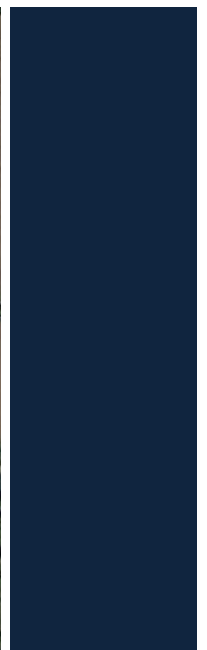


Ashwood Homes

Penny Hill Road, Holbeach – Phase 2

Flood Risk Assessment

Draft
June 2019



Revision Schedule

Flood Risk Assessment

June 2019

Doc Ref: AHL-1361-02-FRA-001

Rev	Date	Status	Prepared by	Reviewed by	Approved by
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-	June 2019	First Issue	Craig Russell	Stephen Riley BSc CEng MICE MCIHT	Lee Barnes BSc (Hons) MCIHT

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1.0 INTRODUCTION

- 1.1** Inspire Design & Development Ltd (IDD) has been appointed by Ashwood Homes to undertake a Flood Risk Assessment (FRA) of land located off Penny Hill, Holbeach.
- 1.2** The purpose of the report is to assess flood risk and drainage in accordance with the National Planning Policy Framework (NPPF) in support of the planning application for residential development at the proposed site. The requirement for an FRA is based primarily upon the flood zone classification (Zone 3a) affecting the site.
- 1.3** The report presents the outcome of the flood risk assessment undertaken on the site proposals. The information does not purport to be a detailed design for approval and/or construction purposes.
- 1.4** Penny Hill Road Phase 2 forms part of the wider Penny Hill Road site previously reported upon in Flood Risk Assessment Ref. AHL-1361-01-FRA-001-P01, dated July 2018.

2.0 SITE DESCRIPTION

2.1 General

2.1.1 The site is located to the north of Holbeach. Access to the site is from Penny Hill Road, which runs north/south to a junction with the A17 at its southern end. It covers an area of around 0.5 ha. The development proposes to construct 9 dwellings.

2.1.2 The approximate site centre is 536147E, 325695N. A site location plan is shown below.

Figure 1: Site Location Plan



Source: Ordnance Survey Open Data (2018)

2.1.3 The site is bound to the west by Penny Hill Road, to the north by a sports ground, to the east by a watercourse and to the south by residential properties.

2.1.4 British Geological Survey (BGS) records indicate that the bedrock geology is West Walton Formation – Mudstone and Siltstone. This sedimentary bedrock formed approximately 157 to 166 million years ago in the Jurassic Period. The local environment was previously dominated by shallow seas.

- 2.1.5 Superficial deposits are indicated as clay and silt, formed up to 3 million years ago in the Quaternary Period. The mapping can be seen on the BGS website. The local environment was previously dominated by organic accumulations. (British Geological Survey, 2018). It should be noted that the BGS data is a guide and is no substitute for intrusive investigation.
- 2.1.6 Topographical Survey data shows the site is relatively flat with elevations between 3.2m to 3.6m AOD.

2.2 Watercourses

- 2.2.1 As with the majority of the Fens, the land is reclaimed from the sea. The area relies upon a network of drainage channels, pumping stations, embankments and tidal barriers that drains the land, enabling its use. The area is renowned for being largely agricultural and the network of drainage supports this land use. The nearest surface watercourse runs along the entire eastern boundary of the site.
- 2.2.2 South Holland IDB have confirmed that the watercourse running along the eastern boundary of the site is maintained by the IDB and there are no known flood risk issues within the IDB network in this area.
- 2.2.3 South Holland IDB has advised that the 1 in 100 year fluvial event water level for the Old River (Drain) at the Eastern boundary, plus climate change (1% annual probability plus climate change) is 2.65m AOD.
- 2.2.4 The River Whaplode, which runs approximately 2 km to the west of the site, is an ordinary watercourse.
- 2.2.5 The River Welland, which lies approximately 7.5 km north-east of the site, is the closest designated Main River.

3.0 REFERENCES AND REPORTS

3.1 National Planning Policy Framework (NPPF)

3.1.1 The NPPF and the guidance on Site Specific Flood Risk Assessment at Paragraph: 030, Reference ID: 7-030-20140306 of the Planning Practice Guidance (NPPG) Flood risk and coastal change, published by the Ministry of Housing, Communities and Local Government, March 2014, is the key guidance referred to. The Environment Agency is a statutory consultee for all planning applications and will give comment and recommendations to the planning authority for any proposed developments in the flood zones and affecting main rivers. Under the Flood Water Management Act 2010, Lincolnshire County Council is the Lead Local Flood Authority (LLFA) and has a responsibility of managing flood risk from ordinary watercourses. A flood risk assessment, in accordance with NPPF, is required to accompany a planning application as the site is within Flood Zone 3.

3.1.2 The non-statutory technical standards for sustainable drainage systems, published by the Department for Environment, Food and Rural Affairs, March 2015, are used in conjunction with NPPG. This document provides additional guidance with reference to flood risk assessments, peak flow and volume control, structural integrity, design and construction of drainage within a proposed site and has been considered as part of this study.

3.2 South East Lincolnshire Local Plan 2011-2036

3.2.1 This document states that strategic flood risk in the context of the local plan has been considered within the South East Lincolnshire Strategic Flood Risk Assessment.

3.3 South East Lincolnshire Strategic Flood Risk Assessment (March 2017)

3.3.1 The Strategic Flood Risk Assessment, completed in March 2017 as an update to the original 2010 report, predicts flood depths from the present day through to 2115 for both the 1% fluvial/0.5% tidal and the 0.1% event probability. Extracts from this mapping are included within the **Appendix A** of this FRA.

3.3.2 From examination of the flood mapping, the proposed development site shows to be affected by flooding as follows;

Table 1: Flood Risk – Residual Flood Depth (South East Lincolnshire SFRA)

Year	Event	Flood Depth
2017	1% Annual Fluvial / 0.5% Tidal Probability	No flooding
2115	1% Annual Fluvial / 0.5% Tidal Probability	0 – 0.25m (some) 0.25m – 0.5m (majority)

Source: (South East Lincolnshire Joint Strategic Planning Committee, 2019)

3.3.3 The values above have been taken from mapping that forms part of the SFRA. Copies of these can be found within Appendix A of this report, however an extract produced at a larger scale is shown below.

Figure 2: 1 in 100 Year (1% annual probability) Flood Depth



Source: (South East Lincolnshire Joint Strategic Planning Committee, 2019)

3.3.4 As part of this report a Sequential Test was undertaken and it was noted that large parts of South Holland District lie within Flood Zone 3. In the absence of this as a useful benchmark for suitability, further assessment should be undertaken examining the hazard and depth maps to assist the application of the sequential test.

3.3.5 The site is located within a defended zone of the tidal River Welland. The River Welland is located over 7km to the north east of the site at its closest point. The River Welland benefits from flood defences to control the spread of flood water and to confine it to the storage area. It is noted from the records provided within the SFRA that the site is defended to a standard that avoids flooding of the site during 2017 at the 1% annual flood probability level. No flood mapping was shown within the SFRA indicating the extent and

depth of flooding in the extreme 0.1% annual exceedance probability event (1 in 1000 year fluvial event) for the South Holland area.

- 3.3.6 The site is considered to be defended from the tidal flooding by the Wash tidal defences to the Holbeach Marsh frontage. Defence embankment levels are noted to be at 7m AOD minimum, well above the current site topography which ranges from 3.2m to 3.6m AOD.
- 3.3.7 The site is notably defended by two lines of flood defences against tidal flooding. The first line has a minimum height of 7.00m AOD, with the 1 in 200 year tidal event predicted to reach 7.20m AOD, therefore overtopping defences by 0.2m. However, the second line of defences has embankments of 6.00m AOD which would contain such an overtopping event within a wider envelope with the depth much reduced. It is considered therefore that the site is well defended against such flooding.
- 3.3.8 With regard to the proposed development, classified as 'More Vulnerable' and within Flood Zone 3a, standing advice provided within Appendix C of the SFRA advises that advice from the Environment Agency (EA) be sought. The EA was consulted and their response formed the basis of the previous FRA – see para. 1.4 above.. The EA information is included in Section 3.6 below.

3.4 Geo-environmental assessment

- 3.4.1 At this time no site specific geo-environmental assessment has been completed to confirm or otherwise the geology identified from the BGS data.

3.5 IDB Correspondence

- 3.5.1 Information regarding the South Holland IDB drainage network was obtained in May 2018 which indicated that the site was bound on its eastern boundary by IDB drainage channels. There was, to the knowledge of the IDB, no surface water flooding issues associated with their drainage network in the vicinity. Copies of correspondence with South Holland IDB can be found in **Appendix B**.

3.6 EA Correspondence and Data

- 3.6.1 Correspondence was received from the EA on the 21 June 2018 and is included in **Appendix C**. This included the following information:
- The Flood Map - showing the area at risk of flooding (assuming no 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 flooding;
 - History of Flooding – indicated that the EA have no records;
 - Tidal Defence Information – detailing that the site is protected by earth embankments, in a fair condition, that reduce the risk of flooding to a 0.67% (1 in 150) chance of occurring in any year;
 - Modelled Hazard Mapping – showing maximum values of flood depth, velocity

and hazard rating resulting from breaching of defences, which indicate that the depth bands across the site for the 0.5% event vary from 0 to 1.0m.

3.6.2 Details of how the EA's requirements will be met are included in Section 6.2.

4.0 THE PROPOSED DEVELOPMENT

4.1 General

4.1.1 The proposal is at detailed stage and comprises the development around 9 dwellings.

4.2 Flood Risk Vulnerability

4.2.1 Table 2: Flood Risk Vulnerability Classification Paragraph: 066 Reference ID: 7-066-20140306 of the Planning Practice Guidance has been used to assess the Flood Risk Vulnerability classification for the proposed use of the site. The proposed residential use of the site is classed as ‘more vulnerable’.

4.3 Sequential Test

4.3.1 Residential developments are classified by the NPPF as ‘more vulnerable’ and appropriate in Flood Zone 3 subject to satisfying the Exception Test.

Table 2: Flood Risk and Flood Zone Compatibility

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception test required	✓	✓
	3a	Exception test required	✓	✗	Exception test required	✓
	3b Functional Floodplain	Exception test required	✓	✗	✗	✗

4.3.2 For the development of residential dwellings, classed as ‘More Vulnerable’ and within Flood Zone 3a, an exception test is required. The exception test, defined in section 160 of the NPPF requires that the development satisfies two criteria;

- It should be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk, and
- It should be demonstrated that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible will reduce flood risk overall.

4.3.3 In answer to the exception test criterium ‘a’, it is considered that the close link to the area

of Holbeach and adjacency to typical settlement development provides facilities for the development that would be unavailable in less adjoining locations. In addition the presence of more residential development provides support for local facilities to perpetuate their existence, such as bus services, local shops, community venues etc. It is therefore considered that the proposed development is sustainable when considered in the context of alternative locations.

- 4.3.4 It is considered in answer to criterium 'b', this site specific flood risk assessment aims to identify the flood risk to the proposed development and ensure that sufficient measures are put in place to enable the safe and timely evacuation of residents in dwellings that have potential flood risk. The flood risk assessment that follows will therefore put in place strategy and plan to ensure safe occupation of the proposed dwellings. It is considered that the proposed development is a significant distance from both the tidal and fluvial flooding sources and significant warning time would be available.

5.0 FLOOD RISK ASSESSMENT

5.1 Fluvial Flood Risk

- 5.1.1 The development site is located within Flood Zone 3a (Figure 4.1), that is, land assessed as having a 1% (1 in 100) or greater annual probability of river flooding or a 0.5% (1 in 200) or greater annual probability of flooding from the sea without the benefit of flood defences.
- 5.1.2 The primary risk of fluvial flooding to the site is from the River Welland, which flows to the north east of the site and is a Main River under the jurisdiction of the EA. A flood defence embankment is located along the River Welland to the west of the site that provides an initial line of defence to keep excess flows in channel. The River Welland is tidal within the area of influence of the proposed development site, however two levels of defences exist. The first line of barrier has a corresponding low spot and water level of 7.00m AOD and 7.200m AOD respectively, during the 2115 100 year plus climate change (1% annual exceedance probability plus climate change) event. This indicates that this first line of defence could be overtopped in this event. However further defences exist, providing a 6m AOD defence. It is considered that the likelihood of the flooding beyond these defences is unlikely.
- 5.1.3 The Strategic Flood Risk Assessment produced for South Holland District Council in 2017 shows that the development without defences would be subject to flooding, however when defended it benefits from protection up to and including the 1 in 100 return period (1% probability) fluvial event.
- 5.1.4 EA data (Section 3.6) states that the site is 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 flooding.
- 5.1.5 The site is within flood warning and alert areas. It is classed to be within the flood alert data as “far extent tidal flooding from the Wash between Gibraltar Point and Admiralty Point, and the Tidal River Witham, the Tidal River Welland and the Tidal River Nene”.

5.2 Breach Hazard

- 5.2.1 In a well defended area such as this, the fluvial risk in real terms is associated with failure by breach or overtopping of the defence embankment. This could potentially result in a sudden surge of floodwater into the land lying behind the defences. In this case, depths and velocities of water may both be significant and an assessment of this is required.
- 5.2.2 To assess the level of hazard presented by a breach, a simple assessment process is used that forms a relationship between distance from the breach and the head above crest level and the danger it presents to human life.

Table 3: Danger to People from Breaching Relative to Distance from Floodplain

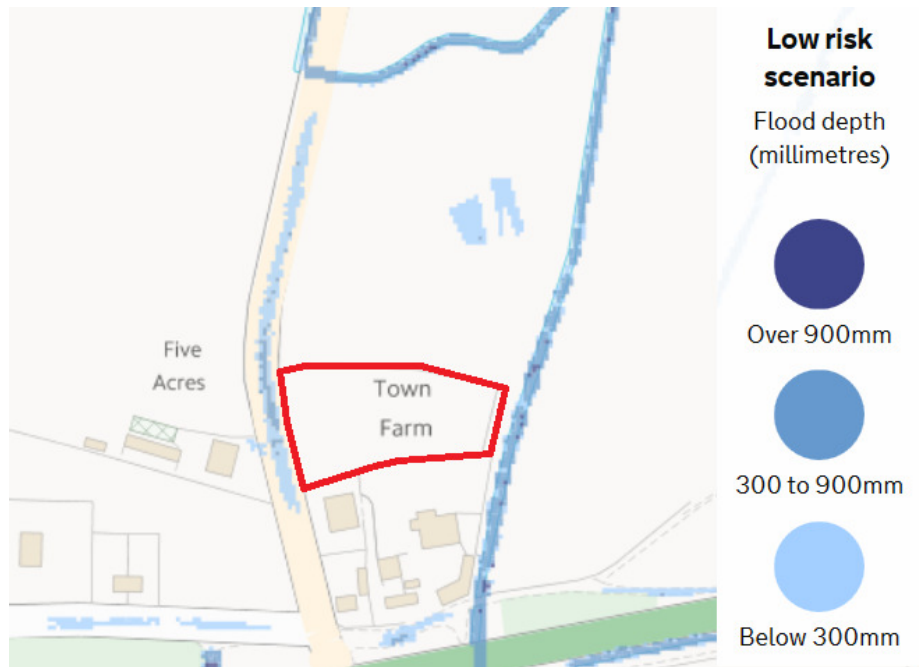
Distance from breach	Head above Flood plain (m)						
	0.5	1.0	2.0	3.0	4.0	5.0	6.0
100							
250							
500							
1000							
1500							
2000							
2500							
3000							
3500							
4000							
4500							
5000							
Key		Danger to all		Danger to most		Danger to some	

- 5.2.3 From the table above it is noted that the site is located approximately 7km from the nearest source of flooding (the Tidal River Welland) and as such the risk falls beyond the scope of this table, i.e. the risk is below the 'Danger to Some' level.
- 5.2.4 As discussed earlier, flood defences to the tidal river corridor are present, with an initial line presenting capacity to contain some events, and the secondary line of defences that contain larger flood events. It is considered that these two lines of defences provide robust defence against tidal or fluvial flood sources.
- 5.2.5 It is noted that other residential development in the locality faces similar and higher levels of exposure, both older and recently approved dwellings.
- 5.2.6 It is considered that as this area is protected by to two flood defences, the flood defences to the Wash that defend against tidal flooding and those to the River Welland that defend against tidal and fluvial events, the risk of flooding is low.

5.3 Pluvial Flood Risk

5.3.1 EA mapping available online indicates that the site is not at risk from surface water flooding.

Figure 3: Surface Water Flooding



5.3.2 The topography of the site and surrounding areas is relatively flat and therefore any runoff is likely to be relatively slow and shallow. The plan extract above shows some limited surface water flood risk outside of the site.

5.4 Flood Risk from Sewers

- 5.4.1 It is not known at this time whether flood risk from sewers exists within the local area, however as part of the planning process the local water company will be consulted to identify if foul or surface water flooding from the public sewer network occurs. Given the local regime for storm water discharge to the open channel network and the limited number of dwellings to generate foul water flows, it considered that sewer flooding is unlikely.

5.5 Groundwater Flood Risk

- 5.5.1 It is understood that the site geology consists of siltstone and mudstone, materials of typically very low permeability. Records from the British Geological Survey have been obtained from the 1:625,000 digital hydrogeological data which indicates that the area is underlain by the West Walton Mudstone and Siltstone formation, with essentially no groundwater.
- 5.5.2 No records of groundwater flooding were found for the site area. The risk of groundwater flooding is considered to be low.

6.0 MITIGATION

6.1 General

6.1.1 The proposed development is considered appropriate for the Zone 3a classification. It is acknowledged by the EA that the flood zone classification may give a misleading picture in that if there were no flood defences, water would spread out across these large Fenland floodplains. Defences are present, however, and are indicated to provide protection for the 1% AEP scenario. In practical terms therefore, the risk of flooding is associated with the unlikely scenario of a flood defence embankment breach.

6.1.2 The proposed mitigation measures to manage this risk are two-fold; raising finished floor levels and the application of advanced flood warning and emergency evacuation procedures.

6.2 Resistant and Resilient Building Techniques

6.2.1 The planning application for the site is for a detailed application. This gives the opportunity to ensure that, as buildings are designed, their layout and use of materials are resilient and resistant to flooding. The following principles will be applied:

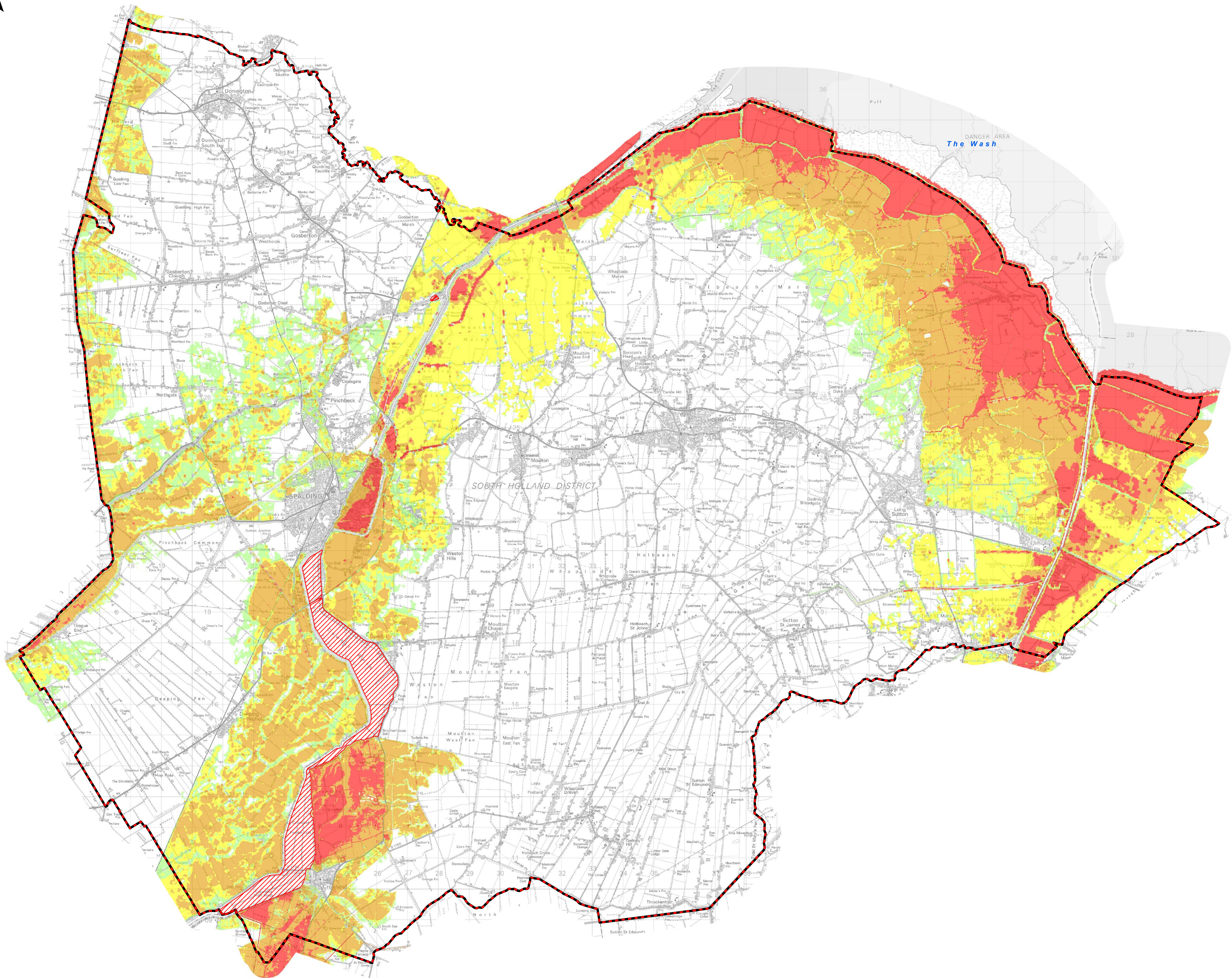
- (1) Finished floor levels will be set in accordance with the depth bands detailed on the EA mapping in **Appendix C**. Based on the current planning layout referenced in **Appendix D**, all plots are located in the 0-0.25m depth band and finished floor levels will be set a minimum of 300mm above the average site ground level of 3.4 m AOD (i.e. FFL at a minimum of 3.7m AOD). Refer to **Appendix D** for source of topographic information and minimum site ground level);
- (2) For information on resilient materials, designers should refer to the Communities and Local Government document 'Improving the flood performance of new buildings – Flood resilient construction';
- (3) Services, wherever possible, will be located above the 1% (1 in 100 year) plus climate change peak flood level.

6.3 Flood Warning and Evacuation

- 6.3.1 As the proposed development is in an area of flood risk, the potential for a flood event as a result of flood protection embankment breach will be considered carefully within the detailed design.
- 6.3.2 Measures will be put in place to ensure that any potential flood events are communicated to the occupiers at the earliest opportunity and safe routes for evacuation are included. Given that a breach of the flood defences would likely be a large-scale emergency scenario leading to wide-scale flooding of the area, Lincolnshire County Council emergency planning team will be consulted as the layout of the site progresses to ensure that due consideration is given to emergency response contingency. Similarly, as the layout for the site is developed, and potentially sold or occupied, all users will be provided with the necessary information to ensure that they register for flood warnings and work with the emergency planners on their evacuation procedure as part of the emergency plan for the area. Information is available at www.lincolnshire.gov.uk/lincolnshire-prepared/about-us.

7.0 CONCLUSION & RECOMMENDATIONS

- 7.1.1 This FRA is intended as a qualitative study based upon a desk-based assessment, readily available information, and where applicable, responses from consultees.
- 7.1.2 The proposals comprise the construction of residential dwellings.
- 7.1.3 The site is located in Environment Agency Flood Zone 3, namely, an area with a high probability of flooding from main rivers. However, it is stated by the EA that the assessment of flood risk in the Fenlands can give a misleading picture, since the area is protected by flood embankments for the 1% AEP event, and as such it is the breach scenario that presents risk.
- 7.1.4 The residential aspects of the site is classed as 'more vulnerable' to flooding, as outlined in 'Planning Practice Guide – Flood Risk and Coastal Change'.
- 7.1.5 Development of 'more vulnerable' uses is compatible with Flood Zone 3, but requires the completion of the Exception Test.
- 7.1.6 An assessment of flood risk to the development site determined that there is potentially a risk of flooding from breach of the flood defence embankments. Proposed mitigation for these risks include raising of finished floor levels in line with hazard depth banding, resilient building techniques and emergency planning for safe evacuation.
- 7.1.7 As part of the planning application, an associated drainage strategy relevant to the particular parcel of land under consideration will be provided.
- 7.1.8 The flood risk assessment highlights that there are some potential flood risks related to the site. However, it is considered likely that risks and impacts can be managed to an appropriate level with the adoption of mitigation measures employed as part of the proposed development and a minimum FFL to be set at 3.7m AOD.



NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.
2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.
3. In addition to the potential flood extents shown on this map, there may be shallow flooding in low-lying rural areas
4. The consequences designated as being a Residual Risk arise from direct overtopping of defences, where this would occur, together with breach failure which is assumed could occur at any point along the defences.
5. Functional Floodplain encompasses areas where water is intended to flow or be stored in times of flood.
6. Land outside South Holland District is not considered.
7. This map shows the extents only of the flooding probability bands relevant to the map Title

Map Legend

Max Hazard	
(Flood Risk to People : FD2320)	
Less than 0.75 (Low Hazard)	
Between 0.75 and 1.25 (Danger for Some)	
Between 1.25 and 2.0 (Danger for Most)	
Greater than 2.0 (Danger for All)	
Functional Floodplain	
South Holland District Boundary	

2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update
REV	DATE	REMARKS
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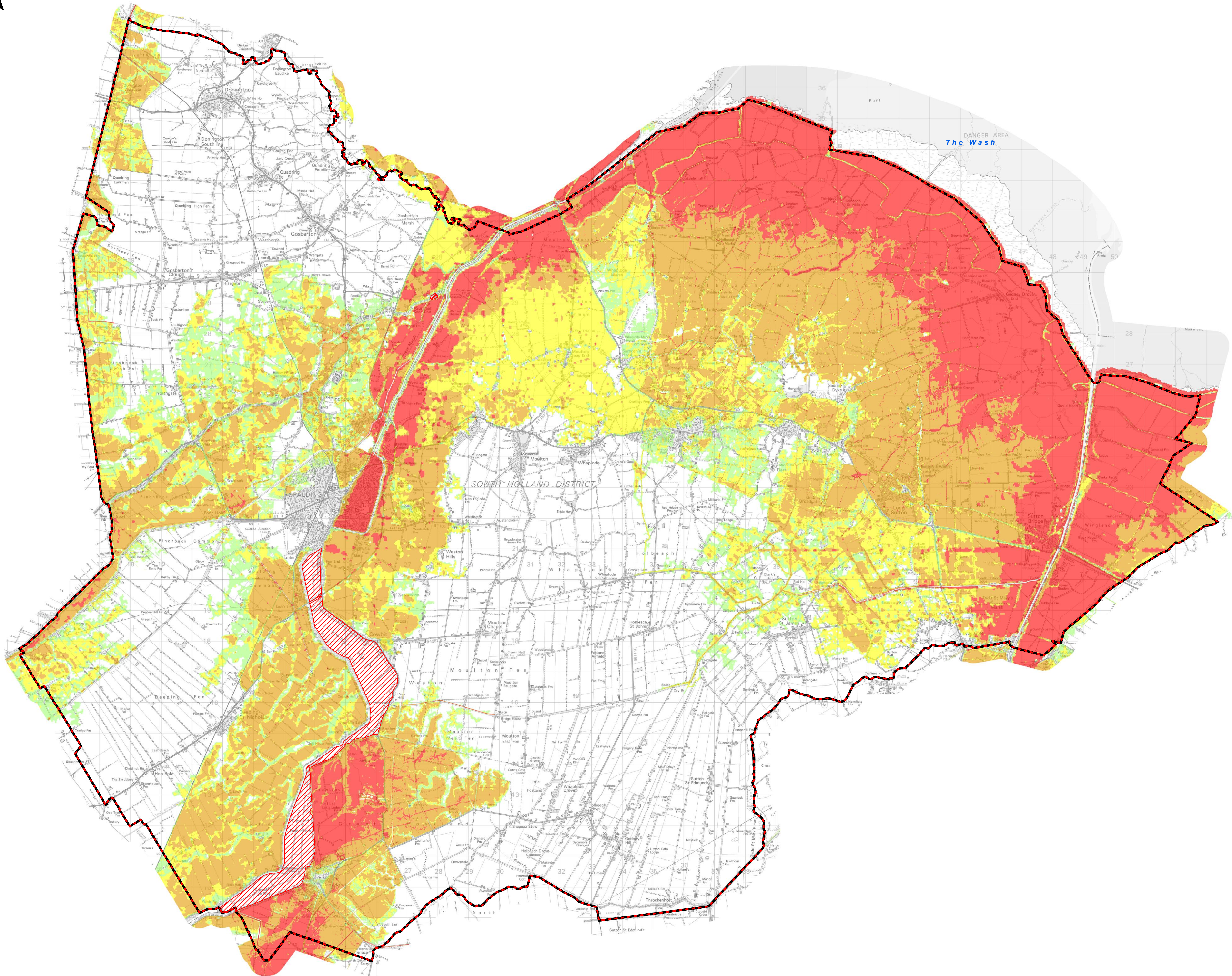
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	SOUTH HOLLAND DISTRICT COUNCIL OFFICES PRIORITY ROAD SPALDING LINCOLNSHIRE PE11 2XE

UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Flood Hazard District - Present Day 1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017	REV NO: 2
SCALE: 1 : 60,000 @ A1	MAP NO:



NOTES

1. The potential flooding consequences shown on this map primarily relate to flooding from the sea and main rivers taking into account the presence of current flood risk management measures such as flood defences.
2. This update only included new flood risk information from River Welland (Fluvial), River Glen (Fluvial) and Tidal hazard mapping (River Welland, River Nene and the Wash sea defences). No new information from the Internal Drainage Boards and associated systems was used for this update.
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Map Legend

- Max Hazard**
(Flood Risk to People : FD2320)
- Less than 0.75
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(Danger for Most)
 - Greater than 2.0
(Danger for All)
- Functional Floodplain
- South Holland District Boundary

2	Feb 17	Modelling and Mapping Update
1	Dec 16	Modelling and Mapping Update
REV	DATE	REMARKS

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COUNCIL OFFICES
PRIORITY ROAD
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LINCOLNSHIRE
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UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT

Residual Flood Hazard
District - Year 2115
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017	REV NO: 2
SCALE: 1 : 60,000 @ A1	MAP NO:

APPENDIX B IDB CORRESPONDENCE

Craig Russell

From: George Boden
Sent: 28 June 2019 13:55
To: Craig Russell
Subject: FW: Penny Hill Road Phase 2

George Boden
Civil Engineer



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Chesterfield, S45 9HA.

From: Graham Brown [<mailto:Graham.Brown@wlma.org.uk>]
Sent: 21 June 2019 15:58
To: George Boden
Subject: RE: Penny Hill Road Phase 2

Hi George,

I have managed to speak to the engineer now so please see the answers in red text to your questions below.

Happy to discuss.

Kind regards,

Graham

Graham Brown
Flood and Water Manager
Water Management Alliance
t: 07733 105048 | **e:** Graham.Brown@wlma.org.uk

From: George Boden
Sent: 13 June 2019 11:36
To: 'graham.brown@wlma.org.uk'
Cc: Craig Russell; 'Barrie Gibson'; 'info@wlma.org.uk'
Subject: Penny Hill Road Phase 2

Hi Graham,

My colleague Craig originally spoke to you regarding the development off Penny Hill Road.

We are now designing the drainage for phase 2 which involves a development of 9 residential dwellings south of the Phase 1 development below the football pitches.

There are several questions that we need to know from the IDB that might affect our design:

- Do you require an easement from the top of bank from the Old River (Drain)? Please see attached site layout with an easement of 9m from buildings. Would you accept less? **The easement we require on this drain is the full 9m. The engineer explained this is because this watercourse is the principle drain serving Holbeach and as such we need to make allowances for the need in the future to widen this drain. As such we would not accept any features in this 9m easement. We are just clarifying how we access this side of the watercourse as we need to advise you whether we currently benefit from use of the applicant's land.**
- We plan to use soakaways for the disposal of surface water for the site. Would you accept the Old River as a foul outfall by using sewage treatment plant such as Klargester? If so what litres per second would you accept? **We would accept treated foul water discharges as long as they meet the EA's general binding rules and/or are permitted by the EA under the Environment Permitting regime. The setting of the invert levels of these outfalls should take into account the likelihood of high water levels within the receiving watercourse and whether these will constrain the proposed discharges. See the HMGov webpage which has a useful calculator for proposed discharges. <https://www.gov.uk/permits-you-need-for-septic-tanks/general-binding-rules>**
- Have you any Old River water levels or depths near the site? **The levels within the watercourse at Chainage 9658 are;**
 - 1 in 2 year event 1.77 AOD
 - 1 in 5 year event 1.91 AOD
 - 1 in 10 year event 2.06 AOD
 - 1 in 30 year event 2.13 AOD
 - 1 in 100 year event plus CC 2.65 AOD

I will forward this up with a phone call and go through it in more detail but will give you a chance to read the email.



Kind Regards

George Boden
Civil Engineer



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APPENDIX C EA DATA AND CORRESPONDANCE

Stephen Riley
stephen@inspiredesigngroup.co.uk

Our ref: CCN/2018/88073

Date: 21 June 2018

Dear Stephen

Provision of Flood Risk Information for Penn Hill Road Holbeach

Thank you for your request to use our flood risk information in the development of the Flood Risk Assessment (FRA) for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

We aim to review our information on a regular basis, so if you are using this data more than twelve months from the date of this letter, please contact us again to check it is still valid.

Flood Map

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.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow depths and could leave pockets of locally slightly higher land as isolated dry islands. It is important to understand the actual risk of the flooding to these dry islands, particularly in the event of defence failure.

The Flood Map also shows the location of formal raised flood defences and flood storage reservoirs. It represents areas at risk of flooding for present day only and does not take account of climate change.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered flooding may occur from other sources such as surface water sewers, road drainage, etc.

History of Flooding

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible other flooding may have occurred we do not have records for, and other organisations, such as the Local Authority or Internal Drainage Boards, may have records.

Tidal Flood Risk Information

Tidal Defence Information

The tidal defences protecting this site consist of earth embankments. They are in fair condition and reduce the risk of flooding to a 0.67% (1 in 150) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified.

Tidal Flood Levels

The attached table shows our current best estimate for extreme tide levels.

Levels for the Humber Estuary have an assessment date of 2014, with others having an assessment date of 2006, which should be used in any consideration of future increases due to climate change.

Modelled Hazard Mapping

For certain locations we have carried out modelling to map the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from overtopping and / or breaching of defences at specific locations for a number of scenarios.

At present this information is available along the full coastal / tidal floodplain, except the tidal Witham Haven in Boston (upstream of Hobhole) where only breaching and not overtopping has been modelled and the tidal River Welland upstream of Fosdyke Bridge where neither breaching nor overtopping are available. Hazard mapping is also available for fluvial flood risk in Northampton, Lincoln, Brigg, Wainfleet and some isolated rural locations.

The number of locations we have this information for is expected to increase in time.

Hazard Mapping & Breaching

The attached maps show the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from breaching of the defences at specific locations for the scenarios below. For some locations the breach mapping also includes flooding from overtopping if this is expected in that scenario. The location of modelled tidal breaches is shown on a separate attached map.

- Year 2115 1% (1 in 100) chance / 0.5% (1 in 200) chance
- Year 2115 0.1% (1 in 1000) chance

Your site is not affected by breaching of the defences for the present day (2006) scenarios.

Development Planning

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of our information for Flood Risk Assessments. We recommend that you undertake a formal pre-application enquiry using the form available from the website.

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Climate change will increase flood risk due to overtopping of defences. Please note the climate change data included has an allowance for 20% increase in flow. Updated guidance on how climate change could affect flood risk to new development - 'Flood risk assessments: climate change allowances' was published on GOV.UK in February 2016. The appropriate updated climate change allowance should be applied in a Flood Risk Assessment.

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

Standard Notice Information

Please see the Standard Notice or licence for details of permitted use. The Standard Notice can be found at the link below.

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

We respond to requests for recorded information we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

Further information on flood risk can be found on the GOV.UK website at:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

Other Flood Risk Management Authorities

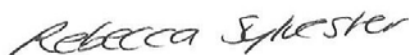
The information provided with this letter relates to flood risk from main river or the sea. Additional information may be available from your Lead Local Flood Authority (ie county council or unitary authority) or, where they exist, the Internal Drainage Board.

Further Contact

I hope we have correctly interpreted your request. If you are not satisfied with our response to your request for information, you can contact us within two calendar months to ask for our decision to be reviewed.

If you have any queries or would like to discuss the content of this letter further please contact Rebecca Syvester using the details below.

Yours sincerely,



FOR Alastair Windler

Partnerships and Strategic Overview Team Leader Welland and Nene

Team dial 020 302 53535

E-mail PSOWN@environment-agency.gov.uk

Enc.

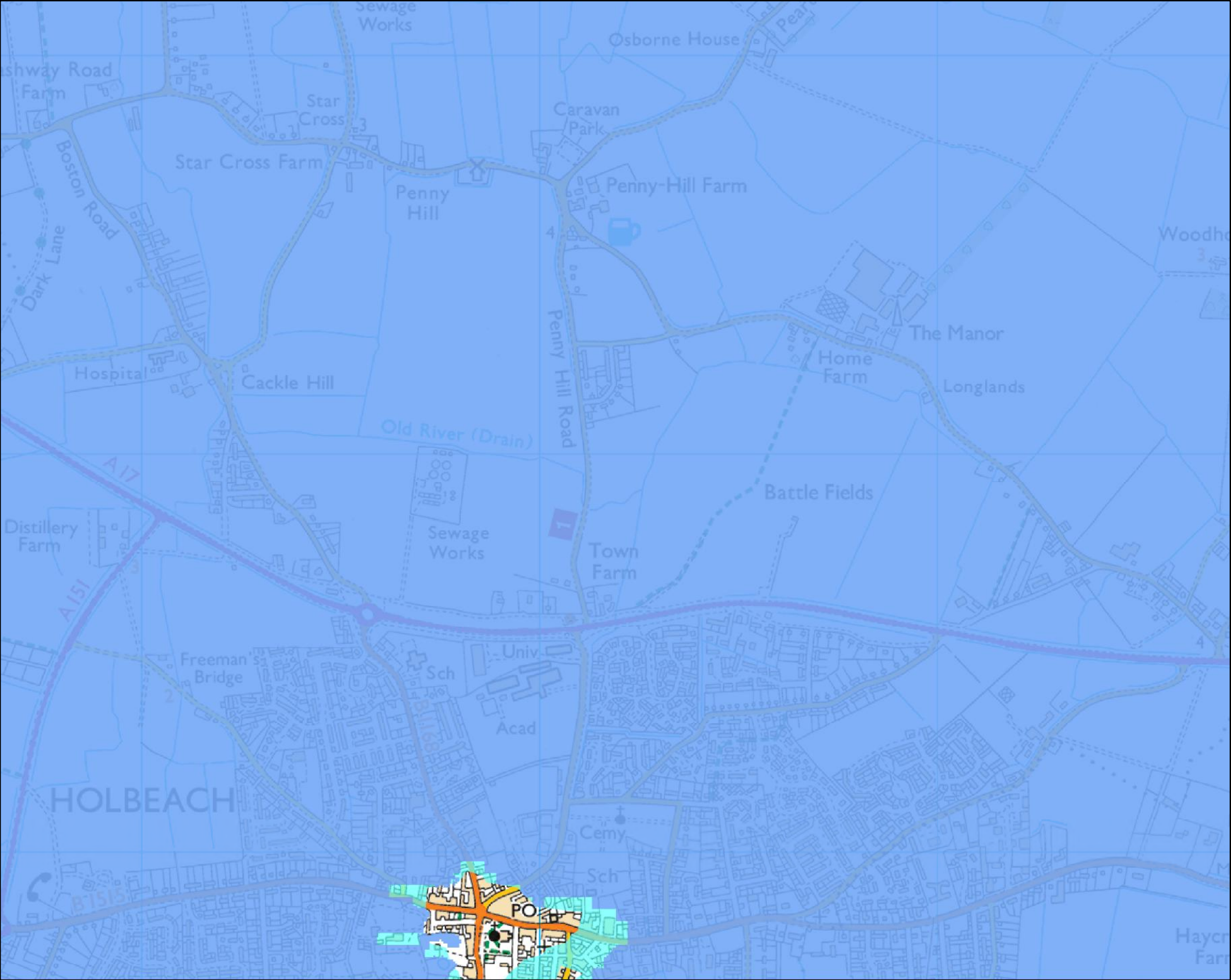
Flood Map

Estimated Tide Levels

Tidal Breach Locations Map

Hazard Mapping & Breaching (2 maps)

Flood Map centred on TF 36192 25908 - created June 2018 [Ref: CCN-2018-88073]



Scale 1:10,000



Legend

- Main River
- Raised Defences
- Area at Risk of Flooding from Rivers or The Sea
- Extreme Flood Outline

Dark blue shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defences. This area could be flooded:

- from the sea by a flood that has a 0.5% (1 in 200) or greater chance of happening each year.
- or from a river by a flood that has a 1% (1 in 100) or greater chance of happening each year.

Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements. Sites outside the two extents, but behind raised defences, may be affected by flooding if the defences are overtopped or fail.

Created by the Partnerships and Strategic Overview Team, Kettering

Environment
Agency



Tidal Water Levels for the South Humber, East Coast and The Wash

The table below shows still water levels for locations, from the above location map, around the South Humber Estuary, East Coast and The Wash. It is important to note the following:

- The base date for the data is 2014 for the South Humber and 2006 for the East Coast and The Wash.
- The data are still water levels. Depending on the use of the data it may be necessary to consider wave heights and / or joint probability analysis of water level and other variables.
- The water level quoted is the ‘Best Estimate’ water level. Depending on the use of the data it may be necessary to carry out sensitivity testing. Upper and Lower 95% confidence bandings are available upon request.
- Levels for other annual chance scenarios are available if required.

Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level					
				metres ODN					
				1	10	50	100	200	1000
HUMBER									
H030	Tetney	535420	403180	3.94	4.29	4.56	4.69	4.82	5.15
H050	Buck Beck	532700	406580	4.03	4.36	4.62	4.74	4.87	5.18
H060	Grimsby	527878	411346	4.10	4.43	4.70	4.82	4.95	5.27
H080	Haborough Marsh	520790	415740	4.26	4.61	4.88	5.01	5.14	5.47
H090	Immingham	519141	417449	4.26	4.61	4.88	5.01	5.14	5.47
H100	South Killingholme	518700	417120	4.41	4.77	5.05	5.18	5.32	5.66
H130	North Killingholme	516530	420000	4.51	4.87	5.15	5.28	5.42	5.77
H150	East Halton	514450	422870	4.59	4.96	5.25	5.39	5.53	5.89
H170	Goxhill	511970	425440	4.67	5.04	5.34	5.47	5.61	5.95
H200	New Holland	508020	424330	4.87	5.26	5.55	5.68	5.81	6.12
H210	Barrow Haven	506380	422620	4.92	5.31	5.60	5.73	5.86	6.17
H220	Ferriby	497550	421150	5.04	5.42	5.67	5.77	5.86	6.04
H230	Winterton	493420	422830	5.14	5.51	5.74	5.83	5.90	6.02
H250	Blacktoft	484247	424190	5.25	5.62	5.83	5.90	5.96	6.04
H270	Goole	474857	422960	5.46	5.85	6.07	6.15	6.21	6.29
East Coast									
~	Great Eau	545500	393800	3.80	4.19	4.46	4.57	4.69	4.96
~	Boygrift	553300	379800	3.84	4.24	4.53	4.65	4.77	5.05
~	Burgh Sluice	555190	358620	4.26	4.45	4.76	4.90	5.03	5.34
Wash									
~	Hobhole	536610	339940	4.82	5.30	5.64	5.78	5.93	6.27
~	Lawyers Sluice	540750	334550	4.84	5.32	5.66	5.80	5.95	6.29
~	West Lighthouse	549150	325750	4.88	5.37	5.71	5.86	6.01	6.35
~	Grand Sluice	532400	344500	4.88	5.33	5.65	5.78	5.93	~
~	Fosdyke Bridge	531700	332200	4.91	5.38	5.71	5.85	5.99	~
~	Marsh Road	526000	324000	5.04	5.44	5.73	5.85	5.98	~
~	Wisbech	546100	310000	4.83	5.25	5.53	5.66	5.78	~
~	Dog In Doublet	527300	299300	3.67	4.00	4.22	4.32	4.42	~



^ Modelled Breach Locations



This map indicates the location of where we have modelled the consequence of breaches along the coastline and tidal rivers. We have mapped the the maximum values of Hazard Rating (Danger to People), Depth and Velocity.

We have not assumed that all breaches occur at the same time, but have modelled each breach individually and overlaid the results to find the maximum values.

Our modelling only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. Our defences generally provide a good standard of flood defence but a risk of breaching remains.

Please contact the Environment Agency for information on how these maps are used in the management of flood risk.



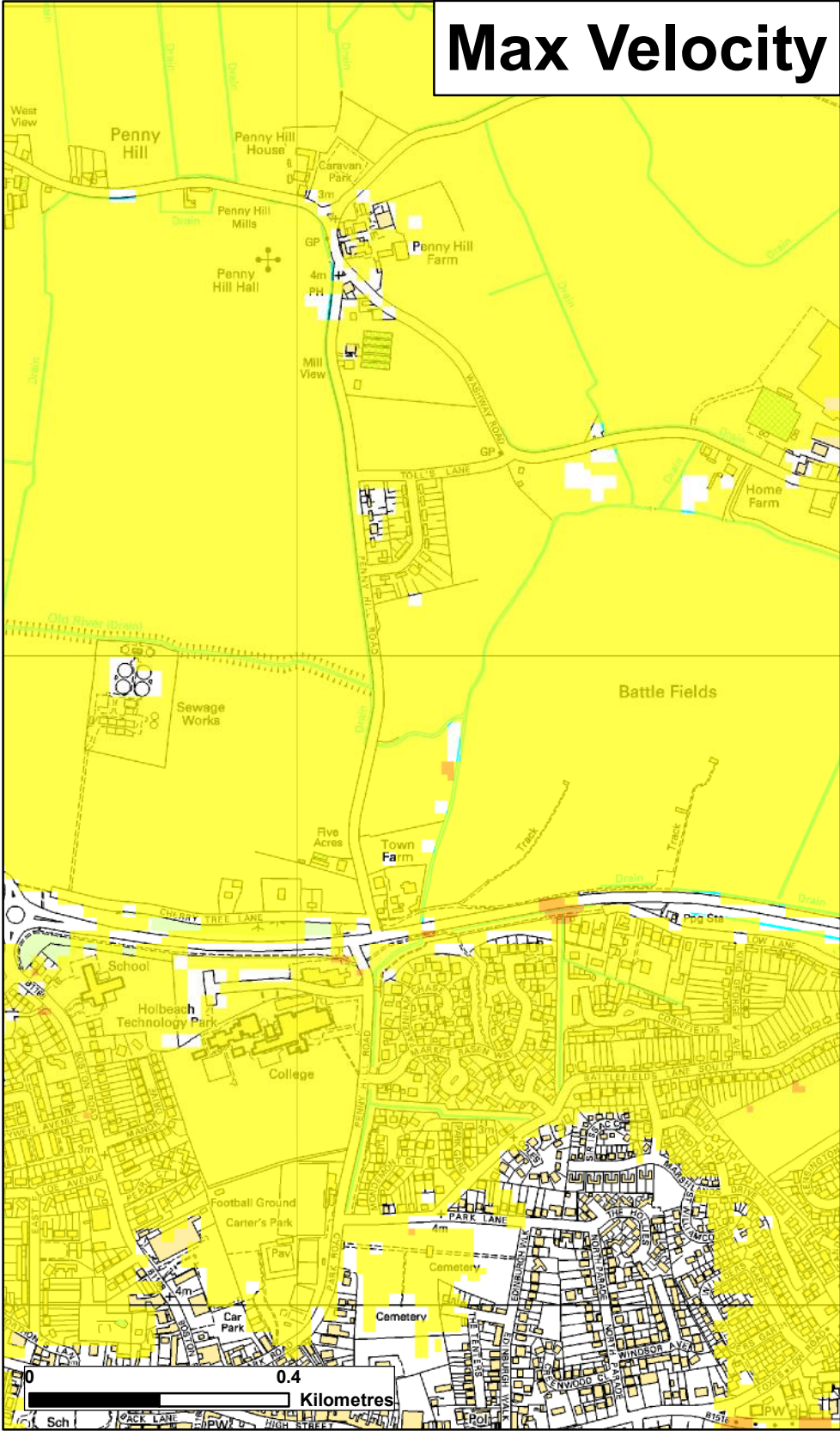
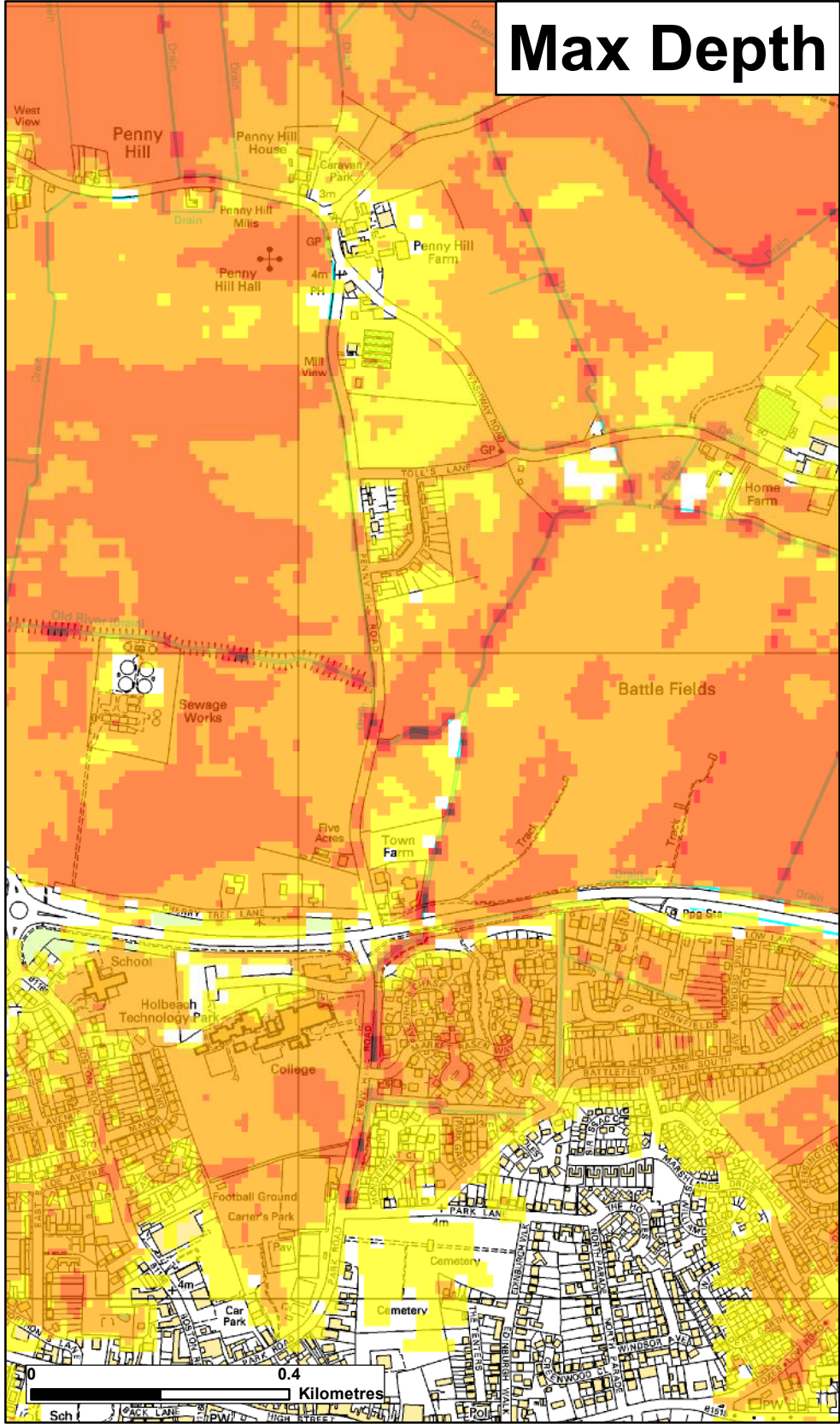
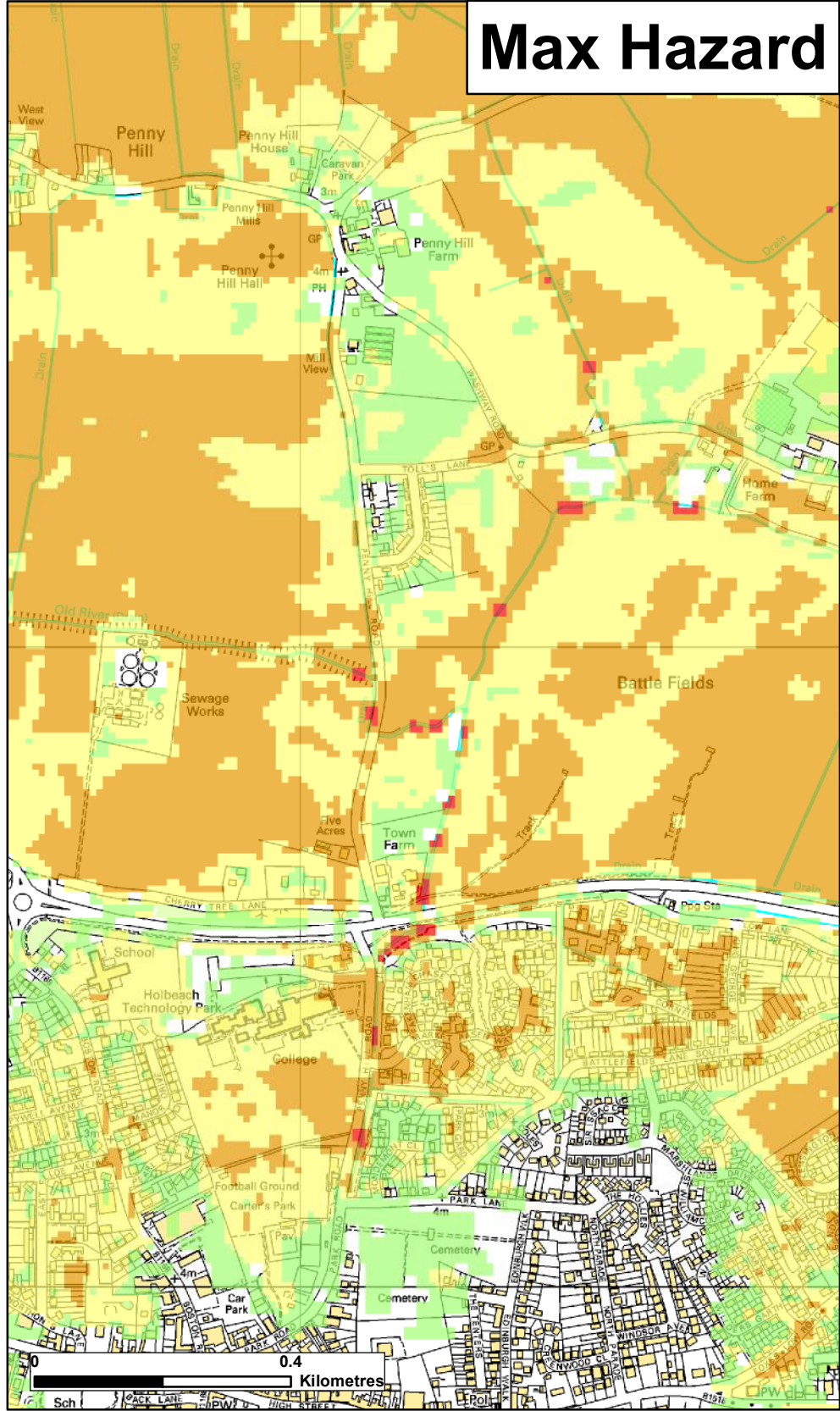
Produced by the Partnership and Strategic Overview Team, Lincoln
General Enquiries No: 03708 506 506

Northern Area Tidal
Hazard Mapping

Location of Modelled Breaches

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★ **Modelled Breach Locations** - see also the accompanying plan "Location of Modelled Breaches"

Max Hazard (Flood Risk to People : FD2320)	Max Depth (m)	Max Velocity (m/s)
Less than 0.75 (Low Hazard)	0 - 0.25	0 - 0.3
Between 0.75 and 1.25 (Danger for Some)	0.25 - 0.50	0.3 - 1.0
Between 1.25 and 2.0 (Danger for Most)	0.50 - 1.0	1.0 - 1.5
Greater than 2.0 (Danger for All)	1.0 - 1.6	1.5 - 2.5
	1.6 +	2.5 +

This map shows the level of flood hazard to people (called a hazard rating) if our flood defences are breached at certain locations, for a range of scenarios. The hazard rating depends on the depth and velocity of floodwater, and maximum values of these are also mapped.

The map is based on computer modelling of simulated breaches at specific locations. Each breach has been modelled individually and the results combined to create this map. Multiple breaches, other combinations of breaches, different sized tidal surges or flood flows may all give different results.

The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely where defences are of a good standard, but a risk of breaching remains.

Date Printed June 2018

Scenario year 2115

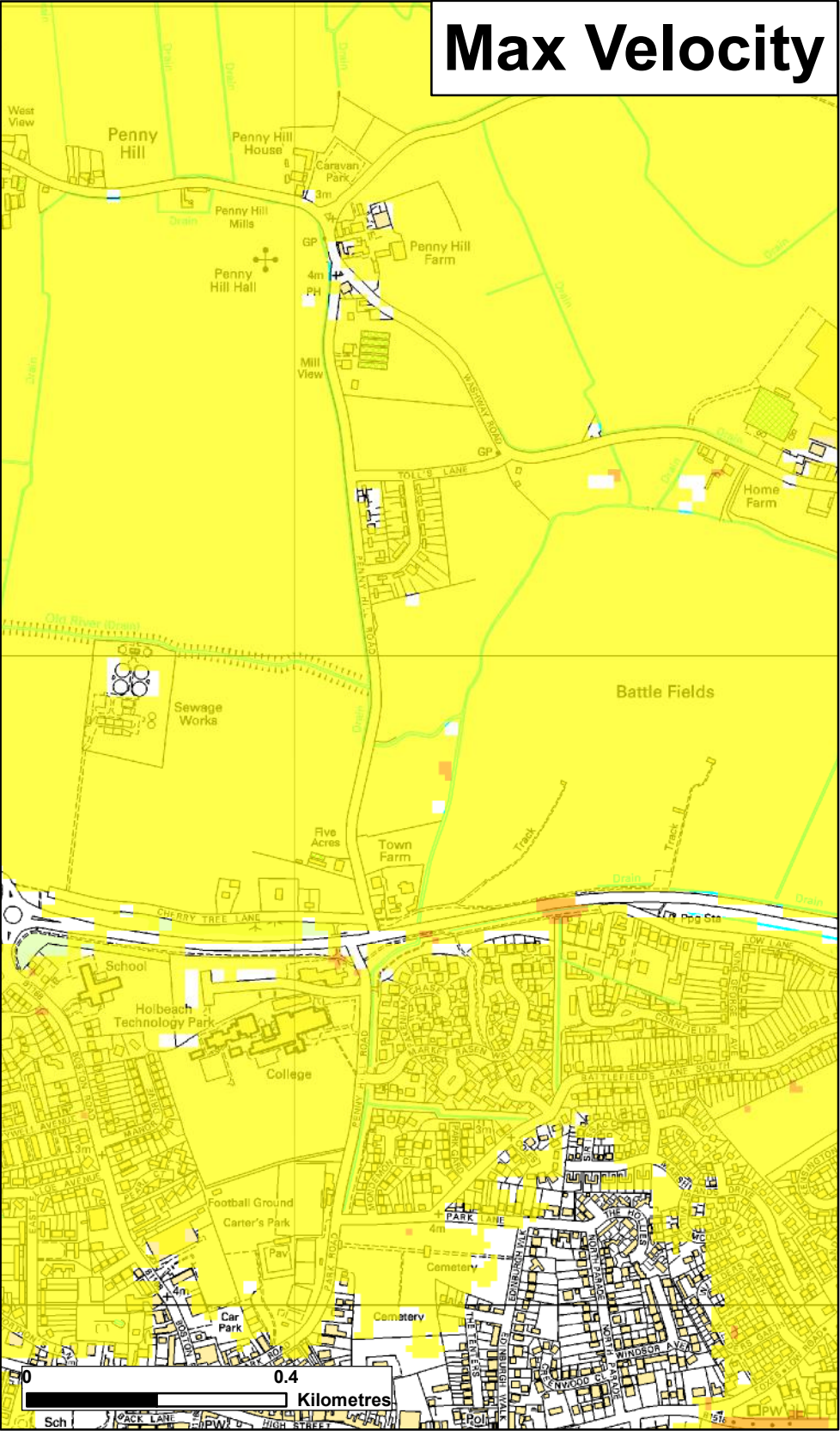
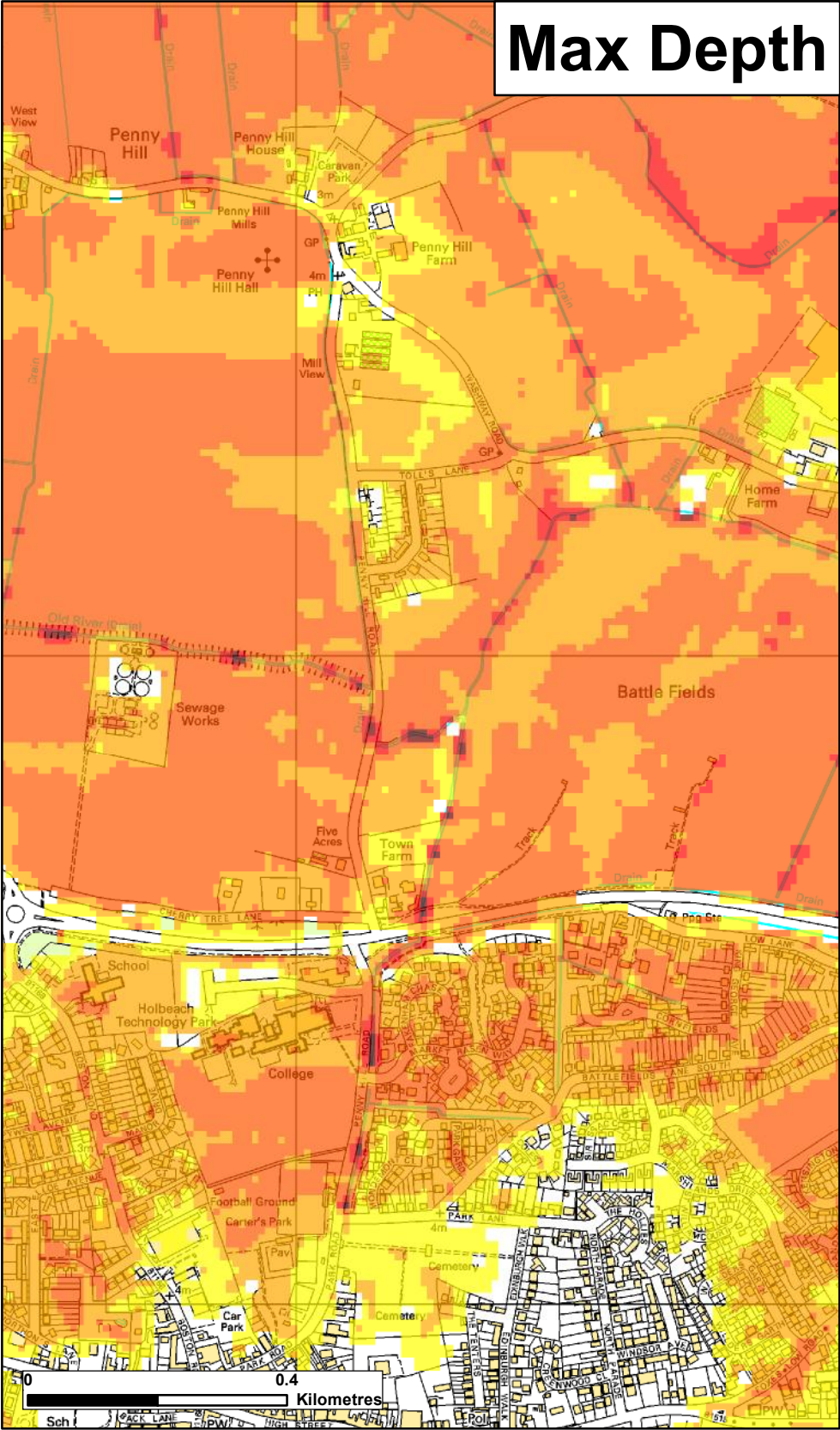
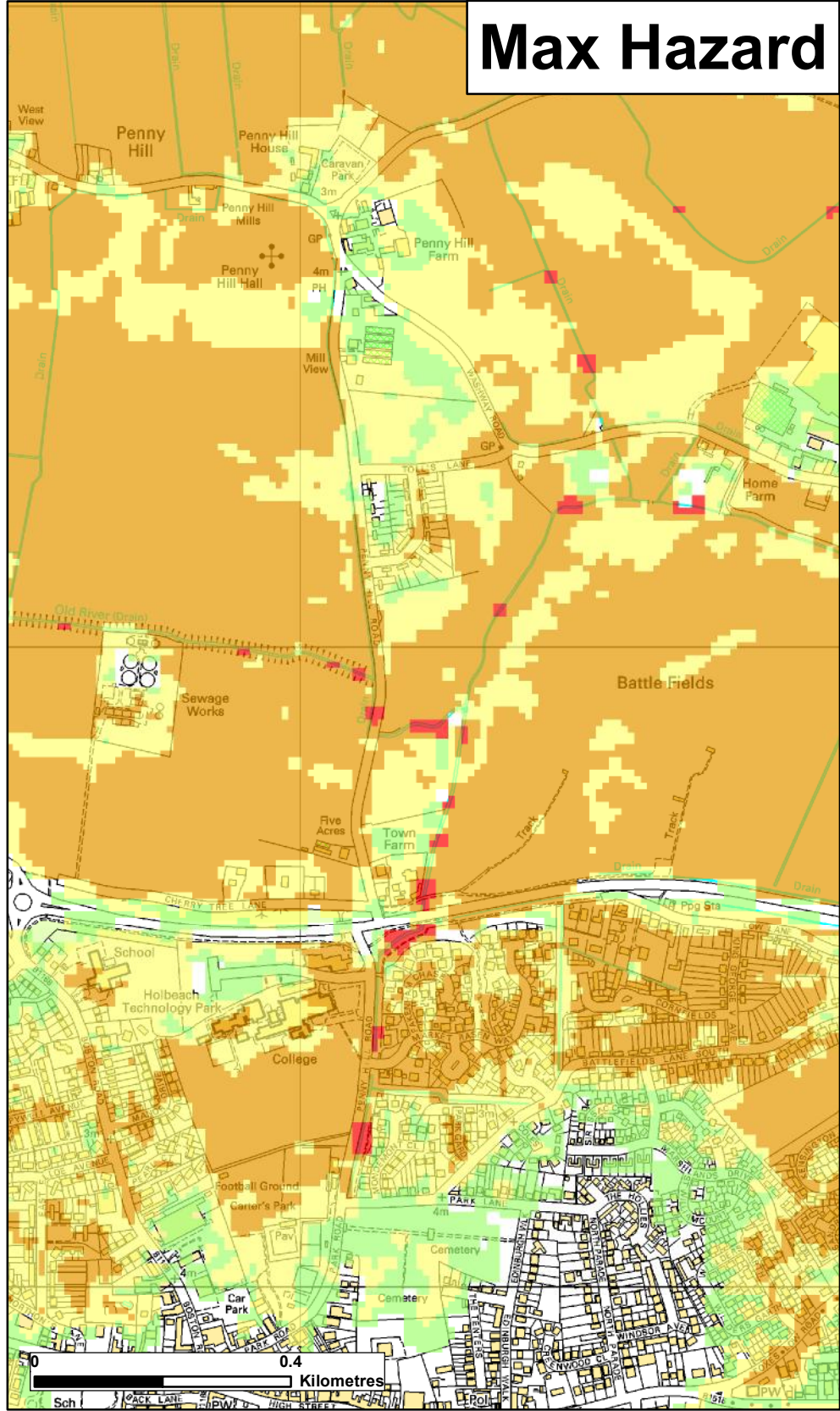
Scenario Annual Chance 0.5% (1 in 200)

CCN Number CCN-2018-88073

Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 36192 25908

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★ Modelled Breach Locations - see also the accompanying plan "Location of Modelled Breaches"							
Max Hazard (Flood Risk to People : FD2320)		Max Depth (m)		Max Velocity (m/s)			
	Less than 0.75 (Low Hazard)		0 - 0.25		0 - 0.3		
	Between 0.75 and 1.25 (Danger for Some)		0.25 - 0.50		0.3 - 1.0		
	Between 1.25 and 2.0 (Danger for Most)		0.50 - 1.0		1.0 - 1.5		
	Greater than 2.0 (Danger for All)		1.0 - 1.6		1.5 - 2.5		
			1.6 +		2.5 +		
Date Printed	June 2018	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-88073

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**Lincolnshire and Northamptonshire
Tidal Breaching Hazard
Mapping**

Map Centred on TF 36192 25908

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