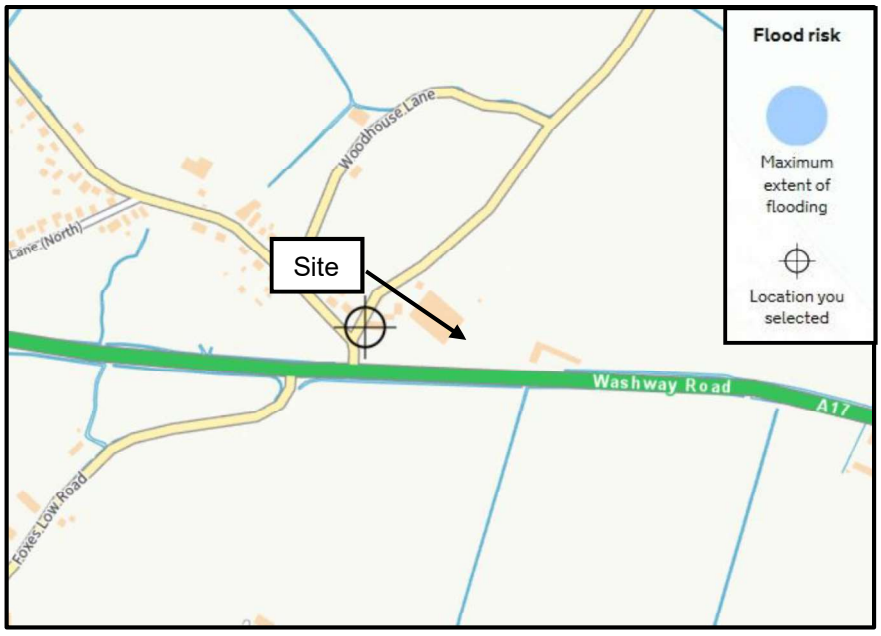


Figure 15 – EA Risk of Flooding from Reservoirs Failure Flood Map

4.5.0 SEWER FLOODING

4.5.1 Sewer flooding can occur when;

I. the capacity of the sewer system is overwhelmed by heavy rainfall and / or,
II. the sewer network becomes blocked or is of inadequate capacity, resulting in flooding of land and/or property.

4.5.2 It is anticipated that the existing surface water sewer system that serves the site will be replaced with a new drainage system which will attenuate runoff via an appropriate sustainable drainage system.

4.5.3 To ensure that the post-development run-off volumes and peak flow rates discharging from the site from do not exceed current levels, it may be necessary to employ SuDS (Sustainable Drainage Systems) methods and source control techniques, including flow control devices to restrict flows and to store attenuated water on site.

4.5.4 The provision of such techniques will ensure that the maximum discharge from the site will be limited to the equivalent greenfield runoff rates. In addition, where practicable, opportunities for reducing flood risk through the management of surface water run-off from the site should be included.

4.5.5 Whilst the surface water drainage strategy for this site is to be prepared independently of this FRA, it is suggested that the surface water drainage strategy should comply with the requirements of the Building Regulations Approved Document H, should be based on sustainable drainage principles and should limit the surface water discharge to the equivalent greenfield runoff rate.

4.5.6 It is anticipated that the proposed surface water drainage system will be designed to:

- not surcharge during the 1 in 5 year storm event,
- have sufficient capacity to accommodate the surface water flows within the pipe network during a 1 in 30 year flood event i.e. not flood the site during a 1 in 30 year storm event.

4.5.7 It is generally accepted that a degree of surface flooding can be permitted during extreme storm events, subject to specific surface areas being designated as flood-susceptible and subject to flooding of these areas posing little or no risk to human life and/or damage to property. Examples of surface areas which might be permitted to flood during extreme events are:

- Agricultural land,
- Recreational land (playing fields etc.),
- Landscaped areas,
- Car parks,
- Other non-inhabited, designated areas.

4.5.8 In all cases where surface flooding might be permitted or designed into a scheme, due diligence needs to be given to the NPPF and the need to make potential users of such areas aware of their

functionality and purpose, and the requirement to maintain safe access and egress at all times.

4.5.9 It is recommended that surface water drainage features should be adopted and maintained by an appropriate and responsible authority in perpetuity to ensure long term operation at the designed parameters.

4.5.10 The site is not known to be susceptible to sewer flooding, however, should the sewers, drains or gullies within the site flood then the flood water would flow away from the site via the network of dykes and ordinary watercourses which serve the catchment.

4.6.0 GROUNDWATER FLOOD RISK

4.6.1 Groundwater flooding generally occurs during intense and/or long-duration rainfall events which is sometimes referred to as antecedent conditions.

4.6.2 Groundwater flooding is most common in low-lying areas overlain by permeable soils and permeable geology, or in areas with a naturally high-water table.

4.6.3 According to the Soilscapes Maps produced by the National Soils Research Institute, soil conditions (Figure 16) at the site and within the surrounding catchment are described as 'Loamy and clayey soils of coastal flats with naturally high groundwater.

4.6.4 The Soilscapes Maps suggest the site and surrounding catchment are moderately lime-rich, soils are mostly drained, shallow groundwater and marginal ditches surrounding most fields mean that surface water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to the land.

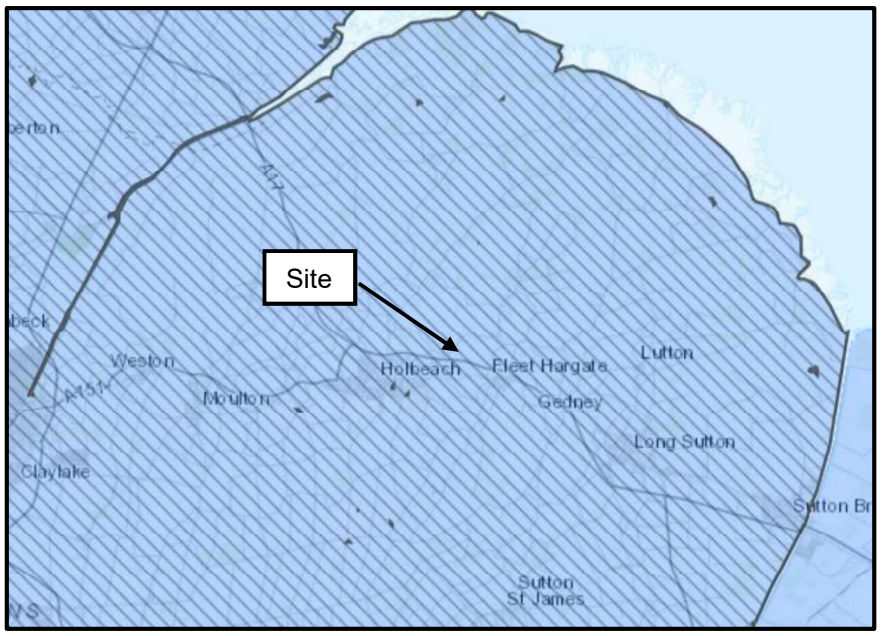


Figure 16 – Soilscapes Map

4.6.5 As part of the BRE 365 Infiltration Testing conducted on the 16th June 2021, three Trial Pits (TP's) TP's 1, 2 and two deep trial trenches (DTT's) were excavated to depth of between 1.17mBGL and 2.1mBGL to try and establish the sites water table.

4.6.6 Whilst neither of the deep trial trenches identified a perched water table during the site investigation on the 16th June 2021, given the sites elevation above sea level, it is recommended that deep infiltration devices are avoided.

4.6.7 Whilst the site specific BRE365 infiltration testing identified that the surface water drainage strategy could utilise infiltration as a means of managing a degree if not all of the increased surface water runoff from the site, it is recommended that should the proposed development utilise infiltration as a means of managing the increased surface water runoff from the proposed development, the infiltration device(s) should be designed with a high-level overflow(s) to accommodate any changes in water table depth due to antecedent conditions.

4.6.8 The permeability of the underlying soil conditions and the subsequent propensity for groundwater flooding may therefore be considered low.

4.6.9 Whilst the propensity for groundwater flooding at the site is considered to be low, the proposed development will construct a new surface water drainage system and therefore the proposed development will not be susceptible to surface water flooding in all events up to and including the 1% AEP plus CC scenario.

4.6.10 The flood resilient measures recommended within this report will further reduce the likelihood and consequence of flooding and will facilitate a quicker recovery in the unlikely event of a flood.

5.0.0 GEOLOGY

5.0.2 The (online) 1:50,000 scale bedrock geology BGS Maps suggests the sites geology comprises of Ampthill Clay Formation - Mudstone with clay and silt superficial deposits formed up to 2 million years ago in the Quaternary Period.

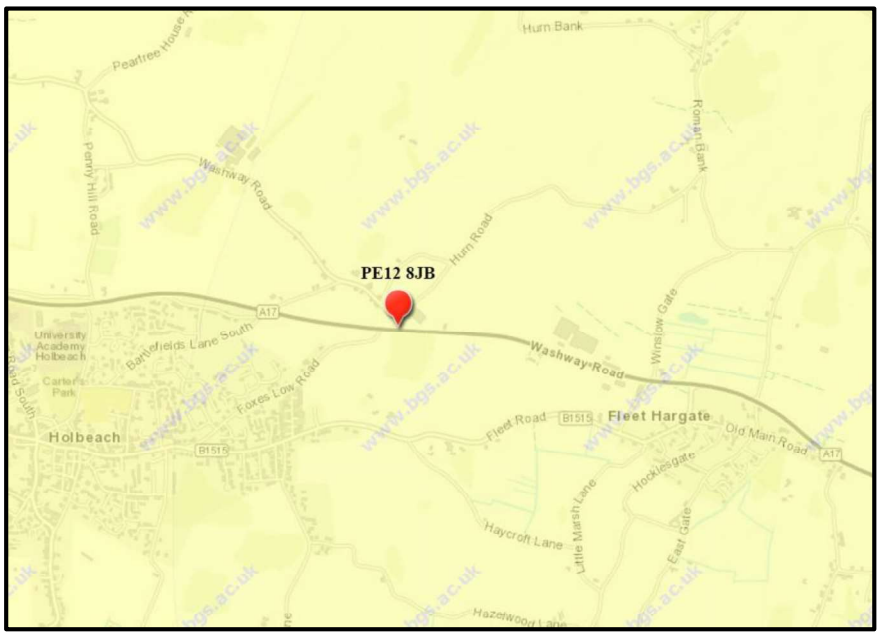


Figure 17 – BGS 1:50,000 Scale Online Mapping Site Geology

5.0.3 The site specific BRE 365 infiltration testing confirmed:

- Topsoil was encountered from ground level to a depth of 0.21mbgl, 0.24mbgl and 0.23mbgl respectively.
- Brown / yellow mudstone, siltstone and sandstone with Alluvium - clay, silt and sand superficial deposits were noted in all trial pits from the base of the topsoil to the base of the trial pits.

6.0.0 FLOOD WARNING AND EMERGENCY EVACUATION PLAN (FWaEEP)

6.0.1 This Flood Warning and Emergency Evacuation Plan (FWaEEP) seeks to ensure that the occupants of the site are satisfactorily prepared for a potential flood and can safely evacuate from the site in the event of a flood.

6.0.2 The purpose of this plan is to:

I. raise the occupant's awareness of the risk of flooding to the site,
II. detail the type of flood warnings and estimated lead time,
III. explain:
    a. the details of the emergency evacuation plan and the need for safe refuge,
    b. when, how and who triggers the evacuation plan,
    c. what actions are required by the occupants of the site,

6.0.3 This FWaEEP has been prepared with reference to the EA's website which contains up to date guidance on flooding issues. The information presented and conclusions drawn are based on statistical data and are for guidance purposes only. Subsequently, the conclusions drawn could differ if the information is found to be inaccurate, misleading or if additional information exists or becomes available.

6.0.4 Whilst every effort has been made to ensure the advice provided within this plan is accurate at the date of production, it is the responsibility of the manager/owner of the site to ensure that any additional risk specific to the site are fully considered and that the FWaEEP is kept up to date.

6.0.5 This FWaEEP should be read in conjunction with the site-specific Flood Risk Assessment for the site.

6.0.6 This FWaEEP has been prepared using our best engineering judgement, however, there are levels of uncertainty implicit in the historical data and methods of analysis. Subsequently, this FWaEEP provides no guarantee against flooding of the site or surrounding catchment, nor does it provide guarantees as to the absolute accuracy of water levels, flow rates and associated probabilities quoted. The author of this report therefore accepts no liability should this be the case.

6.1.0 SOURCE OF FLOODING

6.1.1 The proposed development site is located entirely within the defended Flood Zone 3 extents and the surface water flood maps suggest that the site is considered to be at very low risk of pluvial flooding. The site is not thought to be susceptible to ground water flooding.

6.1.2 The nearest flood defences are located 9.0km north east of the site, approximately 9.0km north west of the site and approximately 10 km south east of the site.

6.1.3 Flood Deference Breach - the site has a hazard classification of 'danger to all', indicating danger to all types of people, including emergency services. The site could experience flood depths of greater than 1.6m arising from a breach in the defences during a flood that has a 0.1% chance of occurring in any one year up to 2115.

6.2.0 FLOOD WARNING INFORMATION

6.2.1 There are a variety of methods of flood warnings available throughout the UK, however, by far the best FWaEEP comes in the form of awareness, vigilance and preparedness.

6.2.2 The EA operates a 5-day flood risk for England and Wales and can be viewed via 5-day flood risk for England and Wales - GOV.UK (flood-warning-information.service.gov.uk)

6.2.3 The EA operate Flood Alerts and Flood Warnings for England and Wales which can be viewed via Flood warnings for England - GOV.UK (flood-warning-information.service.gov.uk) where:

6.3.0 FLOOD ALERTS



Figure 18 – EA Flood Alert – Flood Warning Information

6.4.0 EA – FLOOD WARNING

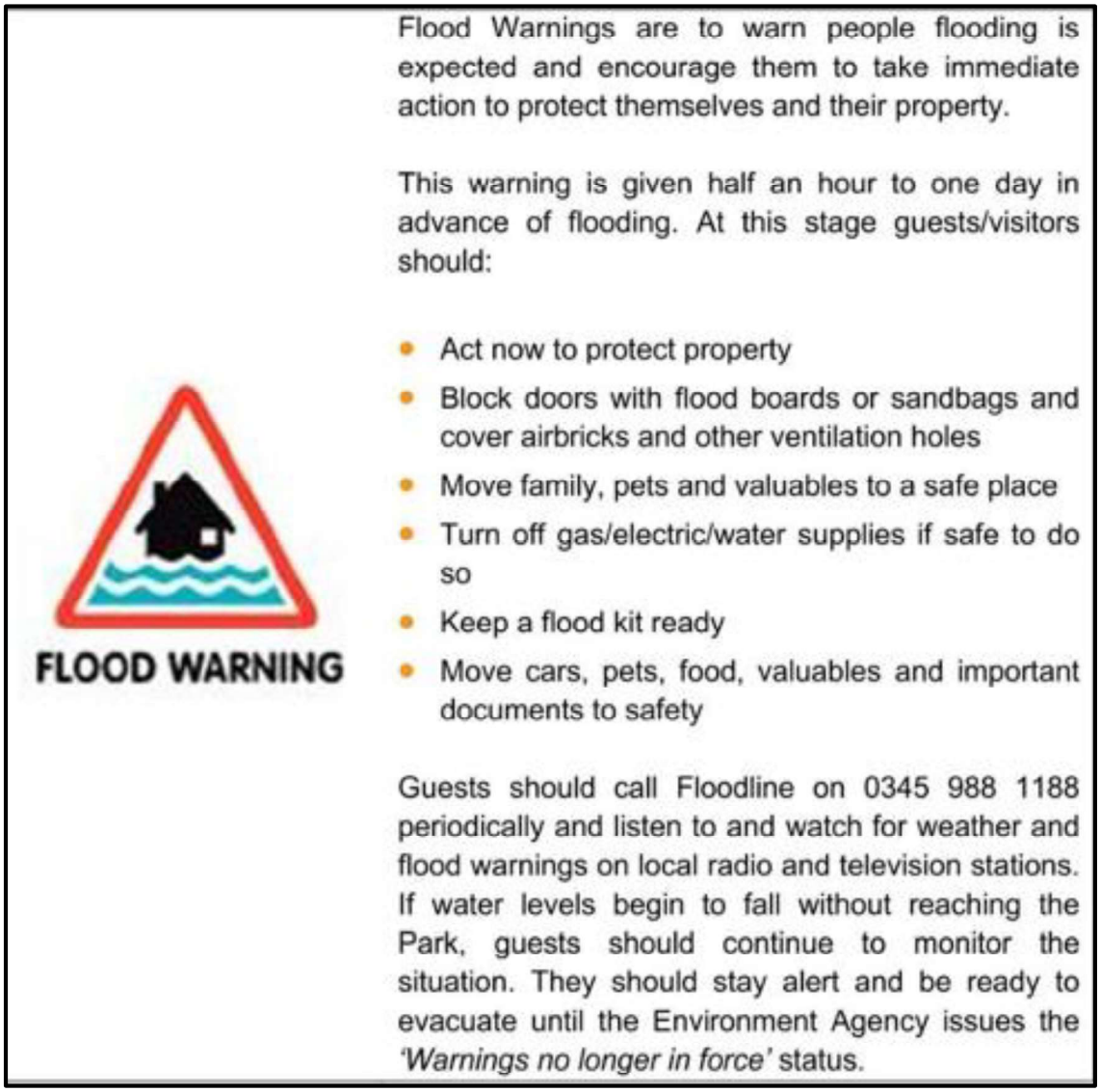


Figure 19 – EA Flood Warning – Flood Warning Information

6.5.0 EA – SEVER FLOOD WARNING

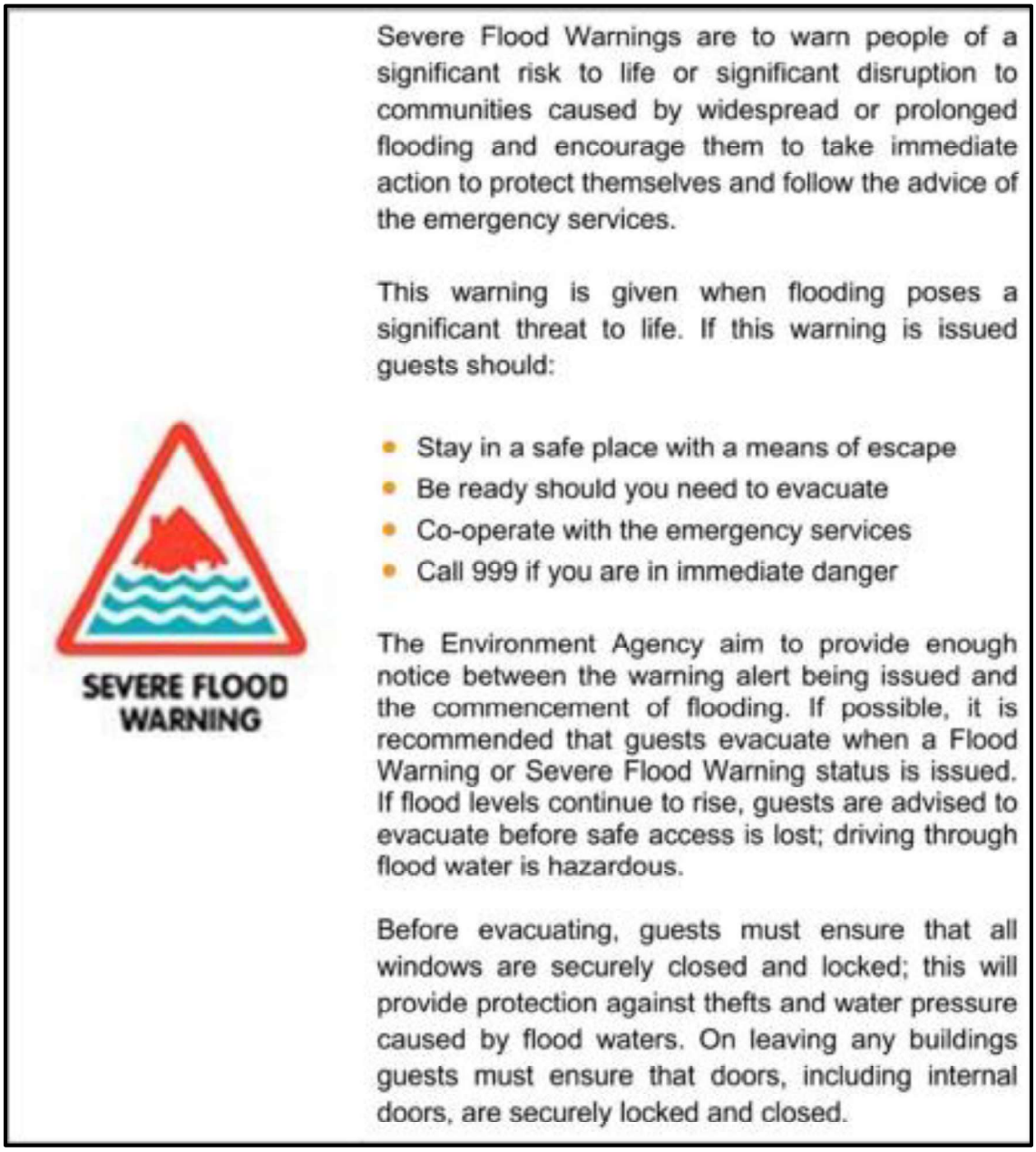
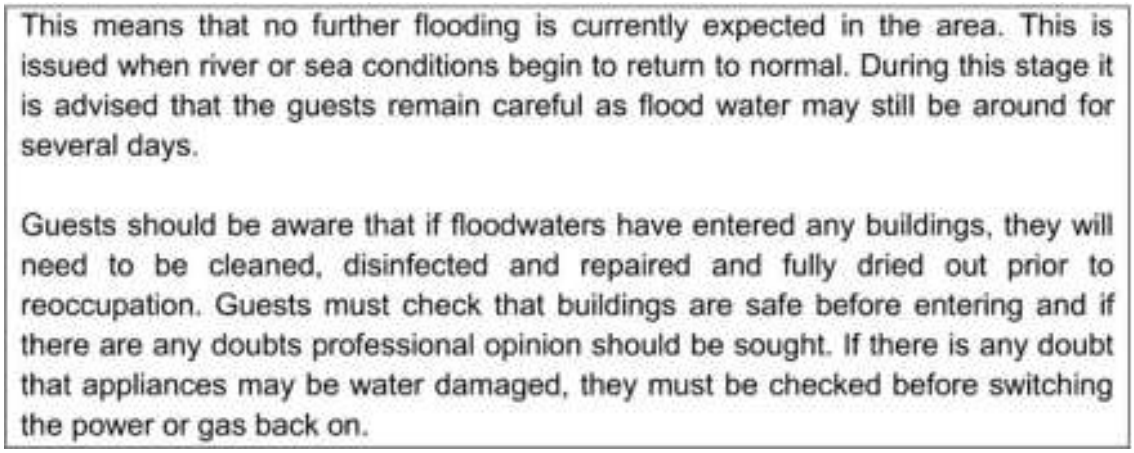


Figure 20 – EA Severe Flood Warning – Flood Warning Information

6.6.0 EA – FLOOD WARNINGS NO LONGER IN FORCE



This means that no further flooding is currently expected in the area. This is issued when river or sea conditions begin to return to normal. During this stage it is advised that the guests remain careful as flood water may still be around for several days.

Guests should be aware that if floodwaters have entered any buildings, they will need to be cleaned, disinfected and repaired and fully dried out prior to reoccupation. Guests must check that buildings are safe before entering and if there are any doubts professional opinion should be sought. If there is any doubt that appliances may be water damaged, they must be checked before switching the power or gas back on.

Figure 21 – EA Flood Warnings no longer in force – Flood Warning Information

6.6.1 Given the anticipated flood hazard, depths, flows and velocities in the event of a flood defence breach and / or overtopping of the flood defence, it is recommended that:

i. The occupants of the site signing up to the Environment Agency Flood Line Warnings Direct via https://fwd.environment-agency.gov.uk/app/olr/register or by calling the Flood line on 0845 988 1188 to facilitate evacuation the event of an extreme flood event.

ii. The occupants of the site should be made fully aware of all the potential flood risk to the site.

iii. The occupants of the site should be encouraged to evacuate the site prior to flooding should significant or prolonged storm events be anticipated.

iv. If the occupants of the site are asked to evacuate the site by a risk management authority such as the EA, LLFA, Police or Fire Services etc., they must do as soon as safe and practicable.

v. The preferred emergency evacuation muster point which is located within Flood Zone 1 is Whaplode, Spalding which is approximately 5.0 km southwest of the site as shown in Figure 22.

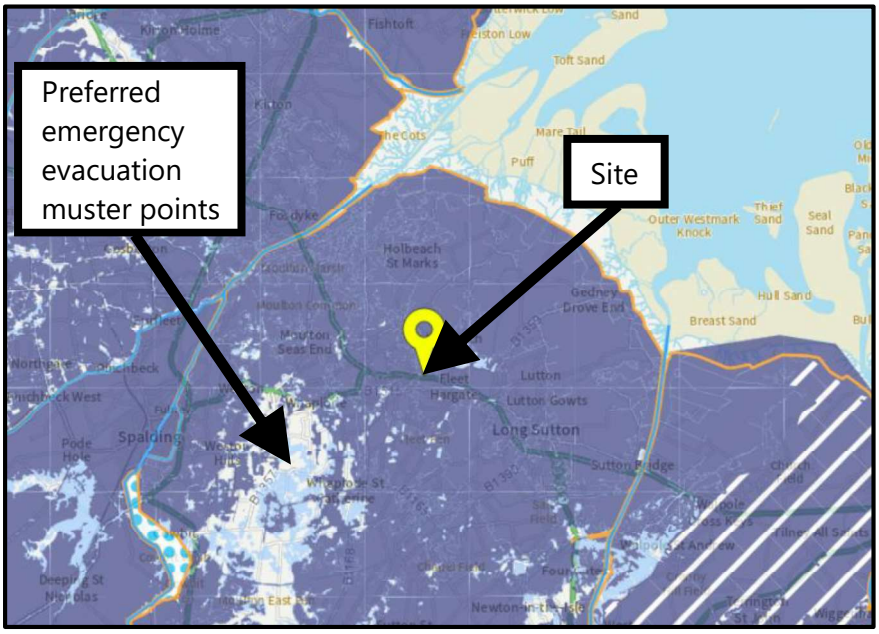


Figure 22 – Indicative location of emergency evacuation muster point(s)

7.0.0 FLOOD RISK MITIGATION

7.0.1 It is recommended that the FFL's shall be set at least 0.20m above existing ground level.

7.0.2 Land levels across the site should remain broadly similar to the existing land levels to prevent a loss of floodplain capacity in the event of a flood defence breach.

7.0.3 Land levels throughout the development should be profiled to encourage the runoff and overland flows to drain away from buildings and vulnerable infrastructure, and towards the nearest drainage point.

7.0.4 The proposed development has a first-floor refuge which could be used by the occupants of the site in the unlikely event of a food defence breach.

7.0.5 The occupants of the site should be made fully aware of the flood risks to the site and should acknowledge, understand and adhere the emergency evacuation procedures if it is safe and practicable.

7.0.6 The occupants of the site may wish to consider signing up to the Environment Agency Flood Line Warnings Direct via https://fwd.environment-agency.gov.uk/app/olr/register or by calling the Flood line on 0845 988 1188 to facilitate evacuation the event of an extreme flood event.

7.0.7 To further reduce the consequences of flooding and to facilitate a quicker recovery in the event of an extreme flood, it is recommended that the developer should consider implementing all appropriate flood resistant and resilient measures and should give due consideration to the reconditions of the Environment Agency and DEFRA report *'Improving the flood performance of New Buildings – Flood Resilient Construction' (ISBN 9781859462874)* including and not limited to:

7.1.0 FLOOD RISK MITIGATION – EXTERNAL WORKS

- The building(s) should:
    - Be constructed using low permeability materials to a level equivalent to the proposed ground floor level plus at least 600mm,
    - Install non-return valves in all sewer pipes,
    - Avoid using timber frame and cavity walls with water absorbing fillers,
    - Raise airbricks as high as practical and consider installing airbrick covers,
    - Consider incorporating property level resilience and / or temporary demountable flood gates /barriers and removable airbrick covers

7.2.0 FLOOD RISK MITIGATION – INTERNAL WALLS

- The building(s) should:
    - Avoid the use of permeable materials gypsum, plaster and plaster boards etc. and use more flood resistant linings (e.g. hydraulic lime, ceramic tiles, etc.)throughout the ground floor,
    - Avoid the use of chipboard throughout the ground floor,
    - Where plaster board cannot be avoided, it should be installed horizontally so that it can be replaced cost effectively if it is damaged,
    - Consider avoiding the use of stud partition walls throughout the ground floor,

- It is recommended that:
    - The ground floor is constructed from a solid concrete floor with an integrated and continuous damp proof membrane and damp proof course,
    - Solid water-resistant insulation materials are used throughout the ground floor.

7.3.0 FIXTURES AND FITTINGS

- It is recommended that:
    - All units and appliances used throughout the ground floor should be elevated as high as practical,
    - All internal electrical sockets are raised as high as practical and least 300mm above the internal Finished Floor Level,
    - Where possible all electrical sockets should wired down from the ceiling rather than up from the ground,

8.0.0 SUSTAINABLE DRAINAGE STATEMENT

8.0.1 The surface water drainage strategy for this site will prepared independently of this FRA and therefore the surface water drainage strategy forms no part of this FRA.

8.0.2 The surface water drainage strategy for the site will be prepared and submitted to the Local Planning Authority independently of this report.

8.0.3 To ensure that the post-development run-off volumes and peak flow rates discharging from the site from do not exceed current levels, it may be necessary to employ SuDS (Sustainable Drainage Systems) methods and source control techniques, including flow control devices to restrict flows and to store attenuated water on site.

8.0.4 The provision of such techniques will ensure that the maximum discharge from the site will be limited to the equivalent Greenfield runoff rates. In addition, where practicable, opportunities for reducing flood risk through the management of surface water run-off from the site should be included.

8.0.5 Whilst the surface water drainage strategy for this site is to be prepared independently of this FRA, it is suggested that the surface water drainage strategy should comply with the requirements of the Building Regulations Approved Document H, should be based on sustainable drainage principles and should limit the surface water discharge to the equivalent greenfield runoff rate.

8.0.6 The Building Regulations Approved Document H outlines a hierarchy of potential methods of disposing of surface water from a site:

- *"A* soakaway; or where that is not practicable,
- A watercourse or river; or where that is not practicable,
- A sewer."

8.0.7 In addition to the aforementioned discharge requirements, it is recommended that any surface water drainage systems should be designed in accordance with the last 'Sewers for Adoption'.

8.0.8 The Sewers for Adoption 7th Edition requires any surface water drainage system which is proposed to be adopted after construction to:

- not *surcharge* during the 1 in 5 year storm event,
- have sufficient capacity to accommodate the surface water flows within the pipe network during a 1 in 30 year flood event i.e. not flood the site during a 1 in 30 year storm event.

8.0.9 It is generally accepted that a degree of surface flooding can be permitted during extreme storm events, subject to specific surface areas being designated as flood-susceptible and subject to flooding of these areas posing little or no risk to human life and/or damage to property. Examples of surface areas which might be permitted to flood during extreme events are:

- Agricultural land,
- Recreational land (playing fields etc.),
- Landscaped areas,
- Car parks,
- Other non-inhabited, designated areas.

8.0.10 In all cases where surface flooding might be permitted or designed into a scheme, due diligence needs to be given to the NPPF and the need to make potential users of such areas aware of their functionality and purpose, and the requirement to maintain safe access and egress at all times.

8.0.11 It is recommended that surface water drainage features should be adopted and maintained by an appropriate and responsible authority in perpetuity to ensure long term operation at the designed parameters.

8.0.12 To inform and assist the detailed design of the Surface Water Drainage strategy, site specific infiltration testing was conduct in accordance with the BRE 365 Guidance at the site on the 16th June 2021.

8.0.13 The site-specific infiltration report has been prepared independently of this FRA and will be submitted to the Local Planning Authority independently of this report.

9.0.0 FOUL WATER DRAINAGE

9.0.1 The foul water drainage strategy for this site has been prepared independently of this FRA and therefore forms no part of this FRA.

9.0.2 The surface water drainage strategy for the site will be prepared and submitted to the Local Planning Authority independently of this report.

10.0.0 CONCLUSION

10.0.1 This FRA is fully compliant with the requirements set out in both the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF.

10.0.2 This FRA has considered all source of flood risk and has demonstrated that:

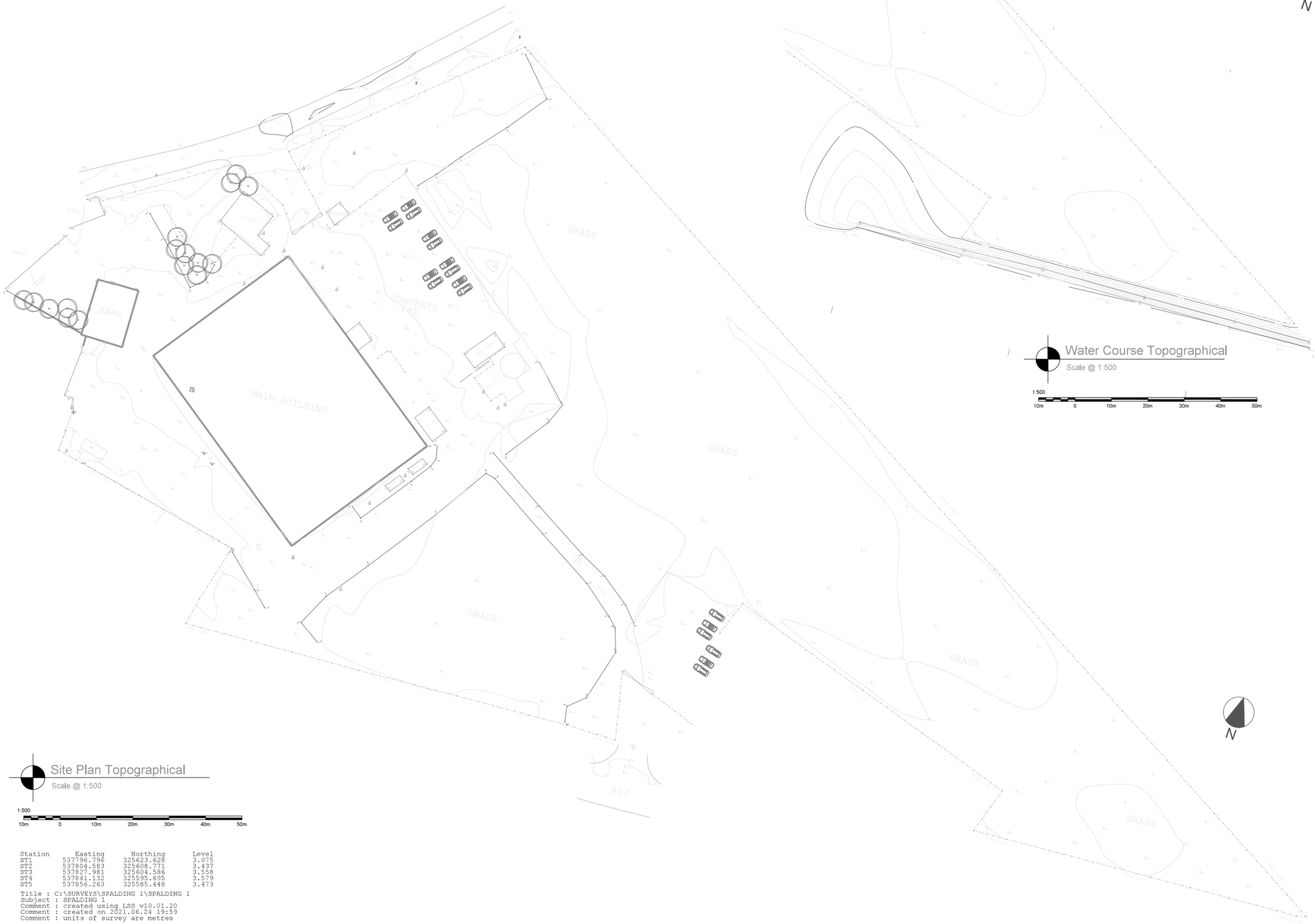
- The proposed development will not increase the risk of flooding to others and will not adversely affect the local management of flood risk within the vicinity of the site.
- All measures so far as reasonably practicable to reduce flood risk to the occupants of the site have been considered and recommended within this FRA.

10.0.3 This report demonstrates that the proposed development is not at significant flood risk subject to the flood mitigation measure recommended within this report.

10.0.4 This Flood Risk Assessment has considered the current understanding of the impacts of climate change and has demonstrated that the development and its occupants will remain safe and operational from all sources of flood risk throughout the lifetime of the development.

10.0.5 This FRA has considered the current understanding of the impacts of climate change and has demonstrated that the proposed development; will remain safe and operational from all sources of flood risk, will not increase flood risk elsewhere throughout the lifetime of the development and is therefore compliant with the requirements of the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) to the NPPF.

APPENDIX 1



Site Plan Topographical

Scale @ 1:500

1:500

10m 0 10m 20m 30m 40m 50m

Station	Easting	Northing	Level
ST1	537796.796	325623.628	3.075
ST2	537804.583	325608.771	3.437
ST3	537827.981	325604.586	3.558
ST4	537841.132	325595.695	3.579
ST5	537856.263	325585.448	3.473

Title : C:\SURVEYS\SPALDING 1\SPALDING 1
Subject : SPALDING 1
Comment : created using LSS v10.01.20
Comment : created on 2021.06.24 19:59
Comment : units of survey are metres

N

Water Course Topographical

Scale @ 1:500

1:500

10m 0 10m 20m 30m 40m 50m

N

Copyright.
This drawing and design and all the information contained therein is the sole copyright of ByronTeknisk Ltd. and reproduction in any form is forbidden unless permission is obtained in writing.

No dimensions to be scaled from this drawing. All Contractors must visit site and be responsible for taking and checking all dimensions relative to this work. The Designer must be advised of any discrepancies in writing.

ALL FLOOR PLANS AND ELEVATIONS ARE TO BE READ IN CONJUNCTION WITH THE ATTACHED TERMS AND CONDITIONS. ANY DISCREPANCIES ARE TO BE REPORTED AND ASSESSED. SURVEY DRAWINGS ONLY AND NOT FOR CONSTRUCTION PURPOSES

THIS IS NOT AN ARBORICULTURAL SURVEY AND IS IN NO WAY TO BE USED AS SUCH. CROWN AND TRUNK DIMENSIONS ARE FOR LOCATION REFERENCE AND NOT TO BE SCALED.
ALL ARBO WORK MUST BE ASSESSED AND COMPLETED BY A QUALIFIED PROFESSIONAL IN THE SPECIFIED FIELD.

FOR TOPOGRAPHICAL PURPOSES ONLY

Revision: REV A GENERAL ARRANGEMENT

Scale: SEE NOTATION

Date: 0107 2021

Drawn by: SB

Job title: **MIDWEST POLYCHEM**
Laurel Lodge, Hurn Rd, Holbeach PE12 8JB

Drawing title: Existing Layout

Drawing Number: TSS0107202MIDWESTHOLBEACH

TSS
TechnicalSurveying.co.uk

TSS
Technical Site Services
FF12
Meteor House
Finningley
Doncaster
DN9 3GA

END