FLOOD RISK ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT, SEAGATE ROAD, LONG SUTTON

LINCS DESIGN CONSULTANCY

12 Vickers Lane, Louth, Lincolnshire, LN11 9PJ

T: 01507 611155 W: www.lincsdesignconsultancy.co.uk

CONTENTS

1	INTRODUCTION	3
2	SITE LOCATION	4
3	HISTORY OF FLOODING	6
4	PROPOSED SCHEME	6
5	SEQUENTIAL & EXCEPTION TESTS	6
6	ASSESSMENT OF POTENTIAL SOURCES OF FLOODING AND MITIGATION MEASURES	9
7	CONCLUSION	16

APPENDIX A- ENVIRONMENT AGENCY INFORMATION

APPENDIX B- DRAINAGE STRATEGY

DOCUMENT HISTORY

ISSUE NO	COMMENTS	DATE
1	Planning	09.12.21

1 INTRODUCTION

1.1 This Flood Risk Assessment (FRA) has been prepared to accompany a Reserved Matters planning application for a proposed residential development at land to east of Seagate Road, Long Sutton, Spalding, Lincolnshire.

1.2 The site (Los015) is allocated for residential development in the South East Lincolnshire local plan and has an extant outline planning permission for a large residential development for up to 215 dwellings, South Holland District Council Reference H11-1207-17.

1.3 The Government has placed increasing priority on the need to take full account of the risks associated with flooding at all stages of the planning and development process. This course of action seeks to reduce the future damage to property and risk to life resulting from incidents of flooding. National Planning Policy does not prevent all development in flood risk areas as this would be unsustainable and result in economic stagnation, depriving existing communities of much needed homes, services, employment opportunities etc. It is in the essential interests of the vitality of settlements and for the wider economic and social wellbeing of the community, that development opportunities are not unnecessarily constrained. Accordingly, the aims of this site-specific FRA will be as follows:

- Identify and address flood risk issues associated with the development.
- Assess if the project is likely to be affected by flooding from all relevant sources both now and in the future.
- Demonstrate that the project is safe and where possible, reduces flood risk.
- Propose measures to deal with the identified effects and risks.

2 SITE LOCATION

2.1 The site is approximately 11 hectares and is located to the east of Seagate Road in Long Sutton (See Figure 1). The grid reference for the site is TF 4322 SE. The site is allocated for residential development in the local plan as a part of site Los015 and has previously been granted planning permission for a large residential development of approximately 215 dwellings, South Holland District Council Reference H11-1207-17

2.2 The site is currently used for agricultural and The BGS geology of Britain Map suggests the geology is mainly clay. A topographical survey shows the site is relatively flat and varies between 2.90mAoD and 3.60mAoD.

2.3 The site is located in a mixed context formed of residential, agricultural and community uses. The land located directly to the south and east is allocated as countryside in the local plan. The land further to the east is allocated for existing employment use in the local plan. The land to the north mainly has a residential use.

2.4 The site is located within Flood Zone 3a (See Figure 2). 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.

2.5 The site is within a defended flood plain, as defined in Appendix 1 of the Environment Agency's "Policy and Practice for the Protection of Flood Plains", which is considered to be passive until such time that a flood greater than the defences can withstand occurs. The likelihood of flooding occurring due to overtopping or failures of the defences is considered to be very low.

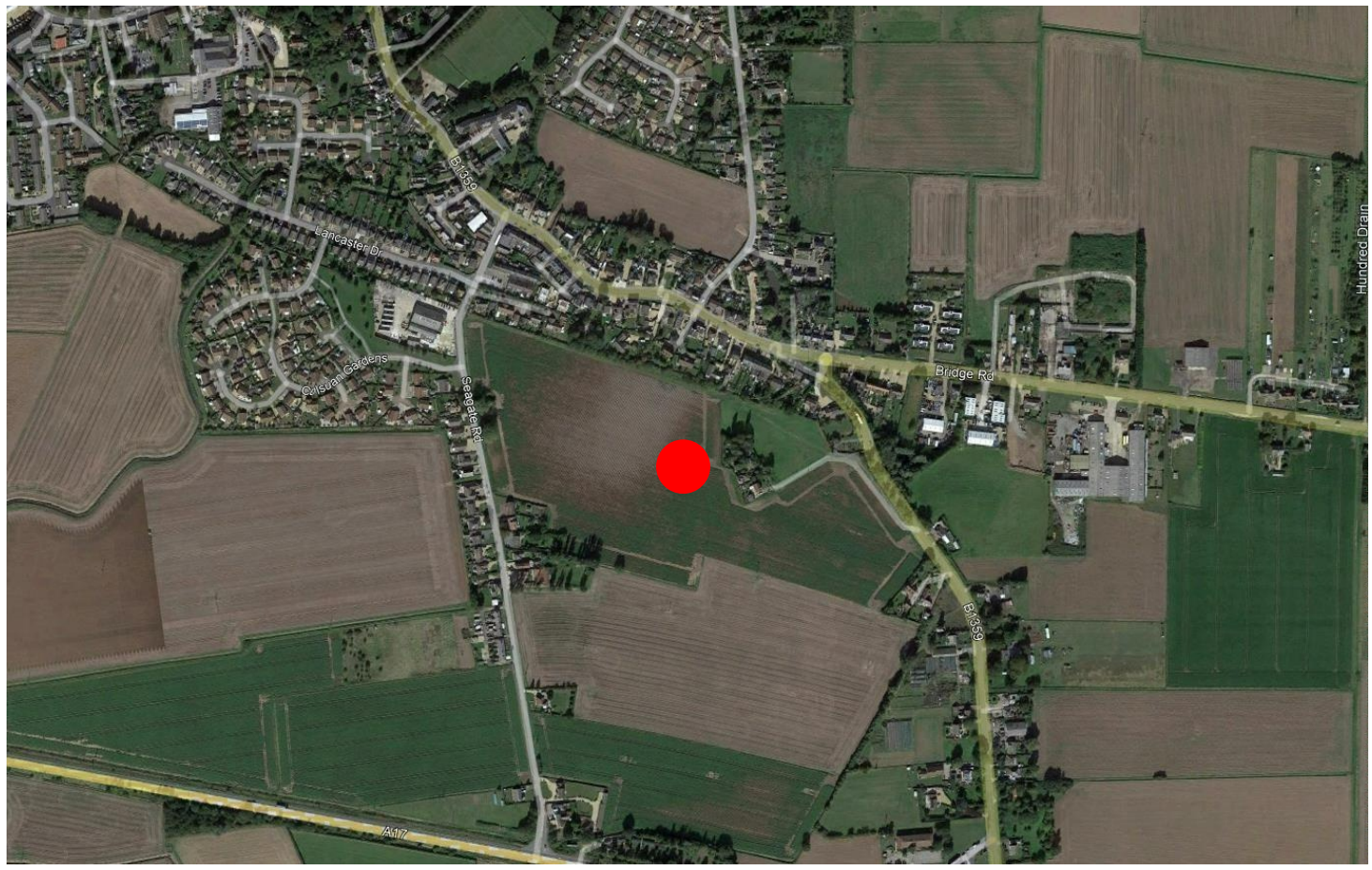


Figure 1- Aerial photograph showing the location of the site

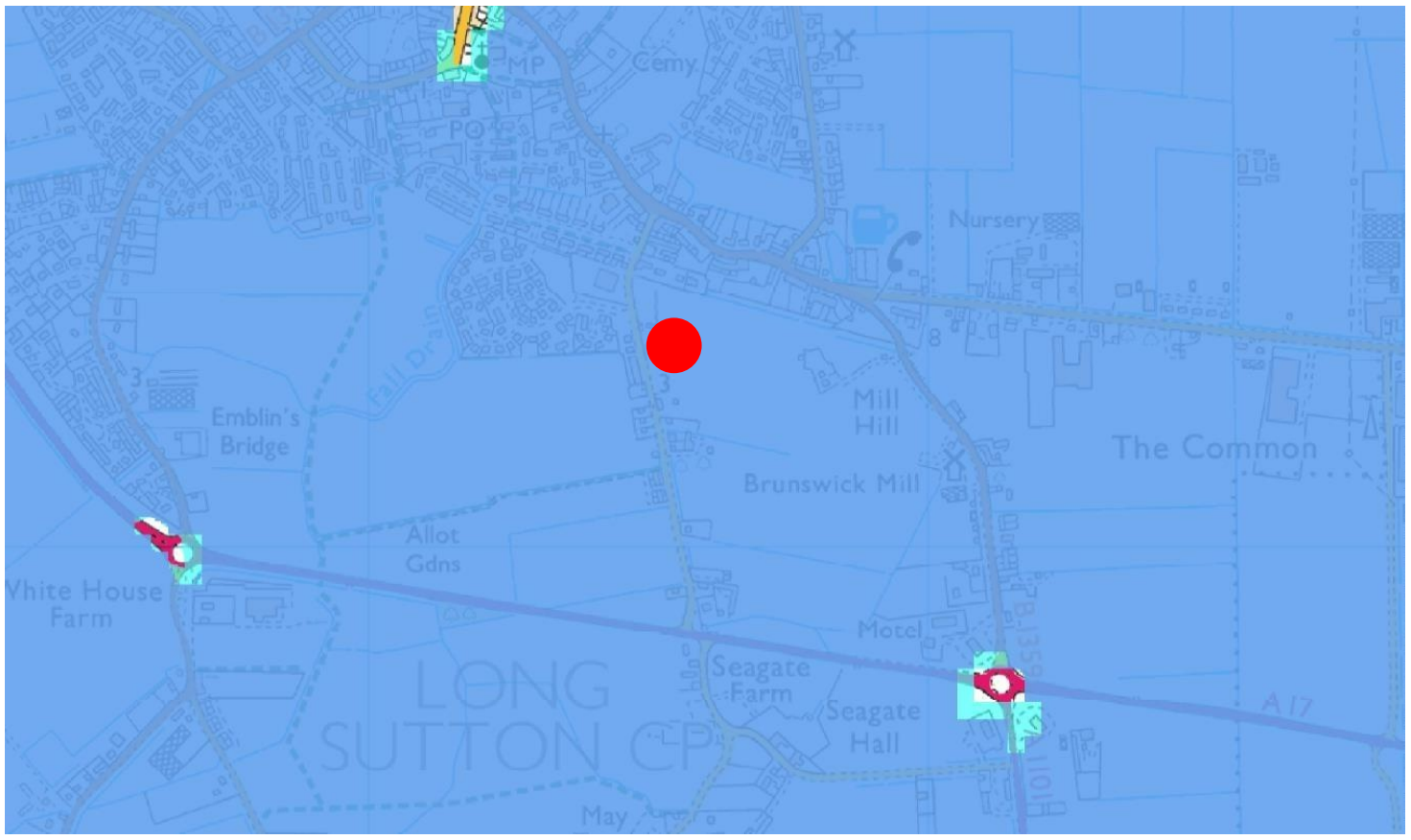


Figure 2- Extract from Flood Map showing the site located in flood Zone 3A

3 HISTORY OF FLOODING

3.1 The Environment Agency has advised that there are no records of flooding in this area. It is possible recent flooding may have occurred, but they have no information relating to this. No evidence has been discovered of the site or any adjoining properties having been flooded in the past.

4 PROPOSED SCHEME

4.1 The proposed development involves the erection of 171 dwellings, creation of internal roads, public open space and landscaping.

5 SEQUENTIAL & EXCEPTIONS TESTS

5.1 Within the National Planning Policy Framework (NPPF) and its accompanying Planning Practice Guidance (PPG) there is an expectation that proposals within the flood zone should be subject to the Sequential Test, and if necessary, the Exception Test at the planning application stage. The Guidance provides advice to Local Planning Authorities (LPA's) to ensure the effective implementation of the planning policy set out in the NPPF on development in areas at risk of flooding. It states that the overall aim should be to steer new development to Flood Zone 1 but adds that where there are no reasonably available sites in Flood Zone 1, LPA's allocating land in local plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses (as set out in Table 2 of the document) and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required.

5.2 Paragraph 3.2.2 of the Local Plan confirms that as large parts of South East Lincolnshire, are at high risk of flooding, a sequential approach to flood risk has been applied to inform the spatial strategy. Accordingly, Policy 4 (Approach to Flood Risk) states that the sequential test is not required for

sites allocated in the Local Plan. This Policy does still require the exception test to be passed and this is discussed in the following section.

5.3 Policy 4 also provides further guidance on what is required within a site-specific FRA and this has been taken into consideration during the preparation of this document.

5.4 The PPG discusses the concept of flood risk vulnerability and flood zone compatibility, providing a mechanism for assessing the appropriateness of proposed uses against the various degrees of flood risk. Applying the likelihood of flooding identified from the flood maps to Table 1: Flood Zones of the PPG, the site falls into Zone 3, classified as having a 'high' probability of flooding. Table 2: Flood Risk Vulnerability Classification, classifies the proposed residential use as 'more vulnerable'. Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' compares the Flood Zone classification from Table 1 against the Vulnerability Classification from Table 2. Table 3 (reproduced below) confirms that the proposed dwellings are appropriate in Flood Zone 3 subject to passing the Exception Test.

FLOOD RISK VULNERABILITY AND FLOOD ZONE 'COMPATIBILITY' *Source: PPG, Table 3*					
Flood Risk Vulnerability classification (Table 2)	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a	Exception Test Required	✗	**Exception Test Required**	✓	✓
Flood Zone 3b 'Functional Floodplain,	Exception Test Required	✗	✗	✗	✓

5.5 Therefore it can be seen that for "More vulnerable" development the sequential and the exception tests need to be applied to the development.

5.5 There are two parts to the Exception Test, and both need to be passed for a development to be considered acceptable. The two parts of the Test require proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk and that it will be safe for its lifetime; without increasing flood risk elsewhere and where possible reduce flood risk overall.

5.6 In relation to the first aspect (community benefit), the proposed scheme includes the provision of 171 dwellings with an element of affordable housing and new public open space to provide a community benefit.

5.7 In relation to the second aspect of the test (safety), this Flood Risk Assessment has been prepared in accordance with the NPPF and accompanying PPG. Later in this document it will be demonstrated the mitigation measures proposed are appropriate to the type of development and that users of the site will be safe. The amount of impermeable area within the site will be increased as a result of the development, affecting surface water runoff. As such a surface water strategy, based on sustainable drainage methods, has been produced and is submitted as part of the planning application documents. As a result of this strategy, it is considered that the proposed scheme will have no adverse effect on the floodplain and will not increase the risk of flooding elsewhere.

5.8 Both the sequential and exception tests have been demonstrated as part of the sites extant outline planning permission reference H11-1207-17. It is therefore considered that both tests are also passed for this application.

6 ASSESSMENT OF POTENTIAL SOURCES OF FLOODING AND MITIGATION MEASURES

6.0 This section presents an assessment of Flood Risk to the development from external sources;

TABLE 1: POSSIBLE FLOODING MECHANISMS

Source	Significant?	Comment
Fluvial	Low	Distance form water courses
Tidal/Coastal	Low	If a breach of the defences occurs
Pluvial (drainage)	No	On site run off
Groundwater	Low	Unlikely due to local drainage network
Overland flow	Low	No higher ground adjacent to the site
Blockage	Low	No culverts or bridges close to the site
Infrastructure failure	Low	No major infrastructure has been identified
Rainfall ponding	No	No depressed areas which could encourage ponding.

A) <u>Assessment of Flood Risk to Development from External Sources</u>

6.1 Assessment of Flood Risk from Fluvial/Tidal Sources

6.1.1 The west bank of the River Nene is approximately 4.4 km east of the site of the proposed development, and the Wash Banks are 10km north of the site at their nearest point. The hazard from the River Nene east of the development site if a breach occurred in the length of bank between the South Holland Main Drain Outfall and the A17 bridge will be considered to be the major risk to the site.

6.1.2 The maps supplied by the Environment Agency predict flood depths for certain tidal breach hazard events. Table 2 summaries the risks. The most relevant hazards shown on Table 2 are the Breach Event for the year 2115 0.5% Breach and 0.1% scenarios (highlighted in red). Given the existing topography the hazard and depth of flooding varies across the site.

TABLE 2: SUMMARY OF HAZARD MAPS			
Breach Scenario	**Hazard Rating**	**Max Depth (m)**	**Max Velocity (m/s)**
Year 2006, 1 in 200 (0.5%)	'Low Hazard'	n/a	n/a
Year 2006, 1 in 1000 (0.1%)	'Danger for Some' (Part of site)	0.0– 0.25 (Part of site)	0.0– 0.30 (Part of site)
Year 2115, 1 in 200 (0.5%)	'Low Hazard' 'Danger for Some' 'Danger for Most'	0.0– 0.25 0.25– 0.50 0.50 – 1.00	0.0– 0.30 0.3 – 1.0
Year 2115, 1 in 100 (0.1%)	''Low Hazard' 'Danger for Some' 'Danger for Most'	0.0– 0.25 0.25– 0.50 0.50 – 1.00	0.0– 0.30 0.3 – 1.0



Figure 3- Extract from the 0.5% (1 in 200) Breach Hazard Map showing the majority of the site being within the 0.25-0.5m depth with the western edge being in 0.5-1.0m depth

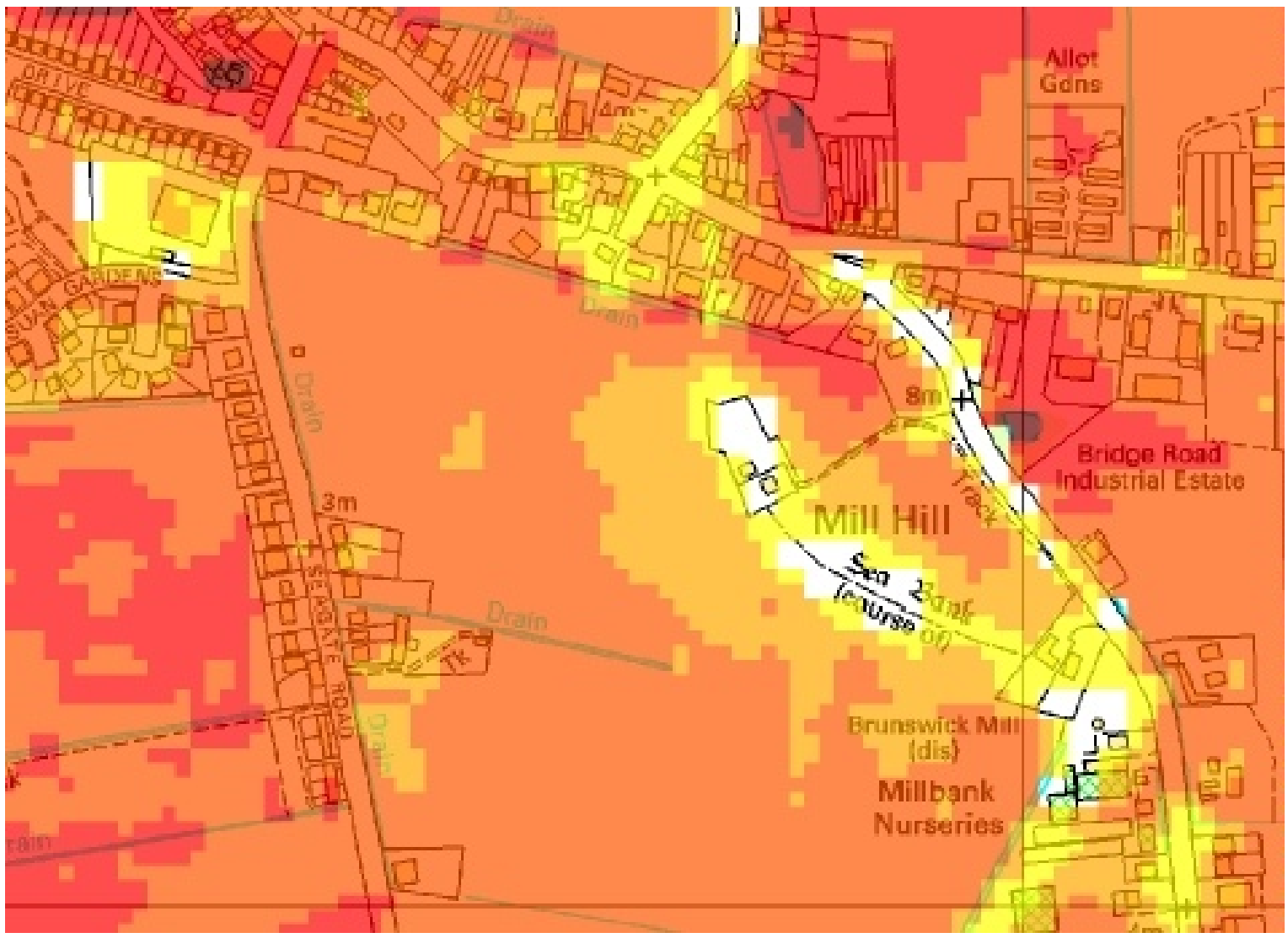


Figure 4- Figure 3- Extract from the 0.1% (1 in 100) Breach Hazard Map showing the majority of the site being within the 0.5-1.0m depth with the central area being in 0.25-0.5m depth

6.1.3 It is likely that this flood water will take at least 24 hours to reach the site, during which time residents will have been warned of the eventuality. The EA breach mapping also assumes no attempt is made to immediately repair the breach. It is also likely that the EA will undertake further bank raising within the next 100 years to ensure that there is a continuing 1 in 200 year defence to Long Sutton and Sutton Bridge.

6.1.4 The Hazard Maps are based on computer modelling of simulated breaches at specific locations. Although these maps show a theoretical risk of flooding to the site should a breach occur, they do not consider the likelihood of a breach occurring. The likelihood of a breach occurring will depend on several factors, including the construction and condition of the defences in the area. It is understood that the tidal defences protecting this site consist of earth embankments on the Tidal Haven and earth

embankments which are supplemented by saltmarsh on the coast to maintain foreshore levels. The Environment Agency have advised that these defences are in good condition and reduce the risk of flooding to a 0.67% (1 in 150) chance of occurring in any year. The defences are inspected routinely to ensure potential defects are identified.

6.1.5 With the condition and maintenance of the defences in mind, it is considered that the likelihood of them breaching is low. However, mitigation measures (discussed later in Section 6.7) should still be considered.

6.2 Assessment of Flood Risk from Overland Flow (Pluvial)

6.2.1 The Environment Agency Surface Water Flood Map shows that there is a small area of the site at risk of surface water flooding varying from Low Risk to High Risk.

6.3 Assessment of Flood Risk from Ground Water

6.3.1 The area surrounding the site is not known to suffer from ground water problems.

6.4 Assessment of Flood Risk from Reservoirs

6.4.1 The Environment Agency Risk of Flooding from Reservoirs Map shows the site is not at risk from reservoir flooding.

B) Potential of the Proposed Development to Cause Flood Risk Elsewhere

6.5 In order to mitigate flood risk posed from the site post development adequate control measures have been considered for the site. In accordance with recognised guidance there is a hierarchy of surface water from new development should be discharges. This should be as follows

- Infiltration
- Water course
- Public sewer

6.6 The BGS mapping shows the geology is formed of clay and it is therefore assumed that infiltration drainage is not possible and that currently the site drains to the water course on the eastern boundary. It is therefore proposed that this process is replicated and the surface water from the hard surfacing be discharged to this water course at an agreed rate via an onsite SUDs attenuation scheme. A surface water drainage strategy has been prepared to accompany this assessment (a copy of the drainage strategy can be found in Appendix B).

MITIGATION MEASURES

6.7 The NPPF requires that a precautionary approach is adopted to ensure that development is safe and not exposed unnecessarily to flooding. Previous advice from the Environment Agency for similar sites states that 2 storey dwellings should refer to the 0.5% (1 in 200) Breach Mapping and 1 storey dwellings should use the 0.1% (1 in 100) Breach Mapping. The following mitigation measures should therefore be incorporated into the development;

- **Finished Floor Level (FFL) of 1 Storey Dwellings to be set a minimum of 1m above existing ground level.**
- **Finished Floor Level (FFL) of 2 Storey Dwellings set a minimum of 3.70mAoD (which was agreed in the previous planning application H11-1207-17).**
- Flood resilient construction should be incorporated to a minimum height of 300mm above the predicted flood level, and all of the electrical installation should be a similar height above finished floor level.
- Avoid the use of plasterboard and gypsum plaster and use water resistant cement render or lime mortar, or fix the plasterboard horizontally to the ground floor walls.
- Avoid the use of absorbent cavity insulation to the ground floor level.
- Treated and sealed timber skirting and architraves.
- Arrange for all service circuits to be routed at first floor level where practical socket outlets, boilers etc. to be a minimum of 0.5m above the raised ground floor level.
- It is recommended that the site is registered with the Environment Agency's 'Warnings Direct' flood warning system. The Agency provides this flood warning service in England and Wales and supports the public taking action to prepare and respond when these warnings are issued. The warnings are provided for flooding from rivers and the sea but not for localised flash flooding that cannot be predicted, for example from blocked or overloaded sewers or local groundwater flooding. The Agency issues warnings through media on TV and radio weather bulletins and on its

website (www.environment-agency.gov.uk/floodline). In areas of particular risk, the Agency can send a warning message direct to people at home or at work by telephone, fax or pager using an Automatic Voice Messaging (AVM) system.

7 CONCLUSION

7.1 The following conclusions, in relation to the questions posed at the start of this document, are as follows:

Identify and address flood risk issues associated with the proposed development:

The potential sources of flood risk have been discussed within this report. It has been established that main source of flooding to the site is if a breach were to occur in the west bank of the tidal River Nene. The risk of this happening along this section of bank can be considered to be low

Assess if the project is likely to be affected by flooding from all relevant sources both now and in the future:

The breach hazard maps show that the site is not theoretically at risk of flooding now but is in the future.

Demonstrate the project is safe and where possible reduces flood risk overall and proposes measures to deal with the identified effects and risks:

It is proposed that the ground floor levels of the 1 storey dwellings be set 1m above existing ground and 2 storey dwellings be set at least 3.70mAoD (which was also agreed in the previous planning application reference H11-1207-17); with an additional 300mm (minimum) flood resilient construction. Flooding events are generally predicted, with warnings being given on pending events at least two hours in advance. There is a good road network in the town and surrounding area which would allow escape in the event of an unpredicted flooding event. If flooding did occur occupants could also escape to the first floor where they could await rescue if evacuation was not possible. It is considered that the risks to occupants and buildings are low and there is an adequate standard of protection against flooding for the anticipated life of the development.

APPENDIX A-
ENVIRONMENT AGENCY DATA

Jade Smith
Jade@lincsdesignconsultancy.co.uk

Our ref: CCN/2021/202140

Date: 11 February 2021

Dear Jade

Provision of Flood Risk Information for Wisbech Road, Long Sutton

Thank you for your request to use our flood risk information for the above site. The information is set out below and attached. It is important you read any contextual notes on the maps provided.

If you are preparing a Flood Risk Assessment (FRA) for this site, please note this information may not be sufficient by itself to produce an adequate FRA to demonstrate the development is safe over its lifetime. Additional information may be required to carry out an appropriate assessment of all risk, such as consequence of a breach in defences.

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.

1. 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.

2. Historic Flood Event Outlines

With regards to the history of flooding I can advise we do not have any records of flooding in this area. It is possible recent flooding may have occurred which we are currently investigating, therefore this information may be subject to change. It is possible other flooding may have occurred which other risk management authorities, such as the Lead Local Flood Authority (ie top tier council) or Internal Drainage Board (where they exist) have responsibility.

3. Schemes in the area

There are no ongoing capital projects to reduce or sustain the current flood risk to this site.

4. Fluvial Flood Risk Information

This site is not considered to be at risk of flooding from main rivers.

The site may be at risk from local ordinary watercourses for which other risk management authorities, such as the Lead Local Flood Authority (ie top tier council) or Internal Drainage Board (where they exist) have responsibility.

5. Tidal Flood Risk Information

5.1 Tidal Defence Information

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

Refer to paragraph 3.1 for details of any ongoing capital projects to reduce the flood risk to this site.

5.2 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 2017, which should be used in any consideration of future increases due to climate change.

5.3 Tidal 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.

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

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.

5.3.1 Tidal Hazard Mapping - Breaches

- Year 2006 0.5% (1 in 200) chance
- Year 2006 0.1% (1 in 1000) chance
- Year 2115 0.5% (1 in 200) chance
- Year 2115 0.1% (1 in 1000) chance

6. Development Planning

If you would like local guidance on preparing a flood risk assessment for a planning application, please contact our Sustainable Places team at lnplanning@environment-agency.gov.uk. It will help if you mention this data request and attach your site location plan.

We provide free preliminary advice; additional/detailed advice, review of draft FRAs and meetings are chargeable at a rate set to cover our costs, currently £100 (plus VAT) per hour of staff time. Further details are available on our website at https://www.gov.uk/guidance/developers-get-environmental-advice-on-your-planning-proposals.

General advice on flood risk assessment for planning applications can be found on GOV.UK at https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications

Climate change will increase flood risk due to overtopping of defences. Please note, unless specified otherwise, 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.

7. Data Licence and Other Supporting Information

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).

This information is provided in accordance with the Open Government Licence which can be found here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Further information on flood risk can be found on the GOV.UK website at:
https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

8. 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 other risk management authorities, such as the Lead Local Flood Authority (ie top tier council) or Internal Drainage Board (where they exist).

I hope we have correctly interpreted your request. If you have any queries or would like to discuss the content of this letter further please contact Sarah Curl using the email address below.

Yours sincerely,



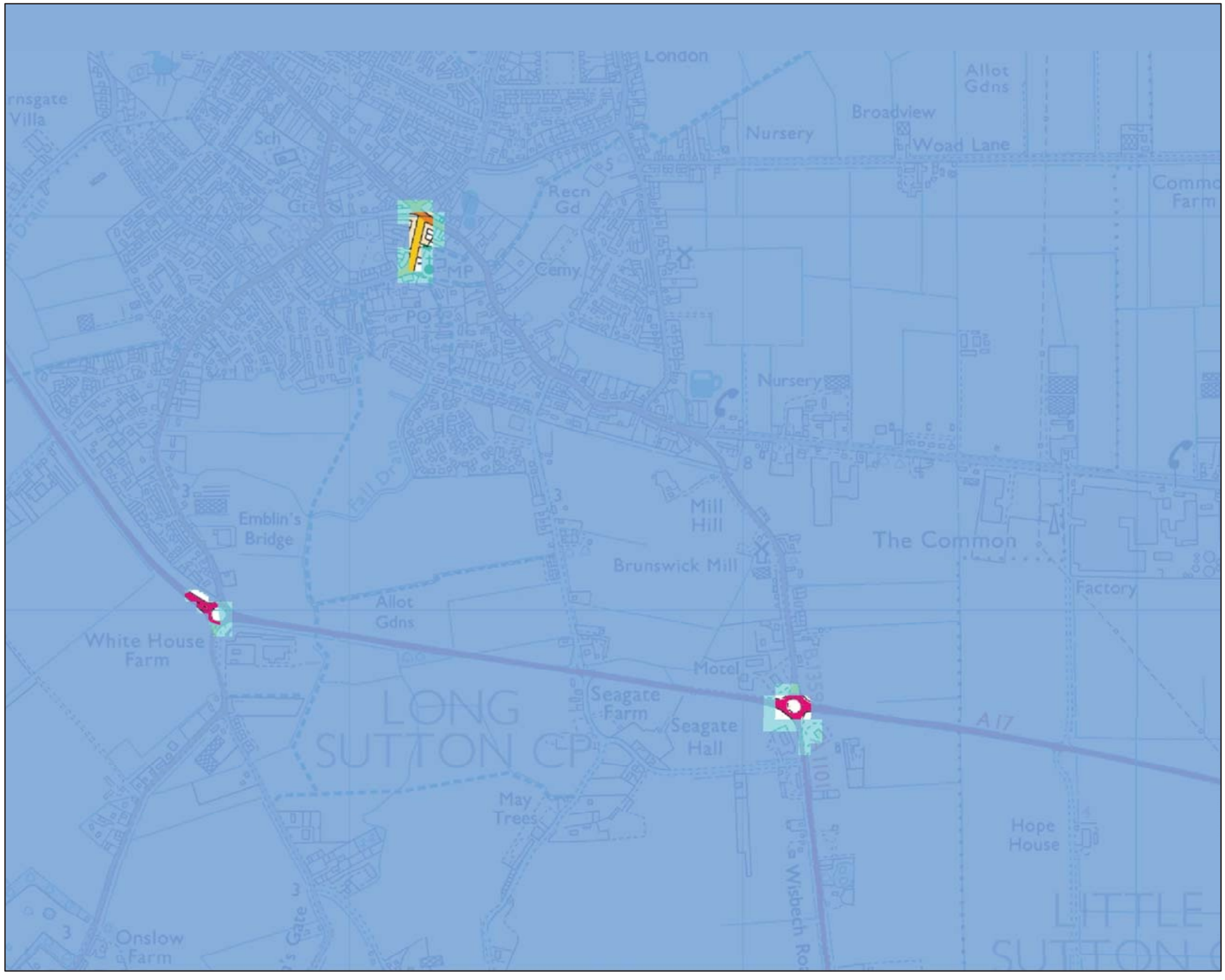
for Alastair Windler
Welland and Nene Partnerships and Strategic Overview Team Leader
e-mail PSOWN@environment-agency.gov.uk

Enc.
Flood Map
Tidal Levels Map and Tables
Tidal Breach Points – Locations Map
Hazard Mapping – Breaching

Ceres House, Searby Road, Lincoln, LN2 4DW
Customer services line: 03708 506 506
Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

Calls to 03 numbers cost the same as calls to standard geographic (ie numbers beginning with 01 or 02)

Flood Map centred on TF 43671 22311 - created February 2021 [Ref: CCN-2021-202140]



Environment Agency

Scale 1:10,000

N

Legend

- Main River
- Raised Defences
- Flood Storage Areas
- 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.

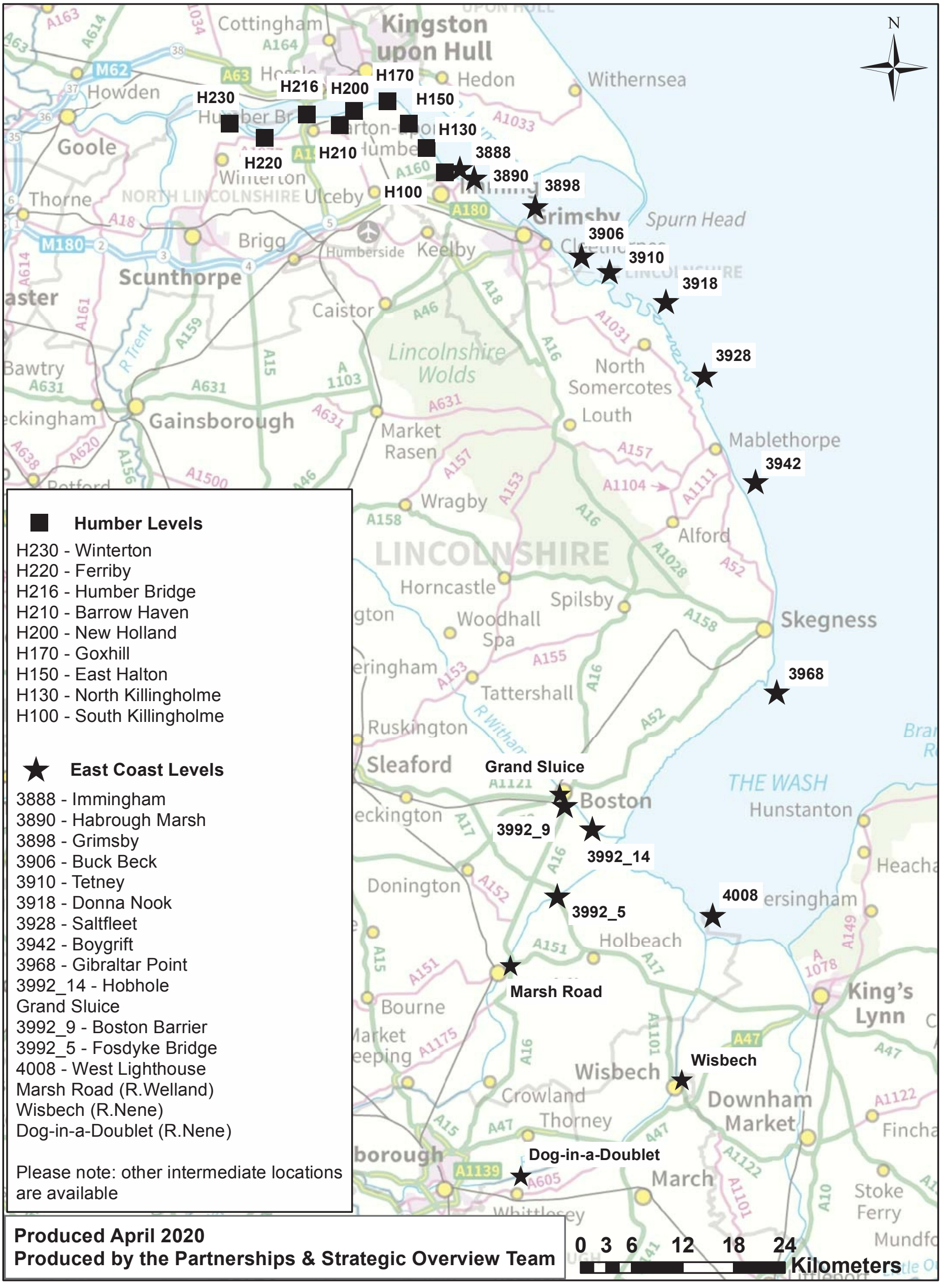
Created by the Partnerships and Strategic Overview Team, Kettering

© Environment Agency copyright and / or database rights 2021. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency, 100026380, 2021.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Tidal Level Location Map
Lincolnshire & Northamptonshire Area

Environment Agency



Humber Levels

H230 - Winterton
H220 - Ferriby
H216 - Humber Bridge
H210 - Barrow Haven
H200 - New Holland
H170 - Goxhill
H150 - East Halton
H130 - North Killingholme
H100 - South Killingholme

East Coast Levels

3888 - Immingham
3890 - Habrough Marsh
3898 - Grimsby
3906 - Buck Beck
3910 - Tetney
3918 - Donna Nook
3928 - Saltfleet
3942 - Boygrift
3968 - Gibraltar Point
3992_14 - Hobhole
Grand Sluice
3992_9 - Boston Barrier
3992_5 - Fosdyke Bridge
4008 - West Lighthouse
Marsh Road (R.Welland)
Wisbech (R.Nene)
Dog-in-a-Doublet (R.Nene)

Please note: other intermediate locations are available

Produced April 2020
Produced by the Partnerships & Strategic Overview Team

© Environment Agency copyright and / or database rights 2020. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency,10002638 2020.

Humber Estuary

2014 Interim Water Level Profile

Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level metres ODN																			
				1			10			50			100			200			300			1000		
				Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound		
				5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%
H230	**Winterton**	493420	422830	5.13	5.14	5.15	5.47	5.51	5.56	5.67	5.74	5.82	5.74	5.83	5.92	5.81	5.90	6.00	5.84	5.94	6.03	5.94	6.02	6.06
H220	**Ferriby**	497550	421150	5.03	5.04	5.05	5.38	5.42	5.47	5.59	5.67	5.77	5.67	5.77	5.89	5.74	5.86	6.00	5.78	5.91	6.06	5.91	6.04	6.19
H216	**Humber Bridge**	502478	423914	4.97	4.98	4.99	5.33	5.37	5.42	5.55	5.64	5.74	5.64	5.75	5.88	5.72	5.86	6.02	5.75	5.92	6.10	5.88	6.09	6.31
H210	**Barrow Haven**	506380	422620	4.91	4.92	4.93	5.27	5.31	5.36	5.50	5.60	5.72	5.60	5.73	5.89	5.69	5.86	6.08	5.74	5.94	6.18	5.87	6.17	6.51
H200	**New Holland**	508020	424330	4.86	4.87	4.88	5.21	5.26	5.31	5.45	5.55	5.67	5.55	5.68	5.84	5.64	5.81	6.03	5.68	5.89	6.13	5.82	6.12	6.47
H170	**Goxhill**	511970	425440	4.66	4.67	4.68	5.00	5.04	5.09	5.24	5.34	5.46	5.33	5.47	5.65	5.43	5.61	5.85	5.47	5.69	5.96	5.62	5.95	6.37
H150	**East Halton**	514450	422870	4.58	4.59	4.60	4.91	4.96	5.01	5.15	5.25	5.38	5.25	5.39	5.57	5.34	5.53	5.77	5.39	5.62	5.90	5.54	5.89	6.33
H130	**North Killingholme**	516530	420000	4.50	4.51	4.52	4.82	4.87	4.92	5.05	5.15	5.28	5.15	5.28	5.46	5.24	5.42	5.66	5.29	5.51	5.78	5.43	5.77	6.19
H100	**South Killingholme**	518700	417120	4.41	4.41	4.42	4.72	4.77	4.82	4.95	5.05	5.17	5.05	5.18	5.35	5.14	5.32	5.55	5.18	5.40	5.67	5.33	5.66	6.08
3888	**Immingham***	520440	417625	4.16	4.17	4.19	4.50	4.53	4.62	4.73	4.80	5.00	4.83	4.93	5.19	4.93	5.06	5.41	4.98	5.14	5.55	5.15	5.38	6.01

NOTE:

- The base date for the data is 2014.
- The levels 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.
- Levels for other annual chance probabilities are available if required.
- The information is due to be updated in mid-2020
- *The levels for Immingham are taken from the 2018 Coastal Flood Boundary dataset.

Customer services line: 03708 506 506
Calls to 03 numbers cost the same as calls to standard geographic numbers
(i.e. numbers beginning with 01 or 02)

Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

East Coast and Wash: Immingham to the West Lighthouse

2018 Coastal Flood Boundary Extreme Sea Levels

CFB Ref	Location	Easting	Northing	Annual Chance (1 in x) of Tide Level in metres ODN																	
				1			10			50			100			200			300			1000		
				Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound			Confidence Bound		
				2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%	2.5%	50%	97.5%
3888	Immingham	520440	417625	4.16	4.17	4.19	4.50	4.53	4.62	4.73	4.80	5.00	4.83	4.93	5.19	4.93	5.06	5.41	4.98	5.14	5.55	5.15	5.38	6.01
3890	Haborough Marsh	522100	416512	4.14	4.15	4.17	4.48	4.51	4.60	4.70	4.77	4.97	4.80	4.90	5.16	4.90	5.03	5.38	4.94	5.10	5.51	5.11	5.34	5.97
3898	Grimsby	529295	413162	3.98	3.99	4.01	4.31	4.34	4.43	4.53	4.60	4.80	4.61	4.71	4.97	4.71	4.84	5.19	4.74	4.90	5.31	4.88	5.11	5.74
3906	Buck Beck	534709	407369	3.87	3.88	3.90	4.19	4.23	4.31	4.41	4.50	4.68	4.50	4.61	4.86	4.61	4.75	5.10	4.64	4.82	5.22	4.80	5.05	5.66
3910	Tetney	538035	405537	3.85	3.86	3.89	4.17	4.22	4.30	4.40	4.50	4.67	4.49	4.61	4.86	4.60	4.75	5.10	4.63	4.82	5.21	4.80	5.06	5.66
3918	Donna Nook	544641	401997	3.82	3.83	3.86	4.14	4.19	4.27	4.38	4.48	4.65	4.47	4.60	4.85	4.58	4.74	5.10	4.63	4.82	5.22	4.81	5.08	5.68
3928	Saltfleet	549131	393360	3.78	3.79	3.82	4.11	4.16	4.26	4.36	4.46	4.64	4.47	4.59	4.86	4.57	4.74	5.11	4.63	4.83	5.25	4.83	5.11	5.74
3942	Boygrift	555131	380860	3.72	3.74	3.77	4.06	4.11	4.22	4.33	4.43	4.65	4.43	4.57	4.87	4.56	4.73	5.13	4.62	4.83	5.28	4.85	5.15	5.82
3968	Gibraltar Point	557652	356181	4.16	4.17	4.20	4.51	4.56	4.67	4.76	4.85	5.08	4.85	4.97	5.27	4.94	5.10	5.49	4.99	5.18	5.63	5.14	5.41	6.09
3992_14	Hobhole	535990	340116	4.96	4.97	5.01	5.40	5.44	5.56	5.66	5.76	5.98	5.78	5.90	6.20	5.88	6.04	6.44	5.92	6.11	6.57	6.03	6.31	6.99
	Grand Sluice*	532366	344510	4.93	4.94	4.98	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
3992_9	Boston Barrier	532754	342852	4.93	4.94	4.98	5.41	5.45	5.57	5.73	5.83	6.05	5.85	5.97	6.27	5.93	6.09	6.49	5.94	6.13	6.59	5.98	6.26	6.94
3992_5	Fosdyke Bridge	531886	332234	4.87	4.88	4.92	5.31	5.35	5.47	5.58	5.68	5.90	5.71	5.83	6.13	5.82	5.98	6.38	5.87	6.06	6.52	6.01	6.29	6.97
4008	West Lighthouse	550094	329971	4.87	4.88	4.91	5.21	5.26	5.37	5.46	5.56	5.78	5.56	5.68	5.98	5.66	5.82	6.21	5.71	5.90	6.35	5.86	6.14	6.81
-	Marsh Road	525988	324065	-	5.04	-	-	5.44	-	-	5.73	-	-	5.85	-	-	5.98	-	-	-	-	-	-	-
-	Wisbech	546110	309940	-	4.83	-	-	5.25	-	-	5.53	-	-	5.66	-	-	5.78	-	-	-	-	-	-	-
-	Dog-in-a-Doublet	527200	299287	-	3.67	-	-	4.00	-	-	4.22	-	-	4.32	-	-	4.42	-	-	-	-	-	-	-

See next page for notes

Customer services line: 03708 506 506
Calls to 03 numbers cost the same as calls to standard geographic numbers
(i.e. numbers beginning with 01 or 02)

Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency

East Coast and Wash: Immingham to the West Lighthouse

2018 Coastal Flood Boundary Extreme Sea Levels

NOTES:

The following notes apply to all CFB sites (ie all on table excluding Marsh Road, Wisbech, Dog-in-a-Doublet)

- The base date for the data is 2017.
- The levels 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.
- Levels for other annual chance probabilities are available if required.
- For additional information relating to the 2018 Coastal Flood Boundary Extreme Sea Levels or to access the full dataset for the above sites or intermediate locations refer to the Defra Metadata Catalogue at https://deframetadata.com/geonetwork/srv/eng/catalog.search#/metadata/84a5c7c0-d465-11e4-b0bd-f0def148f590

The following notes apply to all Marsh Road, Wisbech, Dog-in-a-Doublet

- The base date for the data is 2006
- The levels 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.
- Levels for other annual chance probabilities are available if required.
- These levels will be updated as their respective tidal river models are updated.

The following notes apply to Grand Sluice

- The data is based on CFB 2018 data for Boston Barrier site, capped at 5.3mAOD to reflect use of the barrier.
- The base date for the data is 2017
- The levels 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.
- For additional information relating to the 2018 Coastal Flood Boundary Extreme Sea Levels or to access the full dataset for the above sites or intermediate locations refer to the Defra Metadata Catalogue at https://deframetadata.com/geonetwork/srv/eng/catalog.search#/metadata/84a5c7c0-d465-11e4-b0bd-f0def148f590

Customer services line: 03708 506 506
Calls to 03 numbers cost the same as calls to standard geographic numbers
(i.e. numbers beginning with 01 or 02)

Email: enquiries@environment-agency.gov.uk
www.gov.uk/environment-agency



^ **Modelled Breach Locations**

0 3.5 7 14
Kilometres

This map indicates the location of where we have modelled the consequence of breaches in the defences 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.

General Enquiries No: 03708 506 506.
Weekday daytime calls cost 5p plus up to 6ppm from BT Weekend Unlimited. Mobile and other providers charges may vary

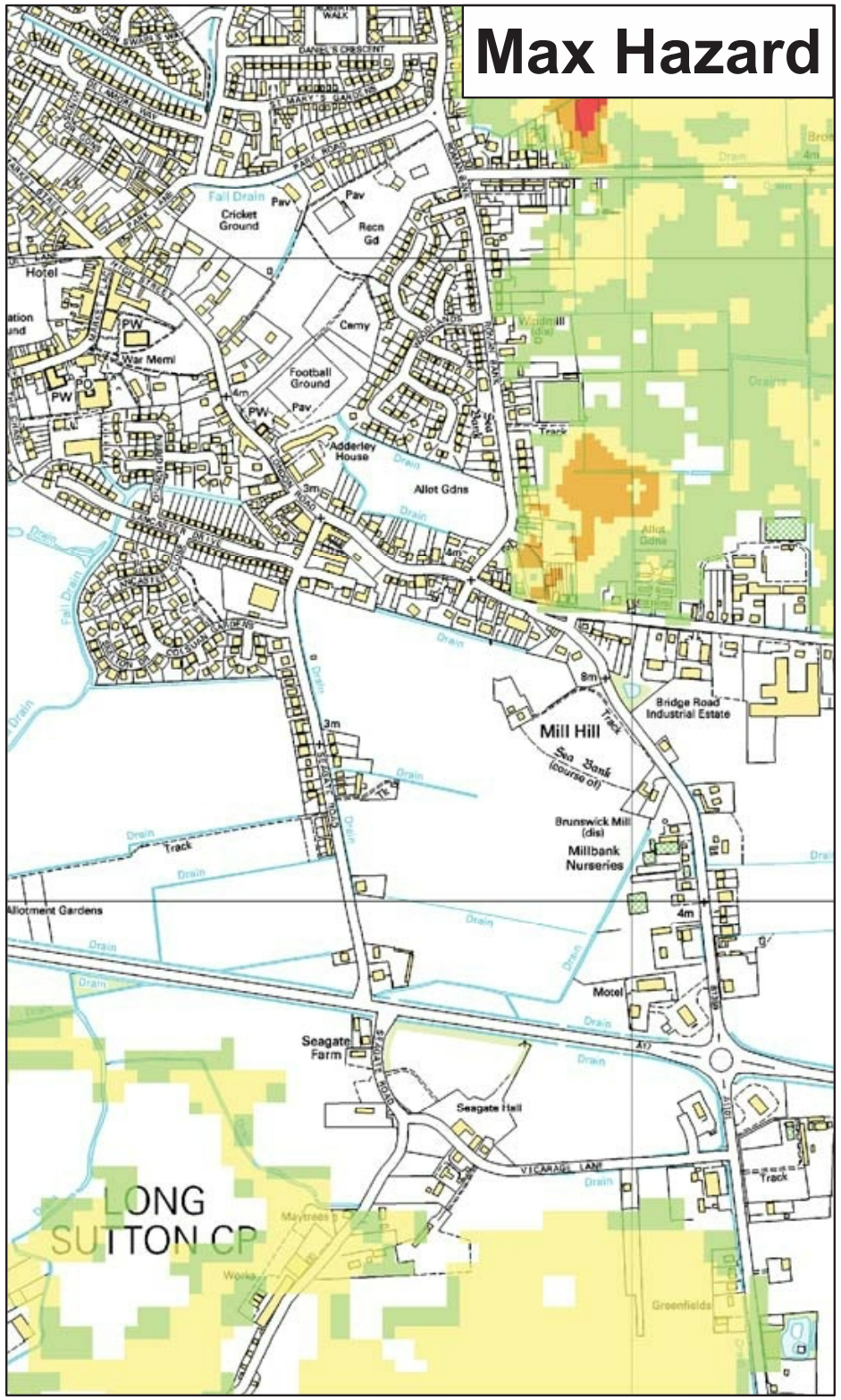
Environment Agency

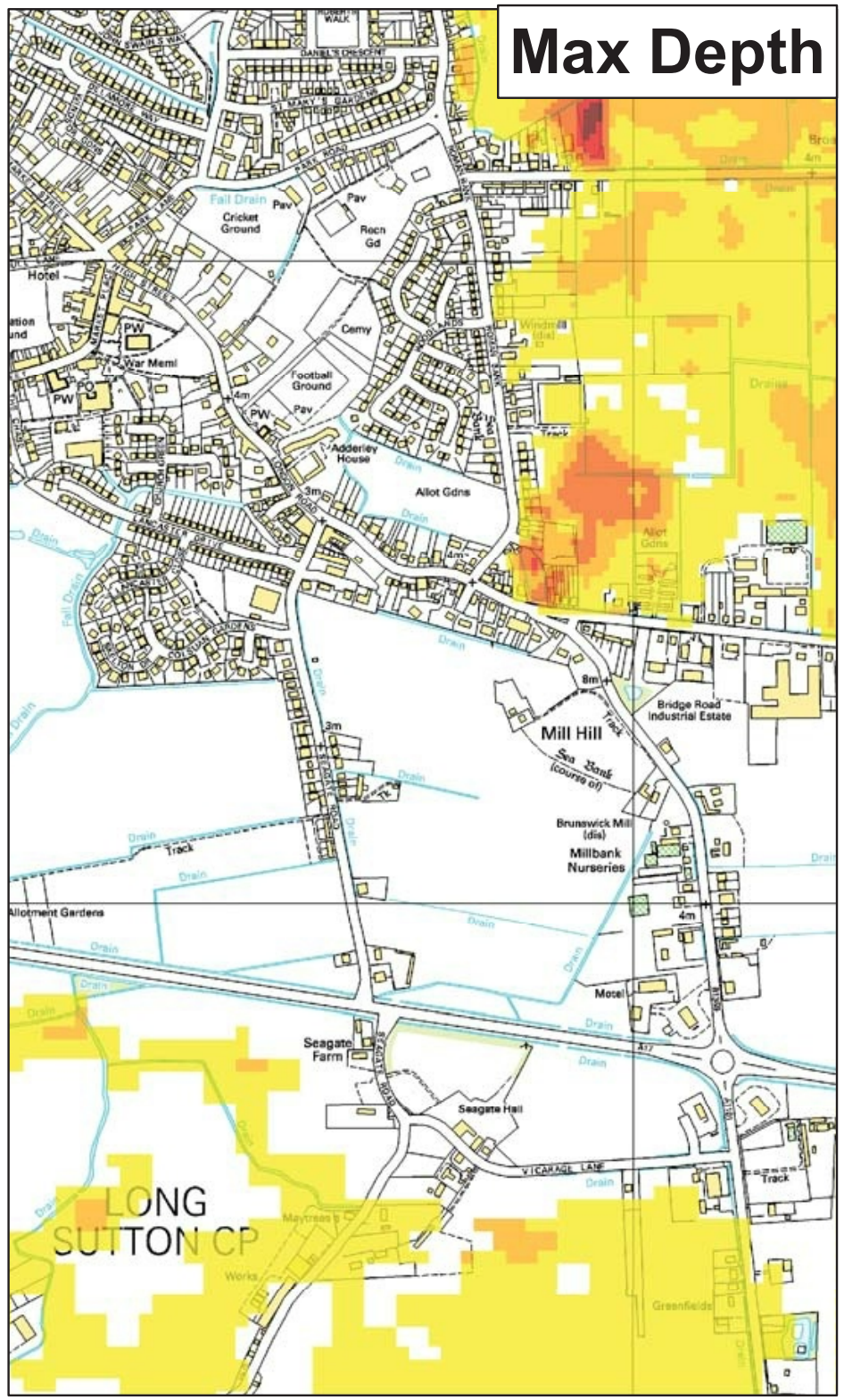
Produced by the Partnership and Strategic Overview Team, Lincoln
General Enquiries No: 03708 506 506

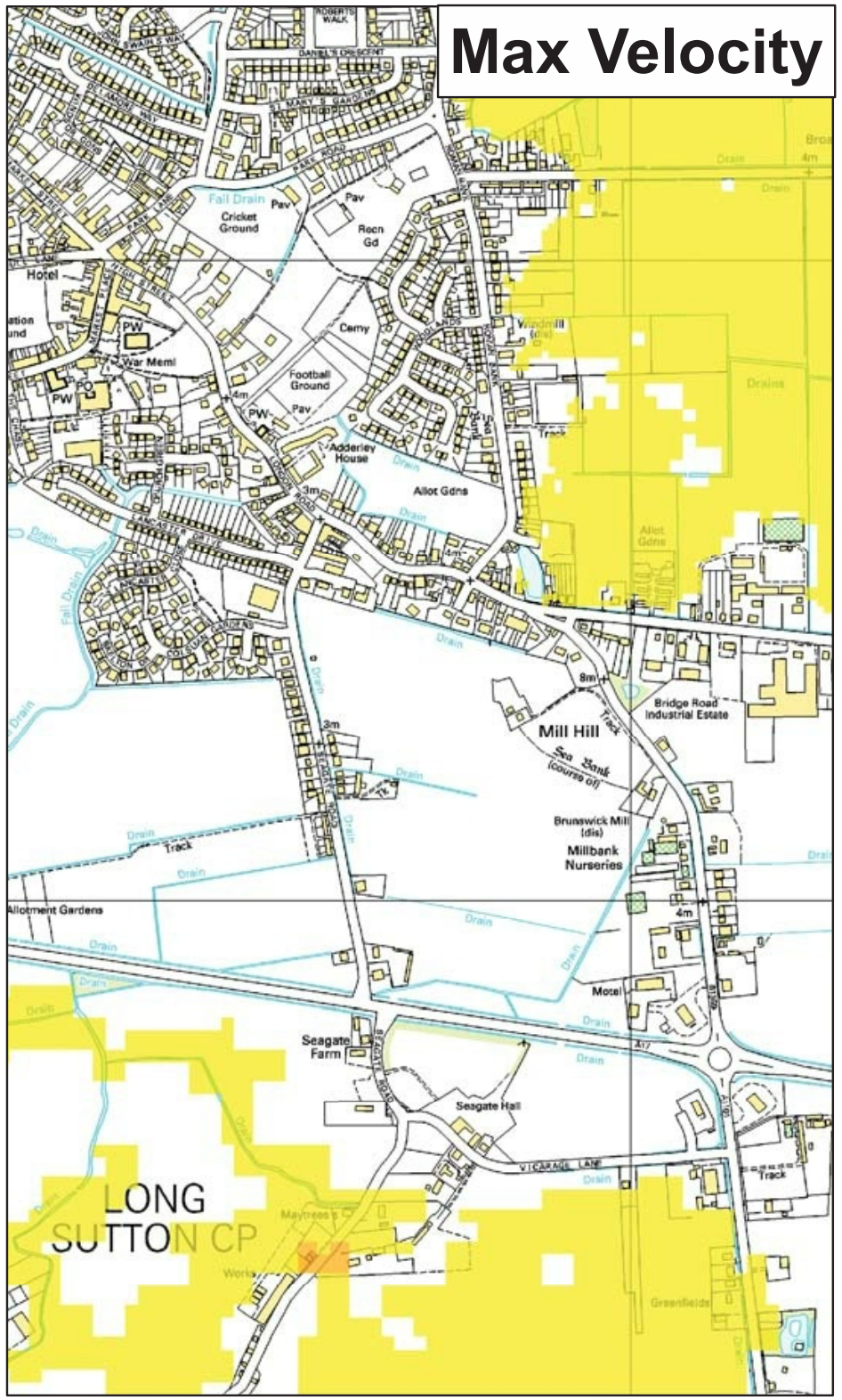
Northern Area Tidal Hazard Mapping

Location of Modelled Breaches

This map is reproduced by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office. Crown copyright.All rights reserved. Environment Agency 100026380, 2020
Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.







★ **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	February 2021	Scenario year	2006	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2021-202140

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.

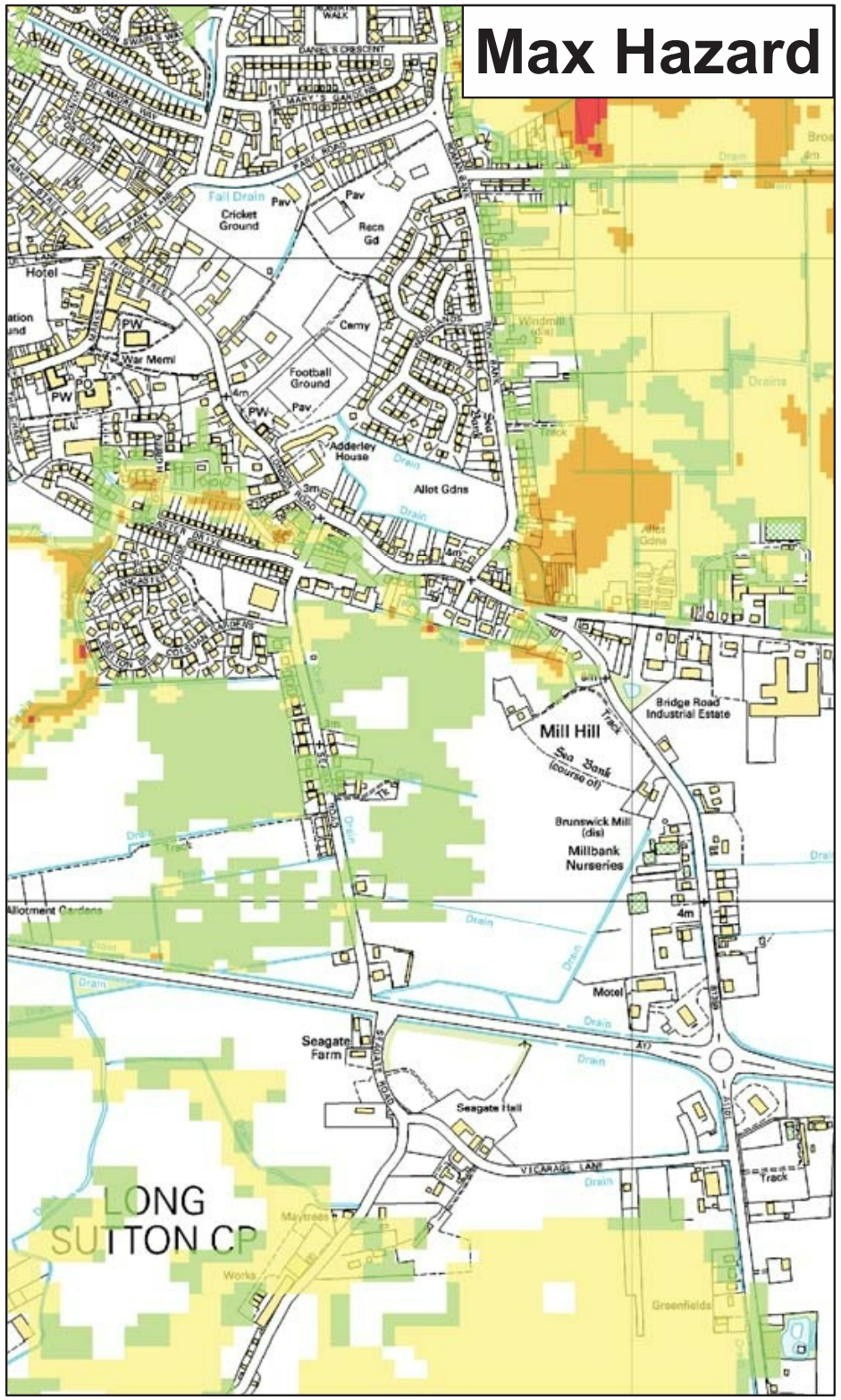
General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

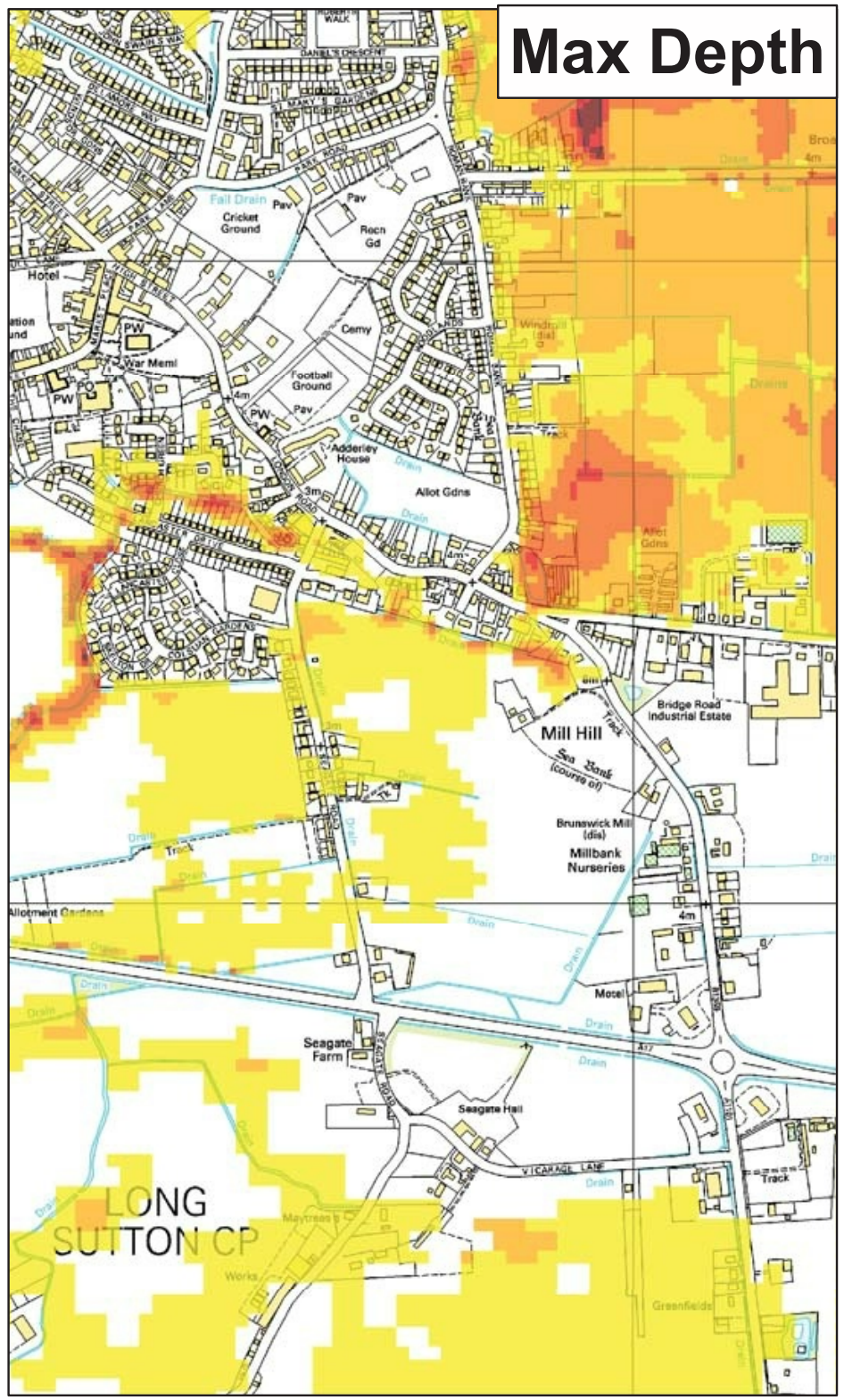
Environment Agency

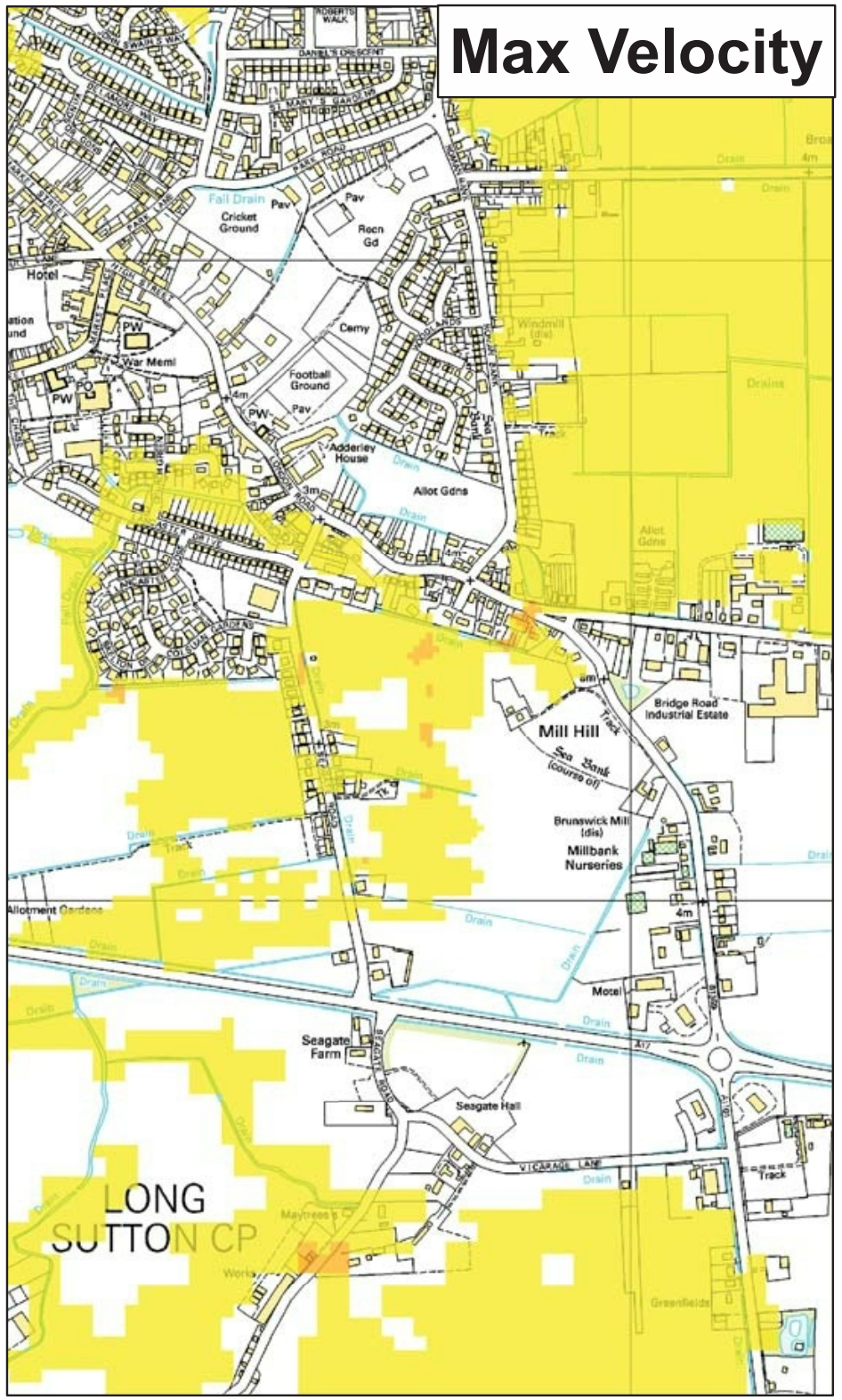
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 43671 22311

This map is reproduced by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office. Crown copyright. All rights reserved. Environment Agency 100026380, 2021. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.







★ Modelled Breach Locations

- see also the accompanying plan "Location of Modelled Breaches"

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)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 1.6
- 1.6 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	February 2021	Scenario year	2006	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2021-202140

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.

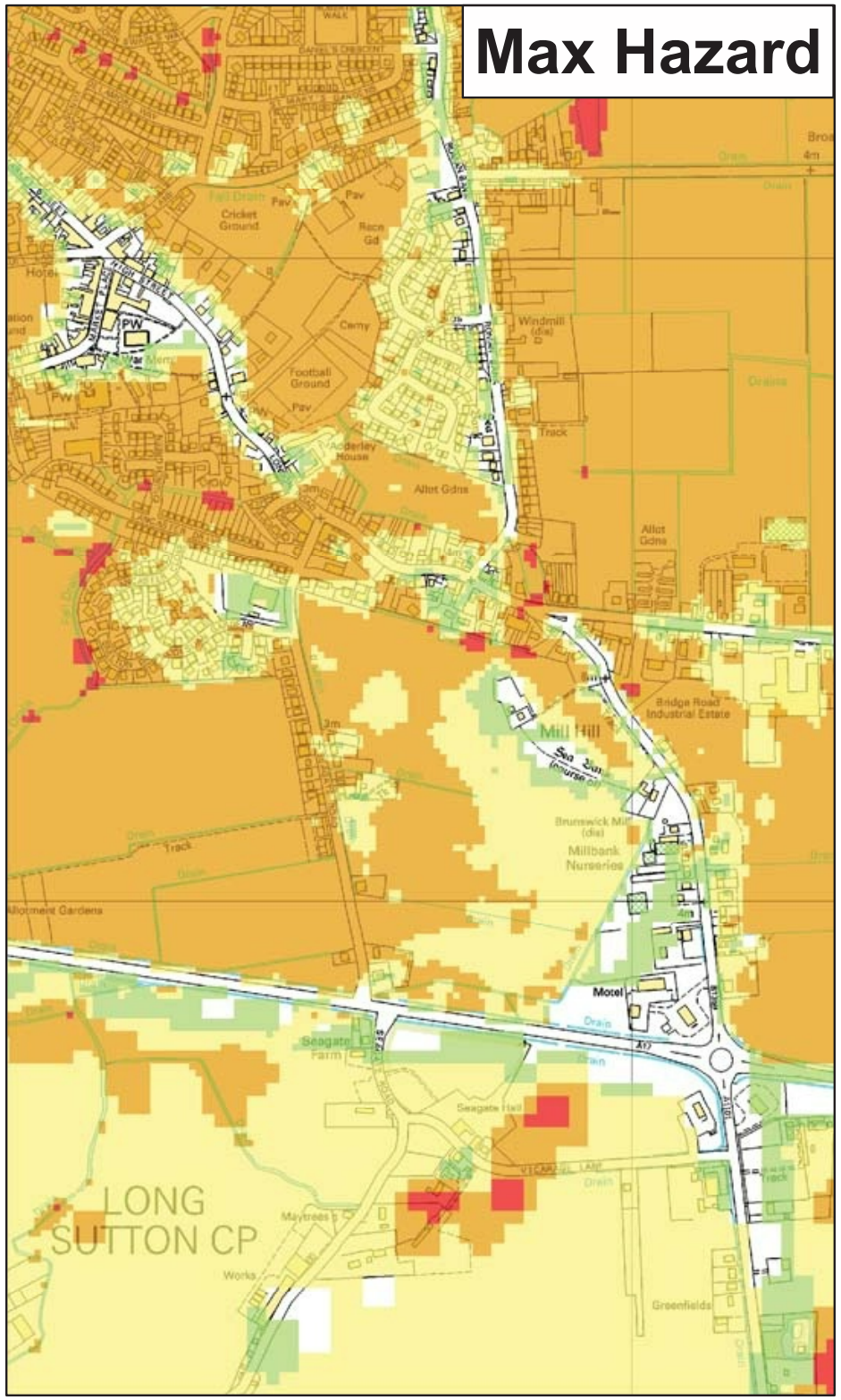
General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

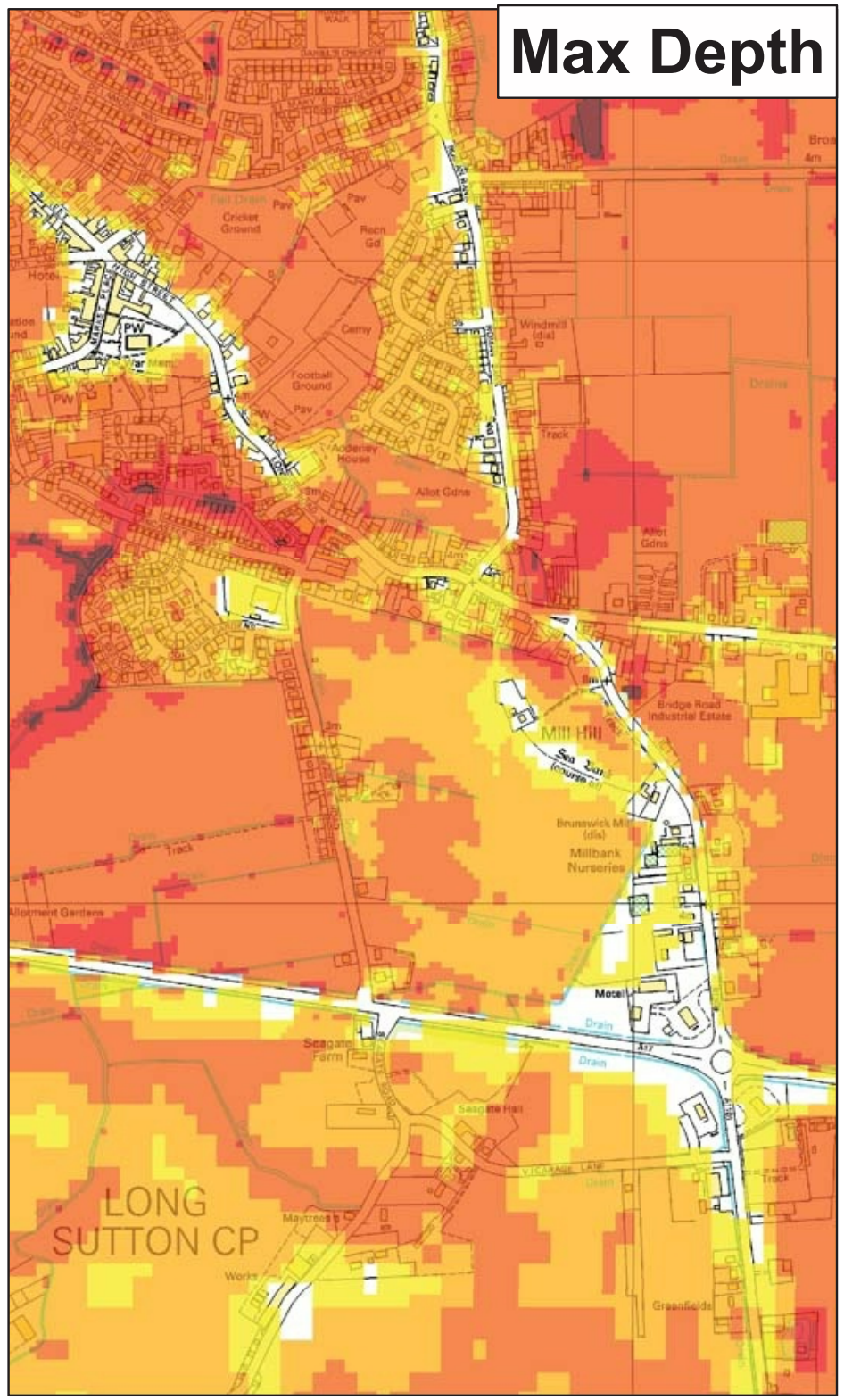
Environment Agency

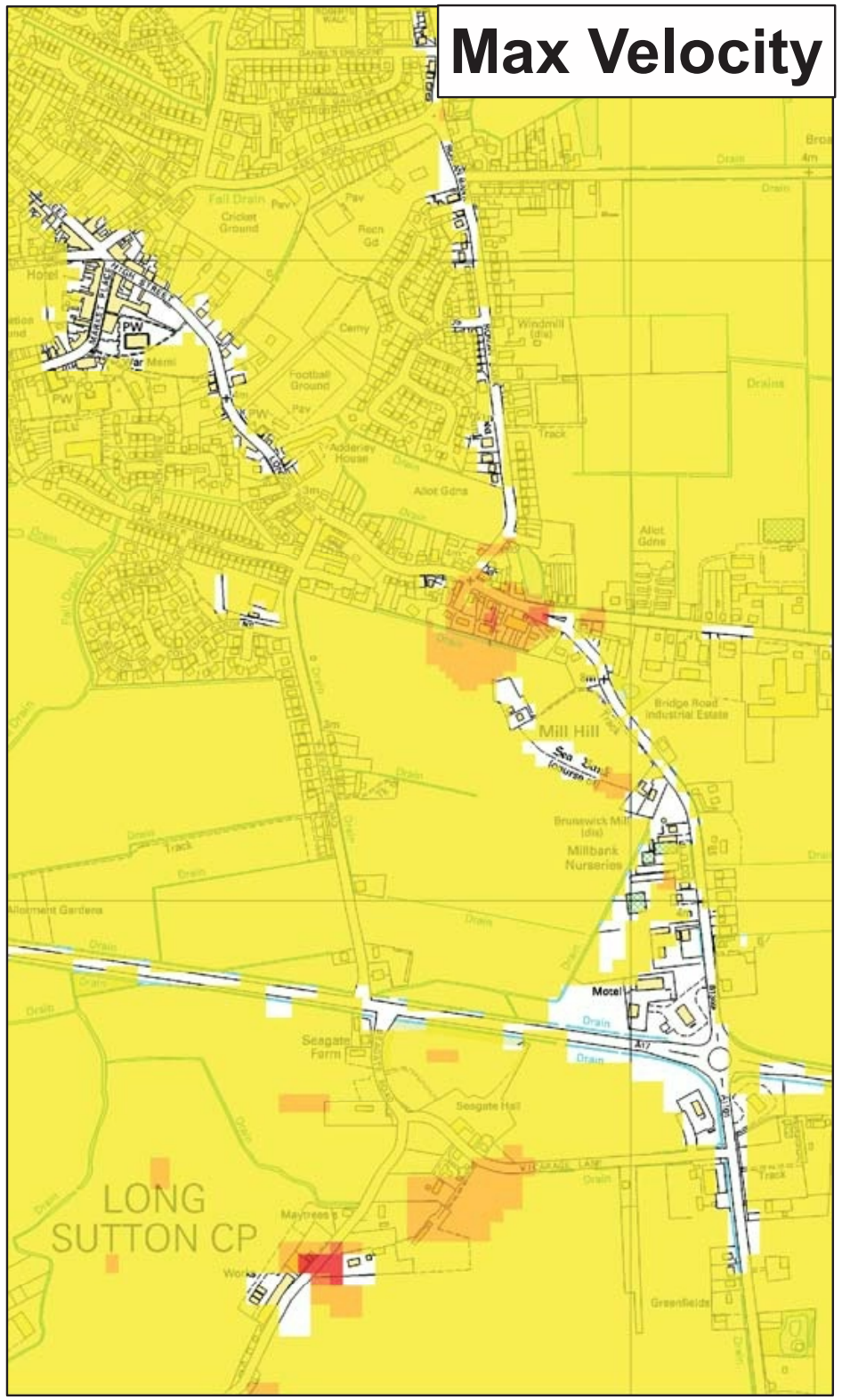
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 43671 22311

This map is reproduced by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office. Crown copyright. All rights reserved. Environment Agency 100026380, 2021. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.







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

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)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 1.6
- 1.6 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	February 2021	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2021-202140

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.

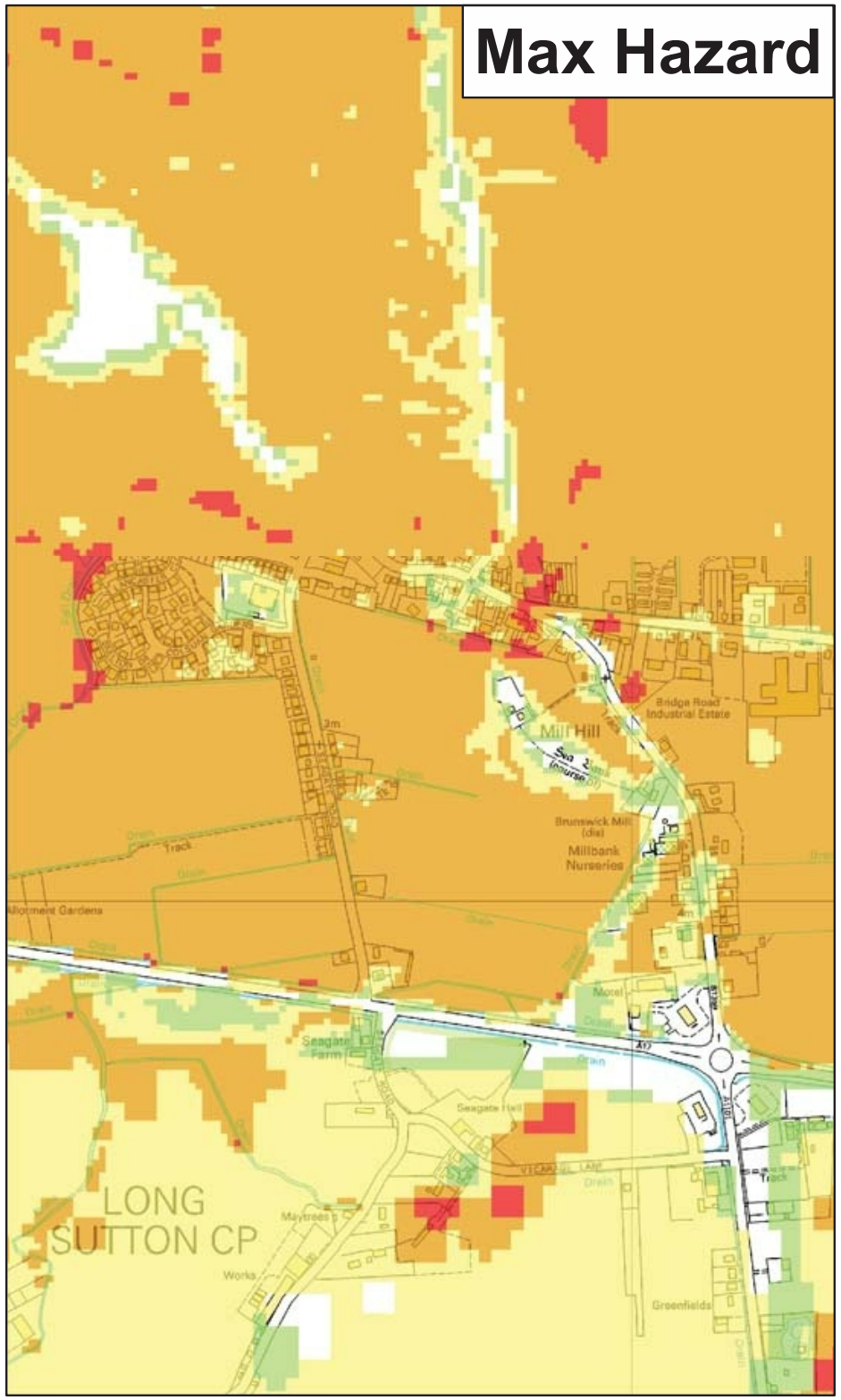
General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

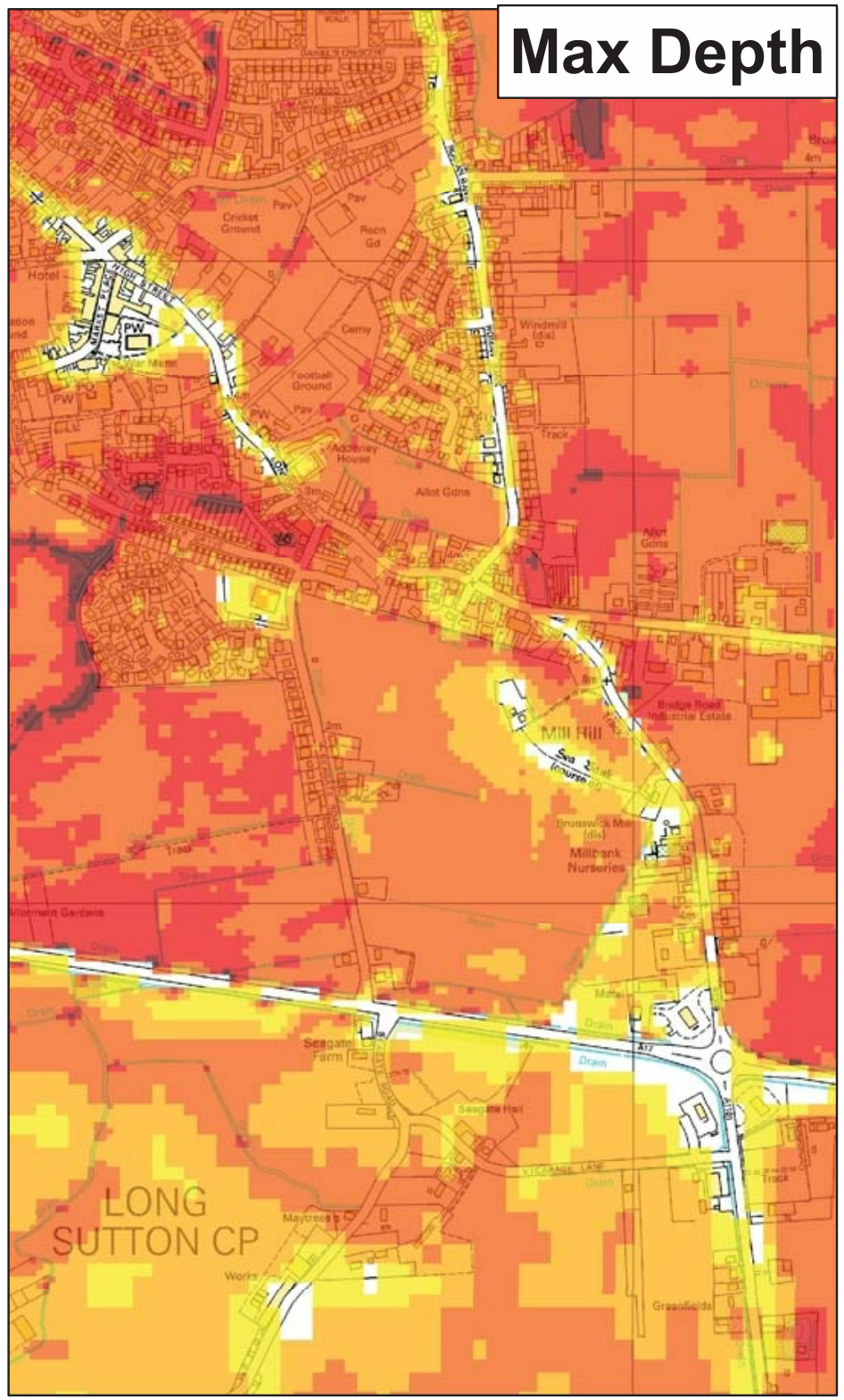
Environment Agency

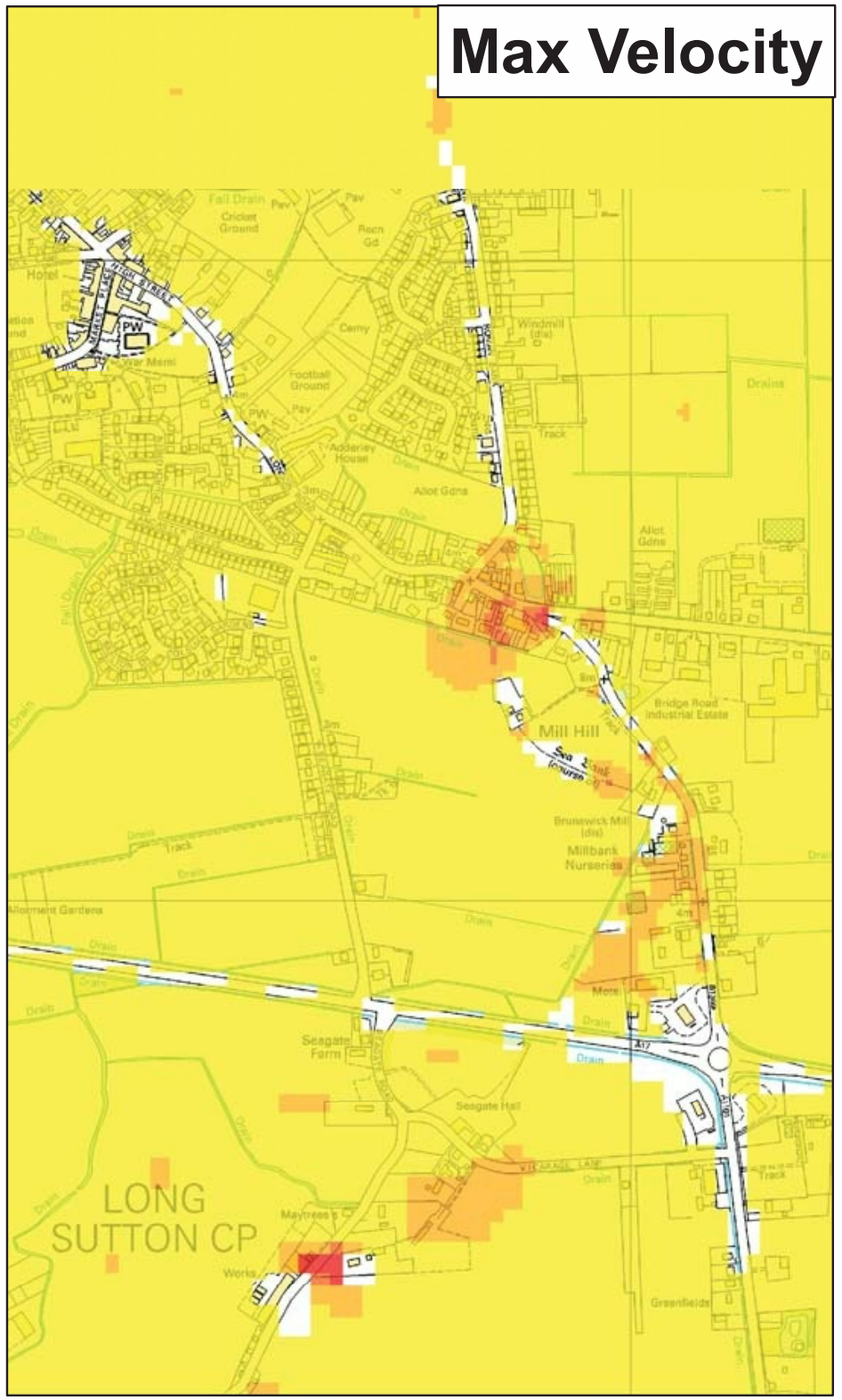
Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 43671 22311

This map is reproduced by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office. Crown copyright. All rights reserved. Environment Agency 100026380, 2021. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.







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

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)

Max Depth (m)

- 0 - 0.25
- 0.25 - 0.50
- 0.50 - 1.0
- 1.0 - 1.6
- 1.6 +

Max Velocity (m/s)

- 0 - 0.3
- 0.3 - 1.0
- 1.0 - 1.5
- 1.5 - 2.5
- 2.5 +

Date Printed	February 2021	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2021-202140

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.

General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

Environment Agency

Lincolnshire and Northamptonshire Tidal Breaching Hazard Mapping

Map Centred on TF 43671 22311

This map is reproduced by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationary Office. Crown copyright. All rights reserved. Environment Agency 100026380, 2021. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings.

APPENDIX B-
DRAINAGE STRATEGY