EP UK Investments

South Humber Bank Energy Centre Development Consent Order

South Marsh Road, Stallingborough, DN41 8BZ

Appendix 14A: Flood Risk Assessment

Applicant: EP Waste Management Limited
Date: October 2019

DOCUMENT HISTORY

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GLOSSARY

Abbreviation	Description
AEP	Annual Exceedance Probability
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency
EfW	Energy from Waste
EIA	Environmental Impact Assessment
EPH	Energetický a Průmyslový Holding
FGT	Flue Gas Treatment
FRA	Flood Risk Assessment
FZ	Flood Zone
Ha	Hectare
IDB	Internal Drainage Board
IED	Industrial Emissions Directive
LFA	Local Flood Authority
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Meters Above Ordnance Datum
mODN	Meters Ordnance Datum (Newlyn)
NELC	North East Lincolnshire Council
NPPF	National Planning Policy Framework
NSTS	Non-Statutory Technical Standards for SuDS
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Policy Guidance
RDF	Refuse Derived Fuel
RSS	Regional Spatial Strategy
SFRA	Strategic Flood Risk Assessment
SHBEC	South Humber Bank Energy Centre
SMP	Shoreline Management Plan
SPZ	Source Protection Zone
SuDS	Sustainable Drainage Systems
UK	United Kingdom

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1.0 INTRODUCTION

Background

1.1 AECOM Infrastructure and Environment Ltd (AECOM) were commissioned by EP Waste Management Ltd ('the Applicant') to prepare a Flood Risk Assessment (FRA) for the Proposed Development of the South Humber Bank Energy Centre (SHBEC). The Proposed Development Site ('the Site') is located adjacent to the South Humber Bank Power Station (SHBPS) off South Marsh Road, Stallingborough in North East Lincolnshire centred at Ordnance Survey National Grid Reference (OSNGR) 523019, 413263. More details of the Site are provided in Section 2.0.

1.2 The Applicant is proposing to develop land located adjacent to and to the east of the existing SHBPS. The Proposed Development is for the construction and operation of a new energy from waste (EfW) power station. More details of the Proposed Development are provided in Section 2.0.

The Purpose and Scope of this Document

1.3 The Environment Agency (EA)'s 'Flood Map for Planning' (EA, 2019a) identifies that the Site is located wholly within Flood Zone 3a, defined by the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019) and Planning Policy Guidance: Flood risk and coastal change (PPG) (Ministry of Housing, Communities and Local Government, 2019), as land with a high probability of flooding (>1% Annual Exceedance Probability (AEP)) (1 in 100 or greater annual chance of river flooding), or a >0.5% AEP (1 in 200 or greater annual chance) of flooding from the sea.

1.4 As the Site comprises an area in excess of one hectare (ha) and is located within Flood Zone 3, a FRA is required to accompany any planning application for the development of the Site, as per the requirements of the NPPF.

1.5 The aim was to undertake a FRA that is appropriate to the nature and scale of the Proposed Development, which would meet the necessary requirements of current planning guidance (see Section 3.0), and which will be sufficient to support the planning application for the Proposed Development. In order to meet this aim, the following was undertaken:

- consultation with and obtaining data from North East Lincolnshire Council (NELC), the EA and North East Lindsey Internal Drainage Board (NELIDB) in regard to the Proposed Development, the flood risks posed to the Site and the necessary measures that would be required to protect the Proposed Development from flooding;
- review of publicly available data to determine the flood risks associated with all sources of flooding including the Humber Estuary, Main Rivers, Ordinary Watercourses, (including those under the jurisdiction of the NELIDB), groundwater, artificial sources, surface water runoff/ overland flow and drainage and surrounding areas; and
- review of the Proposed Development design in light of the identified flood risks and identification of measures, where necessary, that would manage any residual flood risk to the Site to acceptable levels.

Data Sources

1.6 The baseline conditions for the Site were established through a desk based study and via consultation with the EA and other key statutory consultees. This information has been used to inform the assessment made within the FRA. Data collected during the course of this assessment is detailed in Table 1.

Table 1: Data Sources to Inform this FRA

PURPOSE	SOURCE	COMMENTS
Identification of Hydrological Features	1:10,000 Ordnance Survey (OS) mapping EA 1m resolution LiDAR data (EA, 2017)	Identifies the location of local hydrological features and provides topographic elevations
Identification of Land Use	StreetCheck (2019)	Identifies the type of land use
Identification of Existing Flood Risk	1:10,000 OS mapping	Provides indicative ground levels of the Site and surrounding area
	EA Flood Map for Planning (EA, 2019a)	Identifies fluvial/ tidal inundation extents
	EA Flood Risk from Surface Water Map (EA, 2019b)	Identification of flood risk from surface water runoff from land
	EA Flood Risk from Reservoirs Map (EA, 2019b)	Provides information on the risk of flooding from reservoirs (artificial sources)
	EA Groundwater Vulnerability map (EA, 2019c)	Identification of groundwater vulnerability designations
	British Geological Survey (BGS) records (BGS, 2018) Soilscapes Map (Cranfield Soil and Agrifood Institute, 2019)	Provides details of geology (bedrock and superficial deposits), soil type and hydrogeology in the vicinity of the Site
	North Lincolnshire Preliminary Flood Risk Assessment (PFRA) (Entec, 2011)	Indicative risk of flooding from the local drainage system and minor watercourses within the vicinity of the Site
	North and North East Lincolnshire Strategic Flood Risk Assessment (SFRA) (North Lincolnshire Council and North East Lincolnshire Council, 2011) and	Assesses local flood risk from fluvial/ tidal, sewers, overland flow, groundwater and artificial sources

PURPOSE	SOURCE	COMMENTS
	Addendum (North Lincolnshire Council and North East Lincolnshire Council, 2016)	
	North Lincolnshire Local Flood Risk Management Strategy (LFRMS) (Amec Foster Wheeler, 2016)	Provides details of flood risk within the Borough and which statutory authorities are responsible for the management of local flood risk. The report does not consider flood risk from Main Rivers
	Humber Flood Risk Management Strategy (HFRMS) (EA, 2014)	The EA's long term plan for managing flood risk from the Humber Estuary
	Grimsby and Ancholme Catchment Flood Management Plan (CFMP) (EA, 2009a)	Outlines flood risk sources within the plan area and how these may be managed in the future
	Flamborough Head to Gilbraltar Point Shoreline Management Plan (SMP) (Scott Wilson & Humber Estuary Coastal Authorities Group, 2010)	Outlines the proposals for how the tidal flood risk in the area will be managed by the EA in the future
Identification of Historical Flooding	North Lincolnshire PFRA (Entec, 2011)	Details of historical flooding and local flooding records
	North and North East Lincolnshire SFRA (North Lincolnshire Council and North East Lincolnshire Council, 2011)	
	North Lincolnshire LFRMS (Amec Foster Wheeler, 2016)	
	EA pre-development response	
Details of the Scheme	Proposed Development Design Drawings provided by Fichtner Consulting Engineers	Provides the layout of the Proposed Development
Surface Water Drainage Plans	1:10,000 OS Mapping Existing Site Drainage Plans	Identified existing site drainage, public drainage system near the Site and details of existing surface water runoff from the Site

Consultation with Key Stakeholders

1.7 Consultation was undertaken with the EA, NELIDB, NELC and Anglian Water to inform the FRA for the Consented Development. Further consultation has been carried out where required for the Proposed Development, including updating data requests. Responses to date are provided in Annexes 1, 2, 3 and 4 to this report respectively, and within Appendix 2 of the EIA Scoping Opinion for the Proposed Development (see Appendix 1B in Preliminary Environmental Information (PEI) Report Volume III). These advisory recommendations are summarised and addressed in Sections 3.0, 5.0 and 6.0.

2.0 SITE DESCRIPTION

Location

2.1 The Site is defined by the development consent application boundary which comprises approximately 25 hectares (ha) and is located approximately 5.6 kilometres (km) north-west of Grimsby in North East Lincolnshire, centred at OSNGR 523019, 413263. Figure 1 illustrates the Site location and hydrological context.

Existing Land Use

2.2 Within the Site there is an area which is defined as the Main Development Area (as illustrated in Figure 1).

2.3 The Main Development Area comprises approximately 7 ha of undeveloped land which is crossed by a number of existing buried services, underground cooling water pipes connecting the SHBPS in the west of the Site to the cooling water pumping station located to the east, and an associated access road to the pumping station. The two man-made ponds shown on OS mapping within the Main Development Area were drawn down and infilled during 2019.

2.4 The remainder of the Site comprises the existing SHBPS and areas which will be used for construction laydown and the site compound during construction, as well as for ecological habitat creation.

Access

2.5 The Site is currently accessed through the main entrance of the SHBPS off South Marsh Road and is intersected by an internal access road which links the power station to the cooling water pumping station in the east of the Site. South Marsh Road provides highway access to SHBPS and also to Synthomer (UK) Limited and the NEWLINCS Integrated Waste Management Facility, both located to the north of the Site.

2.6 It is understood that South Marsh Road is also used by the EA to access flood defences along the bank of the Humber Estuary to the east of the existing pumping station.

2.7 The cooling water pumping station located approximately 60 m to the east of the Site associated with the existing SHBPS does not service drainage of surface water runoff generated from rainfall at the Site.

Hydrology and Flood Risk Management Infrastructure

2.8 The Site is located approximately 175 m west of the Humber Estuary. The nearest watercourse is Oldfleet Drain located approximately 140 m to the south of the Site (at its closest point) which is classed by the EA as a Main River. Middle Drain, an Ordinary Watercourse is located approximately 340 m to the north (at its closest point). A series of minor land drainage ditches (also Ordinary Watercourses) run along the northern, western, eastern and southern boundaries of the Site and convey surface water runoff discharges from the greenfield areas of the Site into Middle Drain and Oldfleet Drain towards the Humber Estuary. These land drains are illustrated in more detail in Figure 14.1 in PEI Report Volume II.

2.9 Fluvial flood defences are present along Oldfleet Drain upstream of the Site, located approximately 270 m south-west, upstream of the railway line. According to the information provided by the EA, these defences reduce the risk of flooding to a >1% AEP (1 in 100 chance) event.

2.10 Middle Drain discharges via a pumping station located approximately 550 m north of the Site, and Oldfleet Drain that outfalls via a flapped culvert into the estuary approximately 450 m south-east of the Site. The tidal outfall of Oldfleet Drain comprises a flapped twin culvert through the raised coastal flood defence that enables runoff to discharge whilst tide levels are low enough and the flaps are open. Two additional outfalls from a land drain alongside the raised sea defence between the Site and the Middle Drain pumping station comprise two 150 mm diameter un-flapped pipes.

2.11 The EA's 'Flood Map for Planning' (see Annex 1, and EA, 2019a) identifies there to be existing tidal flood defences located approximately 160 m to the east of Site, extending from north-west to south-east alongside the Humber Estuary and reducing the risk of flooding up to a 0.5% AEP (1 in 200 chance) event.

Surrounding Land Use

2.12 There is a body of standing water (see Figure 1) located approximately 80 m to the east of the Site next to the cooling water pumping station associated with the SHBPS. This is a holding chamber for water in and out of the cooling pipes.

2.13 The Site is located on the South Humber Bank which is an area of mixed agricultural and industrial use with no residential receptors located in close proximity to the Site (within 500 m). The closest residential properties (individual receptors) are located approximately 1 km to the west and south-west; these are:

- Poplar Farm (located on South Marsh Road); and
- Primrose Cottage (accessed via Station Road, north of the A180).

2.14 The nearest settlement is the village of Stallingborough located over 2 km to the south-west.

Topography

2.15 A review of 1 m resolution LiDAR data published by the EA (EA, 2017) identified that the Site is situated on generally flat land with levels ranging between 1.90 metres Above Ordnance Datum (mAOD) and 4.25 mAOD (see Figure 2). The levels of the Site gently fall from west to east, towards the Humber Estuary.

Geology

2.16 The British Geological Survey, Geology of Britain Viewer (BGS, 2018) was used to identify the bedrock and superficial deposits beneath the Site. The superficial deposits present beneath the Site are identified as tidal flat deposits (clay and silt) possibly underlain by glacial deposits. These are designated as unproductive strata with low permeability; however permeable sand layers are likely to contain groundwater.

2.17 The bedrock underlying the Site is the Flamborough Chalk Formation and is designated as a 'Principal Aquifer', defined as "*layers of rock or drift deposits that…usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale*". Available groundwater monitoring data indicates that groundwater within the chalk is likely to be confined beneath the overlying low-permeability superficial deposits.

2.18 There are no recorded geological faults identified beneath the Site.

2.19 Soils at the Site are described on the Cranfield Soil and Agrifood Institute's Soilscapes mapping website as *"loamy and clayey soils of coastal flats with naturally high groundwater"*.

2.20 The Site is not located within an EA designated groundwater Source Protection Zone (SPZ) (EA, 2019c). The nearest SPZs to the Site are located approximately 1.2 km to the south-west and north-west and are associated with potable water abstractions from the chalk aquifer. The nearest Inner Zone (Zone 1) Groundwater Source is located in Healing, approximately 1.6 km to the south-west. Groundwater within the chalk is likely to be confined beneath the overlying superficial deposits.

2.21 The Site is located in an area defined as a 'Major Aquifer – High' vulnerability category on the EA's Groundwater Vulnerability Map (EA, 2019c).

2.22 These classifications will be taken into account in detail when the proposed surface water runoff mitigation measures (see Section 5.0) are developed further at the detailed design stage.

The Proposed Development

2.23 The Applicant proposes to develop the Site to construct and operate a new EfW power station with a gross electrical output of up to 95 MW.

2.24 The building envelope of the Proposed Development is approximately 210 m long and 110 m wide at its greatest extent. The nominal design capacity of the facility is 616,500 tonnes per annum of refuse derived fuel (RDF) based on a design net calorific value (NCV) of 11 MJ/kg and average availability. It is expected that the Proposed Development will be capable of maintaining the maximum electrical output while combusting fuel in a range of NCVs between 9 and 14 MJ/kg.

Proposed Access

2.25 It is proposed that the Site will be accessed from the A180 via the A1173, Kiln Lane, Hobson Way and South Marsh Road via a new access from South Marsh Road to the east of the existing SHBPS entrance. The Proposed Development will maintain access to the pumping station for SHBPS via a redirected roadway.

Proposed Development Drawings

2.26 A set of drawings illustrating the Proposed Development proposals are provided in Volume II of the PEI Report. These include:

- Site Location Plan — Figure 1.1
- Proposed Development Site Layout Plan — Figure 4.1

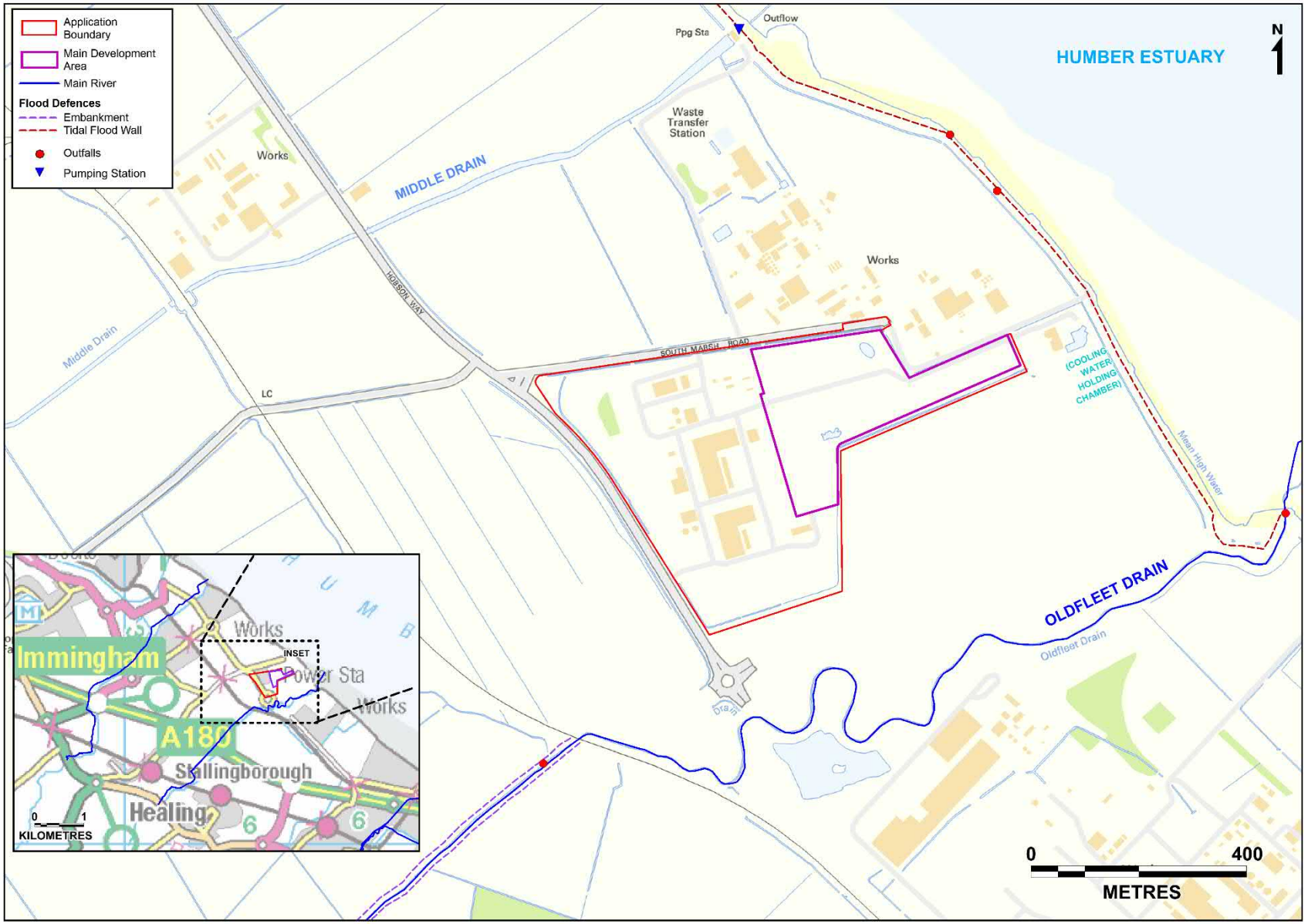

Figure 1: Site location plan

Contains Ordnance Survey Data © Crown Copyright and database right 2018

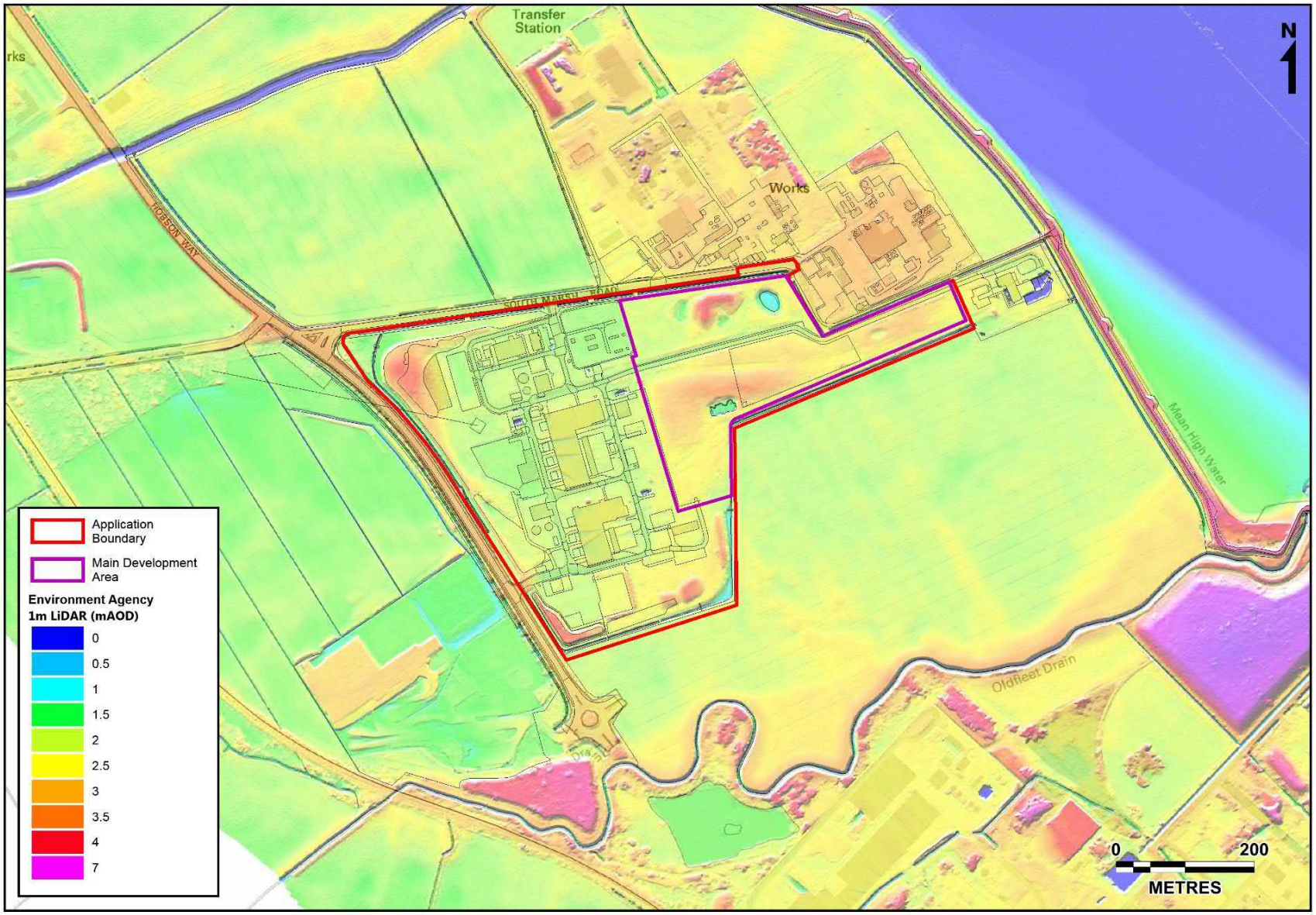

Figure 2: Site topography – EA 1m LiDAR

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3.0 PLANNING POLICY

3.1 The Sections below consider the planning policies and guidance of relevance to the Site with regards to the flood risks from all sources and appropriate mitigation measures which should be considered.

National Policy

National Policy Statements

3.2 The Overarching National Policy Statement (NPS) for Energy (EN-1), Section 5.7 (Flood Risk) (Department for Energy and Climate Change, 2011a) details that projects of 1 hectare (ha) or greater in Flood Zone 1 in England and all proposals for energy projects located in Flood Zones 2 and 3 in England should be accompanied by a FRA.

3.3 The requirements for FRAs are that they should:

- be proportionate to the risk and appropriate to the scale, nature and location of the project;
- consider the risk of flooding arising from the project in addition to the risk of flooding to the project;
- take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;
- be undertaken by competent people, as early as possible in the process of preparing the proposal;
- consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;
- consider the vulnerability of those using the Site, including arrangements for safe access;
- consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the remaining (known as ‘residual’) risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;
- consider if there is a need to be safe and remain operational during a worst-case flood event over the development’s lifetime; and
- be supported by appropriate data and information, including historical information on previous events.

3.4 In determining an application for development consent, the Planning Inspectorate should be satisfied that where relevant:

- the application is supported by an appropriate FRA;
- the Sequential Test has been applied as part of site selection;
- a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk;
- the proposal is in line with any relevant national and local flood risk management strategy;
- priority has been given to the use of sustainable drainage systems (SuDs); and
- in flood risk areas the project is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed over the lifetime of the development.

3.5 Section 5.7.12 of NPS EN-1 also states that in England development should not be consented in Flood Zone 3 or Zone C unless it is satisfied that the Sequential and Exception Test requirements have been met. The technology-specific NPSs set out some exceptions to the application of the sequential test. However, when seeking development consent on a site allocated in a development plan through the application of the Sequential Test, informed by a strategic flood risk assessment, applicants need not apply the Sequential Test, but should apply the sequential approach to locating development within the site. Details of the Sequential Test and Exception Test requirements are provided in Sections 5.7.13-5.7.17 of the NPS EN-1; however, the PPG (Ministry of Housing, Communities and Local Government, 2019) provides more up to date policy definitions of these, as discussed below. These have subsequently been considered as part of this FRA.

3.6 Section 5.15 of NPS EN-1 details that where the project is likely to have effects on the water environment, the applicant for development consent should undertake an assessment of the existing status of, and impacts of the proposed project on, water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent.

3.7 Overarching National Policy Statement for Renewable Energy Infrastructure (EN-3) (Department of Energy & Climate Change, 2011b) provides the following general guidance relating to flood risk assessments and climate change pertaining to renewable energy production facilities:

- consider how the proposal would be resilient to effects of rising sea levels and increased risk from storm surge and tidal flooding resulting from climate change; and
- consider how plant will be resilient to increased risk of flooding and increased risk of drought affecting river flows.

National Planning Policy Framework (NPPF) (2019)

3.8 The NPPF (Ministry of Housing, Communities and Local Government, 2019) is currently supported by the PPG (Ministry of Housing, Communities and Local Government, 2019). These constitute the most up to date guidance for Local Planning Authorities (LPAs) and decision-takers, both in drawing up plans and as a material consideration in determining applications. Section 10 of the NPPF and PPG provides guidance for planning with respect to flood risk.

3.9 The NPPF advocates a 'Sequential' approach for the planning process in order to steer development to areas with the lowest possible risk of flooding. The guidance states that only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

3.10 The Flood Zone definitions as presented in Table 1 of the PPG are defined in Table 2. Table 2:

Table 2: NPPF PPG Flood Zone Definitions

FLOOD ZONE	DEFINITION
Flood Zone 1	Land that has a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding (<0.1% AEP)
Flood Zone 2	Land that has a medium probability of flooding (between 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1-1% AEP), or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1-0.5% AEP)
Flood Zone 3a	Land that has a high probability of flooding (1 in 100 year or greater annual probability of river flooding (>1% AEP), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5% AEP)
Flood Zone 3b (Functional floodplain)	Land where water has to flow or be stored in times of flood (Not separately distinguished from Zone 3a on the Flood Map).

3.11 As discussed in Section 1.0, the EA's 'Flood Map for Planning' (EA, 2019a) identifies that the Site is located wholly within Flood Zone 3a.

Sequential Test

3.12 A Sequential Test is required to assess flood risks across strategic development sites and the NPPF PPG recommends that the test be applied at all stages of the planning process to direct new development to areas with the lowest probability of flooding (Flood Zone 1). However, the PPG also confirms that:

"The Sequential Test does not need to be applied for individual developments on sites which have been allocated in development plans through the Sequential Test"

3.13 Section 2.1 of NELC's Flood Risk Sequential and Exception Tests' Guidance Note (North East Lincolnshire Council, 2016) states that the Sequential Test is not required when:

"The Council has already sequentially tested the site as part of an allocation for development within the development plan"

3.14 The Site is located within Flood Zone 3 as defined in the EA's 'Flood Map for Planning' (see Section 1.3, and EA, 2019a) and the Proposed Development is for power generation, which while not a formal B-class use is an important type of employment use as identified in the Local Plan 2013 to 2032 (NELC, 2018) (see Section 3.35) (paragraphs 12.17-12.19).

3.15 The Local Plan process considered the most appropriate sites allocated for such uses taking into account flood risk. The Site has been allocated as an 'existing employment area' being part of the operational area of the existing SHBPS, and is therefore safeguarded for such uses. It is also in close proximity to a number of sites allocated for 'proposed employment'. It is therefore considered that the Local Plan allocation process has dealt with the Sequential Test and that this is a suitable and preferred site, in flood risk terms, for the Proposed Development.

3.16 According to Table 2 of the PPG, the Proposed Development of a Power Station comprises the vulnerability classification of 'Essential Infrastructure'. Table 3 within the PPG (replicated in Table 3 below) provides a matrix identifying which vulnerability classifications are appropriate within each Flood Zone.

Table 3: NPPF PPG flood risk vulnerability and flood zone 'compatibility'

	FLOOD RISK VULNERABILITY CLASSIFICATION				
	ESSENTIAL INFRA-STRUCTURE	**WATER COMPAT-IBLE**	**HIGHLY VULNER-ABLE**	**MORE VULNER-ABLE**	**LESS VULNER-ABLE**
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	✓	×	×	×
Key: ✓ Development is appropriate × Development should not be permitted.					

Exception Test

3.17 As Table 3 indicates, application of the Exception Test is required for this Site. The PPG states that for the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and
- a site-specific FRA must demonstrate 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.

3.18 Both elements of the test have to be passed for development to be allocated or permitted. Element two has been demonstrated for the Proposed Development in Sections 4.0, 6.0 and 7.0 of this site-specific FRA.

Environment Agency Climate Change Guidance (2019)

3.19 The EA published updated climate change allowances in February 2019 (EA, 2019) to support the NPPF, which supersede all previous allowances written in the 'PPG: Flood Risk & Coastal Change' and are predictions of anticipated change for:

- peak river flow by River Basin District;
- peak rainfall intensity;
- sea level rise; and
- offshore wind speed and extreme wave height.

3.20 These should be considered within a FRA in regard to future impacts from climate change on site specific planning applications. The EA's guidance (EA, 2019) outlines how and when allowances should be applied for FRAs.

Tidal Climate Change Allowances

3.21 Table 4 is an extract replicated from Table 3 of the EA guidance (EA, 2019) detailing the anticipated rise in sea levels up to 2115.

Table 4: Sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

AREA OF ENGLAND	1990 TO 2025	2026 TO 2055	2056 TO 2085	2086 TO 2115	CUMULATIVE RISE 1990 TO 2115 (metres (m))
East, East Midlands, London, South East	4 (140 mm)	8.5 (255 mm)	12 (360 mm)	15 (450 mm)	1.21 m

Fluvial Climate Change Allowances

3.22 For proposed developments in areas of fluvial flood risk, the flood risk vulnerability classification, flood zone and lifetime of development are of particular importance to determine the correct climate change allowance as detailed in Table 5.

Table 5: EA climate change allowances to apply based upon the flood zone and development land use vulnerability

	WATER COMPAT-IBLE	LESS VULNER-ABLE	MORE VULNER-ABLE	HIGHLY VULNER-ABLE	ESSENTIAL INFRA-STRUCTUR E
Flood Zone 2	NA	CA	Assess CA & HCA	Assess HCA & UEA	Assess HCA & UEA

Flood Zone 3a	CA	Assess CA & HCA	Assess HCA & UEA	✖	UEA
Flood Zone 3b	CA	✖	✖	✖	UEA
NA = No Allowance; CA = Central Allowance; HCA = Higher Central Allowance; UEA = Upper End Allowance; ✖ = Development not permitted					

3.23 As the Proposed Development is defined as 'Essential Infrastructure' from the vulnerability classifications in Table 2 of the NPPF, the corresponding percentages that should be assessed at sites within the Humber River Basin District are listed in Table 6. The +40% allowance for climate change is therefore applicable to the Proposed Development.

Table 6: EA peak river flow climate change allowances for the Humber River Basin District (use 1961 to 1990 baseline)

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2020s' (2015 TO 2039)	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2050s' (2040 TO 2069)	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2080s' (2070 TO 2115)
Upper End Allowance	20%	30%	50%
Higher Central Allowance	15%	20%	30%
Central Allowance	10%	15%	20%

Pluvial Climate Change Allowances

3.24 To account for the anticipated changes in rainfall intensity, the EA's guidance (as shown in Table 7) states that a FRA for an expected lifespan of the Proposed Development should assess the 'Upper End' allowance to understand the potential impact and make suitable decisions to mitigate against pluvial flooding.

Table 7: EA peak rainfall intensity climate change allowances across England in small and urban catchments (use 1961 to 1990 baseline)

	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2020s' (2015 TO 2039)	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2050s' (2040 TO 2069)	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE '2080s' (2070 TO 2115)
Upper End Allowance	10%	20%	40%
Central Allowance	5%	10%	20%

3.25 Therefore, a +40% allowance for climate change for peak rainfall intensity is applicable to the Proposed Development at the Site. This has been taken into account in the calculations of surface water runoff rates and volumes in the Outline Drainage Strategy for the Proposed Development (refer to Appendix 14B in PEI Report Volume III).

3.26 When assessing a range of allowances for peak river flow or rainfall intensity, the following must be considered:

- likely depth, speed and extent of flooding for each of the assessed climate change allowances;
- vulnerability of the proposed development types or land use allocations to flooding;
- 'built in' resilience measures used, for example, raised floor levels; and
- capacity or space in the development to include additional resilience measures in the future, using a 'managed adaptive' approach.

Non-Statutory SuDS Guidance

3.27 Defra published their Sustainable Drainage Systems: Non-Statutory Technical Standards (NSTS) in March 2015 (Defra, 2015) setting the requirements for the design, construction, maintenance and operation of SuDS. The NSTS are intended to be used alongside the NPPF and PPG.

3.28 The NSTS that are mainly relevant to the consideration of flood risk to and from development relate to runoff destinations, peak flow control and volume control. These standards are summarised in Table 1 of the SHBEC Outline Drainage Strategy (refer to Appendix 14B in PEI Report Volume III). Additional guidance is provided for structural integrity, designing for maintenance considerations and construction.

Regional Policy

Grimsby and Ancholme Catchment Flood Management Plans (2009)

3.29 The role of Catchment Flood Management Plans are to identify flood risk management policies which will assist all key decision makers in the catchment to deliver sustainable flood risk management for the long term. The Site is located within the Grimsby and Ancholme CFMP study area. The region specific CFMP (EA, 2009b) considers all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding).

3.30 The report identifies Oldfleet Drain (Main River) to be a main source of fluvial flood risk to the Humber Trade Zone Industrial Area, where the Site is located.

Flamborough Head to Gibraltar Point Shoreline Management Plan (SMP) (2010)

3.31 The Site is potentially vulnerable to tidal flooding from the Humber Estuary and the Site location falls into 'Sub Area 4: Immingham, Grimsby and Buck Beck' of the local Flamborough Head to Gilbraltar Point SMP (Scott Wilson & Humber Estuary Coastal Authorities Group, 2010).

3.32 The purpose of a SMPis to identify the most sustainable approach to managing the flood and coastal erosion risks to the coastline in the short-term (0 to 20 years), medium term (20 to 50 years) and long term (50 to 100 years).

3.33 The report identifies the Site to be an area of low to high flood risk where the LLFA and the EA are already working towards managing the risk. However, it is also an area that will be affected by climate change due to the low lying land and its coastal location, and so will need ongoing maintenance and defence improvements.

Humber Flood Risk Management Strategy (HFRMS) (2008)

3.34 The Site lies within 'Area 24 - Immingham to West Grimsby' of the Humber FRMS (Environment Agency, 2008). This FRMS contains policies to manage the risk of flooding in this area which include those in the list below:

- defences here will be improved as necessary to protect the large number of people, businesses and nationally important industry from tidal flooding;
- develop plans to improve the defences near North Killingholme and Stallingborough within the next five years;
- work closely with other authorities and developers to ensure we manage the risk effectively together; and
- aiming to avoid any new development immediately behind the existing defences in case they have to be moved in the future.

Local Policy

North East Lincolnshire Local Plan (2018)

3.35 The North East Lincolnshire Local Plan 2013 to 2032 (NELC, 2018) was adopted in March 2018. The following policies from the Local Plan are considered relevant in regard to flood risk to the Proposed Development:

- **SO2 – Climate Change**: Address the causes and effects of climate change by promoting development that minimises natural resource and energy use; reduces waste and encourages recycling; reduces pollution; brings about opportunities for sustainable transport use; responds to increasing flood risk; and incorporates sustainable construction practices. Promote appropriate distribution of development and the role of green infrastructure in mitigating aspects of flood risk. Recognise the increased stress on habitats and species that climate change causes.
- **Policy 33 – Flood Risk**: In order to minimise flood risk impacts and mitigate against the likely effects of climate change, development proposals should demonstrate that:
  a) where appropriate, a site specific FRA has been undertaken, which takes account of the best available information related to all potential forms of flooding;
  b) there is no unacceptable increased risk of flooding to the development site or to existing properties;
  c) the development will be safe during its lifetime;
  d) SuDS have been incorporated into the development unless their use has been deemed inappropriate;
  e) opportunities to provide natural flood management and mitigation through green infrastructure have been assessed and justified, based upon sound evidence, and, where appropriate, incorporated, particularly in combination with delivery of other aspects of green infrastructure in an integrated approach across the site;
  f) arrangements for the adoption, maintenance and management of any mitigation measures have been established and the necessary agreements are in place;
  g) access to any watercourse or flood defence asset for maintenance, clearance, repair or replacement is not adversely affected; and

h) the restoration, improvement or provision of additional flood defence infrastructure represents an appropriate response to local flood risk, and does not conflict with other Plan policies.

- **Policy 34 – Water Management**: Development proposals should consider how water will be used on the site and ensure that appropriate methods for management are incorporated into the design, considering the objectives and programme of measures set out by the Humber River Basin Management Plan.

North and North East Lincolnshire Strategic Flood Risk Assessment (2011) and Addendum (2016)

3.36 The North and North East Lincolnshire SFRA (North Lincolnshire Council and NELC, 2011) was written in 2011 and provides the LPAs with information to make objective judgements about flooding, both when making decisions on land allocations for development plans and when determining planning applications for development in their areas.

3.37 The SFRA provides a series of maps detailing the hydrological features in the vicinity of the Site, identifying the responsibilities for these by the NELIDB (Significant Ordinary Watercourses) and the EA (Main Rivers), and presents records of historical flooding incidents in the vicinity. The SFRA identifies the South Humber Bank as a strategic employment site as defined in the NELC Local Plan, and also provides site-specific guidance for developers to consider in regard to mitigation of any identified flood risks from all sources.

3.38 An Addendum to the SFRA was completed in April 2016 containing updated maps for a tidal defence breach hazard scenario provided by the EA. No specific policies are presented in relation to the Site.

North and North East Lincolnshire Preliminary Flood Risk Assessment (2011)

3.39 The North and North East Lincolnshire PFRA (Entec, 2011) was a high level screening exercise that compiled information on significant local flood risk from past and future floods, based on readily available information at the time. The PFRA also included the identification of 'flood risk areas', and outlines the responsibilities of key stakeholders.

3.40 Local flood risk was defined in the PFRA as flood risk originating from sources other than Main Rivers, the sea and large reservoirs; principally meaning flood risk from surface water runoff, groundwater and Ordinary Watercourses. This main definition of 'local flood risk' was further clarified:

a) it includes lakes and ponds;

b) it does not consider flooding from sewers unless this is wholly or partly caused by rainwater or other precipitation entering or otherwise affecting the system;

c) it does not include flooding from water supply systems (for example burst water mains); and

d) it considers the interaction with flooding from main rivers, the sea and sewers.

North East Lincolnshire Local Flood Risk Management Strategy (LFRMS)

3.41 As the Lead Local Flood Authority (LLFA), NELC is responsible for managing flood risk from 'local' sources. Their LFRMS (NELC, 2015) report presents the summary of North

East Lincolnshire's preferred strategy for managing flood risk from the following 'local' sources:

- surface run-off;
- groundwater; and
- Ordinary Watercourses (generally small rivers and streams).

3.42 The LFRMS contains a list of objectives for the strategy, which include:

- Objective 1 – to improve the understanding (of both communities and flood risk management partners) of the roles and responsibilities for flood risk management in North Lincolnshire;
- Objective 2 – to improve the understanding of local flood risk;
- Objective 3 – to reduce the risk of flooding from local sources in the communities;
- Objective 4 – seek to implement flood risk management actions that contribute to wider social, economic and environmental outcomes and sustainable development;
- Objective 5 – create a strong collaborative approach across stakeholders to address risks from all sources of flooding;
- Objective 6 – raise public awareness and engage with local people about local flood risks, and help the communities to manage their own risks;
- Objective 7 – contribute to planning and development decisions to ensure new development is appropriate; and
- Objective 8 – contribute to effective emergency flood response.

3.43 The LFRMS refers to the South Humber bank as the 'energy estuary', and states that managing flood risk will be important in ensuring that these businesses can operate in a safe environment. Disruption from flooding could lead to significant disruption to these businesses which could affect the local economy.

3.44 It continues to state that in order to develop stronger communities NELC aims to establish a new relationship with the community to promote a culture of independence. The LFRMS acknowledges that communities will also need to play a greater role than before in reducing their own flood risks, becoming more resilient and ensuring that they are prepared for flooding without relying on the Council to provide all the solutions.

North East Lincolnshire Council SuDS Guide (2016)

3.45 The NELC SuDS Guide (NELC, 2016) provides introductory advice on how best to approach the development of SuDS proposals within schemes. The report is designed to reiterate the wide range of industry guidance already available and to highlight the importance of SuDS. It states the aims of SuDS as being to:

- reduce the risk and impacts of flooding;
- remove pollutants from urban runoff at source;
- provide amenity benefits; and
- contribute to improving and enhancing biodiversity.

3.46 The guidance also provides information on the criteria needed to support planning application submissions and reiterates that under the NPPF, all major developments must incorporate SuDS and must ultimately succeed in all four of the aims listed above.

3.47 The guide acknowledges each site will warrant a different approach to the composition of SuDS applied, dependent on many factors such as, topography, shape, size and underlying permeability. The LPA offers pre-application advice on development proposals, and therefore it is recommended prior to the detailed design process, the LLFA (NELC) be consulted.

Environment Agency - Lincolnshire and Northamptonshire Area

3.48 The EIA Scoping Opinion response (Planning Inspectorate, October 2019) provided in Appendix 1B in the PEI Report Volume III identified the following additional requirements for the ES and related FRA and drainage strategy from the EA's Lincolnshire and Northamptonshire planning team:

- Under the Environmental Permitting (England and Wales) Regulations 2016, permission must be obtained from the EA for any proposed activities which will take place:
  - in, over, under or within 8 metres of a main river (16 metres if tidal);
  - on or within 8 metres of a flood defence structure or culvert (16 metres if tidal) or on or within 16 metres of a sea defence;
  - within 16 metres of any main river, flood defence (including a remote defence) or culvert for quarrying or excavation; and
  - in a flood plain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if tidal) if planning permission has not already been granted for the works.
- Any additional impacts/ mitigation measures [from the Proposed Development compared to the Consented Development] will be identified as part of an updated assessment.

4.0 FLOOD RISK SOURCES

Introduction

4.1 The NPPF, PPG and NPS require the effects of all forms and sources of flood risk to and from the Site to be considered within a FRA. There should be demonstration of how these risks should be managed so that the development remains safe throughout its lifetime, taking into account current climate change predictions.

4.2 This Section discusses these potential risks in relation to tidal, fluvial, surface water runoff, groundwater and man-made/ artificial sources (e.g. canals, reservoirs, pumping station failure).

Historical Flooding Incidents

4.3 The EA provided details of historical flooding events in the local vicinity of the Site. Annex 1 of this FRA contains a map which illustrates that the Site was flooded during a major tidal flood event in January 1953. This event occurred prior to the coastal flood defences being improved, which were installed in response to the 1953 event.

4.4 Map 6 of the 2011 SFRA illustrates no records of reported historical flooding incidents in the immediate vicinity of the Site. The nearest reported incidents were located in the industrial estate approximately 1.1 km to the north-west. The 'River and Tidal Flood Risk Map' on page 9 of the 2011 PFRA contains no additional records of historical flooding to those in the vicinity of the Site.

4.5 No further major historical incidents are recorded in the vicinity on the Chronology of British Hydrological Events website (University of Dundee, 2018).

Tidal Sources

4.6 The Humber Estuary is located approximately 175 m to the east of the Site. The Humber Estuary poses the primary and most significant risk of flooding to the Site, but the Site benefits from existing flood defences.

Flood Map for Planning

4.7 The EA's 'Flood Map for Planning' available to view on their website (EA, 2019a) identifies areas subject to fluvial/ tidal flood risk for the present day but does not include the benefits or impacts of any existing flood defences or climate change respectively.

4.8 A copy of the EA Flood Map is provided in Annex 1. This illustrates that the Site is wholly located within Flood Zone 3 ('high' risk) defined as land having a >0.5% Annual Exceedance Probability (AEP) (greater than a 1 in 200 chance) of sea flooding (refer to Table 2).

Tidal Flood Defences

4.9 In accordance with the NPPF, the requirements are to ensure any proposed developments are built to withstand tidal flooding up to a 1% AEP (1 in 100 chance) event taking into account the potential impacts of climate change.

4.10 The EA's 'Flood Map for Planning' (refer to Annex 1, and Environment Agency, 2019a) identifies there to be existing tidal flood defences located approximately 160 m to the east of site, extending from north-west to south-east alongside the Humber Estuary. According to the additional information provided by the EA (refer to Annex 1), the tidal

defences protecting this Site consist of concrete floodwalls. They are in 'good' condition and reduce the risk of flooding up to a 0.5% AEP (1 in 200 chance in any year) event. The EA inspects these defences routinely to ensure potential defects are identified. The residual risk of flooding in the event of a defence breach scenario needs to be considered.

Modelled Tidal Water Levels

4.11 The EA provided modelled tidal peak water levels for the South Humber Bank area to inform this FRA (refer to Annex 1). The EA's model demonstrated that during a 0.1% AEP (1 in 1000 chance) event based upon the existing (2014) scenario, tidal levels in the Humber Estuary could rise up to 5.27 mODN at the Grimsby gauge to the south-east of Site, and 5.47 m above Ordnance Datum Newlyn (ODN) at the Haborough gauge north-west of the Site.

4.12 Table 8 details the modelled tidal water levels provided by the EA (refer to Annex 1). These are the current best estimate for extreme tide levels in the vicinity.

Table 8: EA modelled flood levels at Grimsby and Haborough Marsh

				ANNUAL CHANCE (1 IN X / % AEP) OF TIDE LEVEL (mODN)					
EA Node Ref	**Location**	**Easting**	**Northing**	**1 (>99%)**	**10 (10%)**	**50 (2%)**	**100 (1%)**	**200 (0.5%)**	**1000 (0.1%)**
H060	Grimsby	527878	411346	4.10	4.43	4.70	4.82	4.95	5.27
H080	Habor-ough Marsh	520790	415740	4.26	4.61	4.88	5.01	5.14	5.47

Modelled Overtopping and Breach Failure Water Levels Behind the Defences

4.13 The EA has modelled simulations for breaching and overtopping scenarios of the tidal flood defences located approximately 160 m east of the Site. The breach and overtopping scenarios were modelled for the 0.5% AEP (1 in 200 chance) and 0.1% AEP (1 in 1000 chance) events. The scenarios were performed for both the existing (2006) scenario and future (2115) scenario taking into account the effects of a predicted 20% increase in flow resulting from climate change,.

4.14 Overtopping was included during scenarios where the design standard of protection (SoP) of the defences would be exceeded and the breach scenarios were undertaken in defences at specific locations. The EA provided maximum modelled depth, velocity and hazard maps from the 2010 Northern Area Tidal Modelling results (refer to Annex 1) including a +20% allowance for climate change and the peak flood depth results in the vicinity of the Site are summarised in Table 9. These include results for the nearest modelled breach location to the Site (located approximately 270 m north of the Site). However, the 30% - 50% climate change scenario flood depth information was not available from the EA; it is understood that this is because no hydraulic modelling has yet been undertaken for these scenarios.

Table 9: EA peak modelled flood level depth bands within the Main Development Area at the Site

		FLOOD DEPTH (m) BAND	
	Scenario	**0.5 % AEP (1 in 200) event**	**0.1 % AEP (1 in 1000) event**
Breach	2006 (Existing)	0.25 - >1.6	0.5 - >1.6
	2115 (inc. +20% Climate Change)	1.0 – 2.75	1.0 – 2.75
Overtopping	2006 (Existing)	0 – 1.6	0 - > 1.6
	2115 (inc. +20% Climate Change)	1 - > 1.6	>1.6

4.15 In October 2019, the EA also provided the peak water level information (in mAOD) from the hydraulic model for a breach failure event at the nearest modelled breach location to the Site during the 0.5% AEP and 0.1% AEP flood events including a +20% allowance for climate change up to the year 2115.

4.16 This data illustrated that modelled peak water levels vary across the Site. Analysis was therefore undertaken of the water levels within the area of the proposed main buildings and these have been summarised in Table 10.

Table 10: EA modelled peak flood levels in the vicinity of the proposed buildings within the Main Development Area at the Site

		PEAK FLOOD WATER LEVEL (mAOD)	
	Scenario	**0.5 % AEP (1 in 200) event**	**0.1 % AEP (1 in 1000) event**
Breach	2006 (Existing)	3.9	3.95
	2115 (inc. +20% Climate Change)	4.5	4.6

4.17 The peak 0.1% AEP water level resulting from a breach event taking into account the impacts of future climate change up to 2115 is approximately 4.60 mAOD. This estimate has been used to inform the mitigation proposals for elevating critical equipment and provision of a place of safe refuge for occupants at the Site in Section 6.0. This is considered a robust assessment based on the available information and can be updated if any further information becomes available.

4.18 Additional maps illustrating the flood depth, velocity, hazard classifications and rate of inundation for the largest magnitude event modelled are presented in Annex 1. These illustrate that during a 0.1% AEP breach failure event for the year 2115, the Site could flood in under 20 minutes of a breach occurring. This emphasises the requirement for the place of safe refuge within the Site.

4.19 In the event of such an overtopping scenario occurring in the present-day scenario, the modelled hazard classifications range from 'Low Hazard' to 'Danger to Some' in the central-southern area of the Site and along the southern boundary.

4.20 In the event of such an overtopping scenario taking into account the impacts of future climate change up to 2115, or a breach scenario occurring during the present day or future scenario, the modelled hazard classifications range from small areas with 'Danger to Most' to largely 'Danger to All' across the entire Site.

Summary

4.21 Based on the information provided by the EA, it has been determined that during the existing scenario the Site is at a 'low' risk of flooding from tidal sources with the defences in place, or resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) of flooding. If the defences were to fail and breach during the existing scenario, the Site would be at a 'high' risk of flooding during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

4.22 During a future scenario taking climate change up to 2115 into account however, the impacts are more significant. The Site is potentially at a 'high' *residual* risk of flooding as a result of overtopping during events that exceed a 0.5% AEP (1 in 200 chance) of flooding, or in the event that the defences were to breach during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

Fluvial Sources

4.23 A review of OS mapping identified that the nearest watercourse is Oldfleet Drain (Main River) which is located approximately 140 m to the south of the Site (at its closest point) and flows in a north-easterly direction. Middle Drain, a Significant Ordinary Watercourse as defined by the SFRA, managed by the NELIDB, is located approximately 340 m to the north (at its closest point). A series of minor land drainage ditches (also Ordinary Watercourses) run along the northern, western and southern boundaries of the Site, and to the east of the Site, and convey surface water runoff discharges from the greenfield areas of the Site to Oldfleet Drain and Middle Drain. These watercourses all pose a potential risk of fluvial flooding to the Site.

Flood Map for Planning

4.24 The EA's 'Flood Map for Planning' (Environment Agency, 2019a) (refer to Annex 1) illustrates that the Site is wholly located within Flood Zone 3 (high risk) defined as land having a >1%/0.5% AEP (greater than a 1 in 100 / 1 in 200 chance in any year) of river or sea flooding respectively (see Table 2). However, this map does not differentiate between the tidal/ fluvial sources of risk and the tidal defences are not taken into account.

Modelled Fluvial Water Levels & Extents

4.25 The site specific information provided by the EA (refer to Annex 1) illustrates the Site to have a 'very low' risk of fluvial flooding as the Site is located outside of the modelled defended 0.1% AEP (1 in 1000 chance) flood extent for Oldfleet Drain and Middle Drain derived from the 'Oldfleet Drain and Stallingborough North Beck Model' (April 2009). No modelled flood extents are available specifically for the land drains. However, Oldfleet Drain is considered to be the primary source of fluvial flood risk.

4.26 The EA also provided modelled peak fluvial flood levels for three model nodes along Oldfleet Drain alongside the Site from this model. The modelled 1% AEP (1 in 100 chance) event peak water level at all three nodes during the defended scenario is 2.58 mODN. This flood level is replicated for all modelled events up to the 0.1% AEP (1 in 1000 chance) event plus a 20% allowance for climate change (however, the +30% to +50% climate change scenarios have not yet been modelled by the EA). The model demonstrated that peak flows would reach a maximum of 4.34 m^3/s during a 0.1% AEP (1 in 1000 chance) event.

Fluvial Flood Defences

4.27 The EA's 'Flood Map for Planning' (refer to Annex 1, and Environment Agency, 2019a) identifies there to be existing fluvial flood defences upstream of the Site, located approximately 270 m south-west along Oldfleet Drain, upstream of the railway line. According to the information provided by the EA, these fluvial flood defences comprise earth embankments. Their condition is 'fair' and will reduce the risk of flooding up to a 1% AEP (1 in 100 chance) event. The EA regularly inspect the defences to ensure potential defects are identified.

4.28 The EA confirmed that the Oldfleet Drain channel capacity (downstream of the railway line) is sufficient to convey flows in excess of a 1% AEP (1 in 100 chance) event.

Un-modelled Land Drains

4.29 The proposed access from South Marsh Road will cross the land drainage ditch in the north-eastern corner of the Main Development Area (Land Drain 1 in Figure 14.1 presented in the PEI Report Volume II). The design will comprise either a new culvert or a clear-span bridge. There is subsequently the potential for an increased risk of fluvial flooding from this watercourse as a culvert could reduce the conveyance capacity of the drain, potentially causing floodwater to back up westwards along the drain. However, the bed levels of the drain are relatively flat and so the scale of any water level afflux on the upstream face of the bridge would be very limited. This would likely only impact a short, very localised reach of the watercourse and as the adjacent ground levels of the Site and South Marsh Road are relatively flat, any additional flood water overtopping the banks would continue to follow its existing route eastwards.

4.30 The proposed ramped access to the tipping hall which will be at a height of approximately 5.5 mAOD will be located in close proximity (approximately 10 m) to the right/ southern bank of Land Drain 1 which requires consideration for this FRA. No flood extents specifically pertaining to Land Drain 1 are currently defined in the EA's 'Flood Map for Planning'. No hydraulic modelling has been undertaken to provide any fluvial flood extents or flood level information to compare to the location of the proposed ramps or buildings within the Main Development Area to determine if they intersect.

4.31 However, as Land Drain 1 only provides a drainage mechanism for surface water runoff generated by the local greenfield land use, and water levels within the drain are managed by the Middle Drain pumping station that discharges flows into the tidal Humber Estuary, it is not considered to pose any significant flood risk to the Site. If the discharge from the Middle Drain pumping station was restricted by high tide levels, flooding from this channel resulting from overtopping due to capacity exceedance could potentially occur. However, the layout of the ramps and buildings are not orientated in a manner that would significantly obstruct flow routing and therefore, a requirement for any fluvial flood volume compensation is not considered necessary.

4.32 During the detailed design phase, a detailed assessment of the local topography (through acquisition of detailed survey along the drain) and of the small catchment hydrology will be undertaken to determine the flow capacity of and flow estimates likely to be conveyed along the drain respectively to inform the adequate sizing and levels of a culvert/ clear-span bridge necessary to prevent any obstruction to flow.

Summary

4.33 Based on the information provided by the EA, it has been determined that the Site is at a 'very low' risk of fluvial flooding from Oldfleet Drain or Middle Drain.

Groundwater Sources

4.34 Groundwater flooding can occur when groundwater levels rise above ground surface levels. The underlying geology has a major influence on where this type of flooding takes place; it is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

4.35 The EA's 'Areas Susceptible to Groundwater Flooding' map is illustrated (refer to Annex 2 of the Joint Lincolnshire Flood Risk and Drainage Management Strategy (Lincolnshire County Council, 2012)). The map is divided into 1 km^2 grid-squares in which a percentage is given for what proportion of the 1 km^2 is considered to be susceptible to groundwater emergence. This map illustrates that the Site lies within a 1 km grid square of which up to 25% of the area is considered to potentially be at risk of groundwater emergence.

4.36 In 2006, RSK Group was commissioned by Centrica to undertake a ground investigation as part of the design phase for a Site Protection and Monitoring Program (SPMP) for the SHBPS. The following summary from the ground investigation is based on the document 'Site Protection and Monitoring Programme Review for South Humber Bank Power Station' (September 2011). This document states that the intrusive ground investigation inferred that groundwater flowed towards the south-east and recorded resting groundwater depths across a monitoring well network ranging from 0.22 m below casing top (bct) to 1.55 m bct.

4.37 The risk of groundwater flooding within the Main Development Area is therefore considered to be 'low' to 'medium'.

Surface Water Runoff to the Site

Overland Flow of Rainfall Runoff

4.38 The EA 'Flood Risk from Surface Water' map available on their website (EA, 2019b) identifies the vast majority of the Site to be at a 'very low' risk from surface water flooding (<0.1% AEP event). Small areas along the roads and along adjacent land drains within the Site are identified to be at a 'low', 'medium' and 'high' risk from surface water flooding (>0.1% AEP, 3.3% to 1% AEP event and >3.3% AEP event respectively). The Proposed Development area within the Site is illustrated as being predominantly at a 'very low' risk from surface water flooding, with very small areas at 'low risk' at the topographic low points.

4.39 Additionally, this information is supported by the fact that there are no significantly raised ground levels adjacent to the Site that could generate sufficient rates/volumes of surface water runoff to pose a risk of overland flow coming into the Site.

4.40 The risk of surface water flooding within the Main Development Area within the Site from elsewhere is therefore considered to be 'low' to 'very low'.

Existing Drainage Infrastructure

4.41 The existing surface water drainage infrastructure within Site is illustrated in drawing 'Surface, foul, oily water HRSG blowdown services DRGDS2506' provided in the Outline Drainage Strategy (refer to Appendix 14B in PEI Report Volume III) and consists of a series of surface water drainage features servicing the existing man-made facilities of the SHBPS.

4.42 The effluent from the boiler facilities of the SHBPS discharge into effluent basins with buried outlet pipes connected to the cooling water pumping station at the far eastern extent of the Site. Surface water from the rooftop and access road areas of the Site that are already developed is currently collected via gullies and conveyed into these effluent basins via buried surface water pipelines. A body of standing water located to the east of the Site next to the cooling water pumping station is a holding channel for water in and out of the cooling pipes (see Figure 1). The combined water is discharged via this holding channel into the Humber Estuary.

4.43 It is assumed that the land drains located around the perimeter of the Site accept lateral drainage of surface water from the greenfield areas of the Site. No level information however has been provided for these drains.

4.44 A review of OS mapping and the EA's 1 m LiDAR data identified that the holding chamber to the east is also elevated at lower ground elevations that the Site (i.e. they are not elevated above any adjacent ground levels so do not create a pathway of flooding towards the Site). It is therefore considered to pose a 'very low' risk of surface water flooding to the Main Development Area.

Summary

4.45 The risk to the Site from overland flow of surface water generated adjacent to the Site, or from waterbodies located within the Site is considered to be 'low' in small areas, but largely 'very low'.

Artificial Sources

Reservoirs

4.46 The EA defines a reservoir as an artificial body of water which can hold >25,000 cubic meters or more of water, above ground level as specified in The Reservoirs Act (1975) (HMSO, 1975).

4.47 The closest reservoir to the Site is located approximately 13 km south-east of Site north of Rothwell, west of Cuxwold. The EA 'Flood Risk from Reservoirs' map (Environment Agency, 2019b) illustrates that there is very low flood risk to Site from reservoirs in the event of a breach scenario.

Canals

4.48 There are no canals in close proximity to the Site, and therefore it is considered that there is no flood risk posed to the Site from this source.

Summary

4.49 There are no artificial sources of flood risk, such as reservoirs or canals in close proximity to the Site. It is therefore considered that there these sources pose very low flood risk to the Site.

5.0 MANAGEMENT OF SURFACE WATER FROM THE SITE

5.1 This Section summarises the approach taken in the Outline Drainage Strategy (refer to Appendix 14B in ES Volume III) to define the scale of surface water runoff at the Site, and the choice of surface water management measures investigated.

Policy & Guidance

5.2 The NPS (Department for Energy and Climate Change, 2011a), NPPF (Ministry of Housing, Communities and Local Government, 2019), the EA, the NSTS SuDS Guidance (Defra, 2015) the NELC Local Plan (North East Lincolnshire Council, 2018) and the NELC SuDS Guide (North East Lincolnshire Council, 2016) require that new developments should not increase flood risk to the site and the surrounding area. Therefore, surface water runoff rates discharging from the propped development at the Site should not exceed the existing runoff rates.

5.3 General advisory recommendations of the EA require the existing greenfield runoff rates to be maintained from any proposed development using SuDS where practicable to provide adequate storage up to the 1% Annual Exceedance Probability) (AEP) event (1 in 100 chance in any year) including an allowance for climate change. More information on the EA's requirements can be found in Section 2.0 of the Outline Drainage Strategy (refer to Appendix 14B in PEI Report Volume III).

5.4 Following consultation for the Consented Development with the NELIDB and NELC (refer to Annex 2 and Annex 3 respectively), they provided the following comments:

- no development should be commenced until the LPA has approved in writing a scheme to their satisfaction for the provision, implementation and future maintenance of a surface water drainage system;
- the NELIDB would support the use of SuDS and the drainage policies of NELC;
- any discharge should be limited to the greenfield rate, however Middle Drain Pump Station was designed to allow for areas of development (to the design standard of the time). Any potential increase in discharge would be subject to the drainage system being able to convey the flows (modelling required) and a development charge payable to the NELIDB; and
- under the terms of the Land Drainage Act 1991 the prior written consent of the NELIDB is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion.

5.5 Anglian Water's consultation response for the Consented Development (refer to Annex 4) requires that the disposal hierarchy as presented below should be followed:

- discharge by infiltration to the ground;
- discharge to an open surface water body;
- discharge to a surface water sewer;
- discharge to a combined sewer;
- discharge to a foul sewer; and
- discharge rates and volumes are to be limited to the equivalent greenfield runoff rate (with on-site attenuation for all events up to the 1 in 100 (1% AEP) rainfall event plus climate change). Flooding must also not occur on any part of the development for the 1 in 30 year (3.3% AEP) rainfall event.

5.6 The EIA Scoping Consultation response from Anglian Water stated that the use of SuDS for the development is encouraged and provided a guidance document on the use of SuDS and an overview of the adoption policy should a developer seek to connect into an Anglian Water asset.

5.7 The EIA Scoping Opinion response (Planning Inspectorate, October 2019) provided in Appendix 1B in the PEI Report Volume III identified the following additional requirements for the ES and related FRA and drainage strategy from Anglian Water and the NELIDB:

- consideration to all potential sources of flooding - including foul drainage, sewage treatment and water services;
- consideration of whether the Proposed Development would lead to alterations in the drainage patterns around the Site;
- Anglian Water fully supports the use of SuDS as an alternative to discharging surface water to the public sewerage network and welcomes further details of the proposed method of surface water disposal including the SuDS attenuation feature being provided for comment;
- consideration of any increased flood risks linked to climate change;
- the surface water discharge will be limited to the greenfield rate; and
- under the terms of the Land Drainage Act 1991 the prior written consent of the NELIDB is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion.

5.8 The detailed design of the drainage scheme will take these considerations above into account.

Existing Surface Water Runoff Rates

5.9 The existing surface water greenfield runoff rates for the Main Development Area within the Site (approximately 7.3 ha) were calculated. The detailed calculation parameters used for the runoff rates can be found in Section 3.0 of the Outline Drainage Strategy (Appendix 14B of PEI Report Volume III).

5.10 Table 11 details the existing runoff rates calculated during the 1%, 3.3% and >99% AEP events.

Table 11: Calculated greenfield surface water runoff rates for the Main Development Area (7.3 ha)

RAINFALL EVENT (AEP/ 1 IN X YEARS)	GREENFIELD RUNOFF RATE (REFH2) (l/s/ha)	TOTAL RUNOFF FROM THE EXISTING SITE (7.3 ha) (l/s)
>99% (1 in 1)	0.5	3.7
3.3% (1 in 30)	1.2	8.8
1% (1 in 100)	1.6	11.5

Un-attenuated Proposed Surface Water Runoff Rates

5.11 The runoff rate from the proposed land use within the Main Development Area will increase due to an increase in impermeable area (hardstanding and roofing). The anticipated un-attenuated surface runoff rates, assuming up to 6.5 ha will all be changed to impermeable land use, were calculated in the Outline Drainage Strategy (refer to Appendix 14B in PEI Report Volume III), and replicated in Table 12.

Table 12: Calculated impermeable surface water runoff rates for the proposed land use within the Main Development Area (up to 6.5 ha) – un-attenuated (including allowances for climate change)

FLOOD EVENT (% AEP / 1 IN X YEARS)	TOTAL RUNOFF (l/s) FOR A RANGE OF RAINFALL DURATIONS								
	15 mins	30 mins	1 hr	2 hr	3 hr	5 hr	12 hr	24 hr	48 hr
50% (2)	440	289	181	127	100	71	39	23	14
20% (5)	775	503	316	201	151	104	53	31	18
10% (10)	1008	660	416	254	188	127	63	36	21
3.3% (30)	1390	917	579	340	247	163	80	45	26
2% (50)	1561	1036	656	381	275	181	88	50	28
1% (100)	1811	1207	766	439	316	207	100	57	32
1% (100) + 20% CC	2173	1448	919	527	379	248	120	68	38
1% (100) + 40% CC	2535	1690	1072	615	442	290	140	80	45

Surface Water Volume Attenuation Requirements

5.12 In order to ensure that flood risk is not increased elsewhere, in accordance with the NPPF, EA, NELC and NELIDB requirements, discharge of surface water runoff from the Main Development Area within the Site will be restricted to the existing greenfield runoff rate to prevent an increased risk of flooding downstream. The Outline Drainage Strategy (refer to Appendix 14B in PEI Report Volume III) identifies that a surface water attenuation solution will be implemented on Site to ensure the greenfield runoff rates presented in Table 10 are not exceeded up to a 1% AEP (1 in 100) event including an allowance for climate change.

5.13 The minimum achievable discharge from outfall control structures, for example a HydroBrake, is usually 5 l/s. Consultation with the NELIDB for the Consented Development (see Annex 2) concluded with an agreement in principle that a maximum discharge rate of 5 l/s during the 1 in 1 year event into their land drainage network is acceptable for the total runoff from the Main Development Area following completion of the Proposed Development.

5.14 The storage volumes of the attenuation solution required relating to the existing greenfield runoff rates are detailed in Table 13. The areas required for the storage

solution needed in order to accommodate these volumes under two different scenarios (free discharge, and no discharge resulting from high tide levels) are also provided. This assumes the depth of the storage area is 2 m, reflective of the depth of the land drains around the perimeter of the Site.

Table 13: Calculated surface water runoff attenuation volumes and areas for attenuation ponds for the Main Development Area (assuming up to 6.5 ha impermeable land use)

SCENARIO	RAINFALL EVENT (AEP / 1 IN X YEAR)	TOTAL STORAGE VOLUME (m^3) – MINIMUM	TOTAL STORAGE VOLUME (m^3) – MAXIMUM	TOTAL STORAGE PLAN AREA (ASSUMING 2 m DEPTH) (m^2) - MINIMUM	TOTAL STORAGE PLAN AREA (ASSUMING 2 m DEPTH) (m^2) - MAXIMUM
Free Discharge	1% (1 in 100) + 40% CC	7535	7935	3768	3968
No Discharge	1% (1 in 100) + 40% CC	8106		4053	

5.15 These storage volumes are preliminary estimates, and further detailed surface water modelling will be undertaken as part of a detailed design phase to more accurately assess the storage volume requirements once the exact extent of proposed impermeable area is confirmed.

Proposed Surface Water Attenuation Solution

Consideration of Appropriate SuDS Techniques

5.16 In line with the NPPF, Defra, EA, NELC and NELIDB advisory recommendations, best practice guidelines and local planning policy, SuDS techniques detailed in the CIRIA SuDS Manual (Ciria, 2007) should be used as a preferential option. A summary of potential SuDS techniques which could be used at the Site are found in Table 5 of the Outline Drainage Strategy (refer to Appendix 14B of PEI Report Volume III). This is not an exhaustive list of techniques and so other options could be explored at the detailed drainage design stage.

Attenuation Storage

5.17 Surface water runoff is to be collected on site and conveyed to a surface water attenuation pond SuDS feature via the use of drainage gullies, ditches/ swales where possible. Site topography is conducive for flows to be gravity drained to a surface water attenuation area located at the eastern edge of the Main Development Area (see Figure 2) where opportunity is presented for attenuation-based SuDS. The extent of this basin illustrated in Figure 2 will accommodate the total storage plan area required (as presented in Table 13) assuming a 2 m depth.

5.18 It is proposed that the discharge from this attenuation pond will outfall into one of the existing NELIDB land drainage ditches located along the southern or northern boundary of the Site using a flow control mechanism such as a Hydro-Brake to limit the discharge to greenfield rates to 5 l/s/ha (i.e. so that there will be no change to the existing surface

water runoff rate into the drainage ditch). The detailed drainage design stage will confirm that the bed levels of the local land drains into which the attenuation solution will discharge are appropriate relative to the bed levels of the storage solution to ensure they are positively drained by gravity (i.e. to confirm that no additional pumping is required).

5.19 As the Middle Drain pumping station discharges into the tidal Humber Estuary, it may be the case that during some high-tide events, discharges into either the southern or northern drains become restricted. Design for this will be allowed for during the detailed design phase of the project. To illustrate the effect that this may have on the storage volume, a conservative assumption that no discharge is allowed into the drain during the duration of the critical storm has been applied. An indicative storage volume for this scenario was calculated and is also presented in Table 13.

5.20 A detailed drainage design stage will confirm the storage volumes required once the exact impermeable area of the Main Development Area is confirmed, and it will confirm the exact location and feasibility of the outfall from the pond into the existing land drainage network following further consultation with the NELIDB to obtain their agreement.

6.0 MITIGATION OF RESIDUAL FLOOD RISKS AND OFF-SITE IMPACTS

6.1 Consideration should be given to measures that protect the Proposed Development from the residual risk of flooding in the event that the existing tidal defences fail in the vicinity of the Site, or in the event of heavy rainfall that could result in surface water flooding at the Site if the design capacity of the drainage network is exceeded.

6.2 The EA recommended a series of flood mitigation measures to reduce this risk to occupiers and equipment within the Site for the Consented Development, which will also apply to the Proposed Development (Annex 1). The Applicant does not intend on building their own new flood defences but wish to build the Proposed Development to the requirements expected in order to prevent flood damage to their own assets and to prevent displacement of flood water that could negatively impact land uses elsewhere off site, following agreement with the EA.

6.3 This Section therefore provides recommendations in accordance with the guidance provided in the NPPF, SFRA and by the EA on how the Applicant can design their development to withstand predicted tidal flood levels and mitigate the impact. The following mitigation measures were considered to protect the Proposed Development within the Site in accordance with the legislative and regulatory authority requirements:

- flood resistance and resilience measures;
- flood emergency response plans;
- flood warnings and alerts;
- emergency access and egress; and
- design capacity exceedance.

Flood Resistance and Resilience Measures

6.4 The following flood resilience and resistance mitigation measures were considered to ensure the operation of the Proposed Development is maintained during inundation, and to ensure the safety of people:

- flood resistant/ resilient design;
- raising external ground levels; and
- elevating critical plant equipment and/ or internal finished floor levels above the peak flood inundation level.

6.5 The NELC SFRA (North Lincolnshire Council and NELC, 2011) states that FRAs should demonstrate that a proposal will be safe for its lifetime, including taking into account the potential impacts of climate change. This includes a requirement to demonstrate that the designed internal finished floor levels are elevated above the modelled breach event peak flood level.

6.6 CIRIA Report C688 'Flood Resilience and Resistance for Critical Infrastructure' (Ciria, 2010), states that "*Flood resilience involves designing an infrastructure asset, or adapting an existing infrastructure asset so that although it comes into contact with floodwater during floods, no permanent damage is caused, structural integrity is maintained and, if operational disruption does occur, normal operation can resume rapidly after a flood has receded. Flood resistance involves designing an infrastructure asset, or adapting and existing infrastructure asset so that floodwater is excluded during*

flood events and normal operation can continue with no disruption occurring to the essential services the asset provides".

6.7 The following measures are potentially appropriate for inclusion in the Proposed Development:

- pipelines and storage tanks designed to withstand the water pressures associated with high return period event flooding;
- tanks securely tethered in such a way to ensure the infrastructure remains secure should flooding occur;
- electrical supply entering the Proposed Development from height and down to required connections;
- use of flood barriers on access points;
- protecting wiring for operational control of the Proposed Development, telephone, internet and other services by suitable insulation in the distribution ducts to prevent damage;
- materials with low permeability up to 0.3 m and which accept water passage through building at higher water depths;
- flood proofing including the use of flood resistant building materials, use of water-resistant coatings, use of galvanised and stainless steel fixings and raising electrical sockets and switches;
- utilising floor materials that are able to withstand exposure to floodwater without significant deterioration and that can be easily cleaned, e.g. concrete-based or stone;
- incorporating water resistant services within the buildings, i.e. avoid services using ferrous materials;
- design development to drain water away after flooding;
- provide access to all spaces to permit drying and cleaning;
- carefully considering the usage and layout of ground floor areas to minimise the potential impact on business operations following a flood; and
- suitable waterproofing measures to development located below ground i.e. tanking below ground storage areas etc.

6.8 The following measures are potentially appropriate for inclusion in the design/ layout of the Proposed Development:

- boundary walls and fencing could be designed with high water resistance materials and/ or effective seals to minimise water penetration for low depth, short duration floods;
- tanks can be bunded to a level higher than the 0.5% AEP plus climate change breach flood level;
- pollution control considered to prevent/ reduce the chance of any fuel/ material stored on site leaking;
- site drainage and landscape design following such guidance as CIRIA C635 (Ciria, 2006) to minimise the risk from exceedance flows and any overland flow entering the Proposed Development buildings;

- landscaping of the Site or building curtilage to direct or divert floodwater away from buildings; and
- sustainable drainage systems (SuDS) designed to manage surface water flood risk and water quality.

6.9 There are no proposals to raise land for the purposes of protecting the Proposed Development. Therefore, flood water will not be displaced, and this will not pose an increased risk of flooding off-site to adjacent land uses. As this is also a residual risk of flooding, no flood volume compensation will be required for the building footprints or ramps beneath this water level in accordance with the NPPF PPG.

6.10 The predicted peak flood level for the Site following a breach in the tidal flood defences during a 0.1% AEP (1 in 1000 chance) flood event including climate change up to 2115 is defined by EA North Area Tidal Modelling to be around 4.60 mAOD. This estimation is based on the worst case scenario of a breach occurring in the immediate vicinity of the Site. It is therefore recommended that in order to protect all critical equipment assets on site, where possible these items are elevated above the estimated peak flood level. This could either comprise being located on elevated internal floor levels or on platforms upon stilts. However, where this is not possible, alternative mitigation such as localised flood resistance and resilience measures or the storage of critical spares could be arranged.

6.11 Relevant pieces of critical equipment include:

- electrical equipment, switchboards and control panels;
- transformers;
- main boiler feed pumps;
- condensate extraction pumps;
- primary air fans; and
- induced draught fans.

6.12 The Applicant has confirmed that items of critical plant for which spares can be kept on Site will be identified, and storage of those items on Site will be implemented to reduce the potential recovery time in the event of a major flood event.

Flood Emergency Response Plan

6.13 When operational the Proposed Development, will be operational and manned 24 hours, 7 days a week. The Site is at a high residual risk of flooding and therefore a system should be put in place to safeguard the workers at the Site in the event of defence failure.

6.14 It is recommended that a Flood Emergency Response Plan be developed to ensure the residual risk to the site is sufficiently managed and mitigated. A management system will be implemented to respond to a variety of emergency situations both during normal hours (24/7) and over holiday periods.

6.15 A Flood Emergency Response Plan will be prepared in consultation with the EA. This will define access and egress routes from the site and will ensure that the development is registered to receive flood warnings from the EA's 'Floodline Warnings Direct' service to inform if there is a risk of flooding from a tidal storm surge type event which could result in overtopping or breach of defences. This will include the recommendation of at least one Flood Warden for the plant.

6.16 As the Flood Emergency Response Plan will be set up to manage the residual risk of flooding, careful consideration will be undertaken as to what action will be taken at each level of warning. The plan will define how occupants of the Site will be evacuated to an appropriate place of safe refuge should there be a real risk of flooding if a defence breach were to occur, as the safety of all occupants is essential. However, it is also important to ensure that the Site is only evacuated when it is really necessary.

Flood Warnings and Alerts

6.17 The EA operates a Flood Warning Service (EA, 2019d) for many areas at risk of fluvial and tidal flooding. The service currently consists of three stages:

- **Flood Alert** - flooding is possible and that you need to be prepared;
- **Flood Warning** - flooding is expected and that you should take immediate action. Action should be taken when a flood warning is issued and not wait for a severe flood warning; and
- **Severe Flood Warning** - there is severe flooding and danger to life. These are issued when flooding is posing significant risk to life or disruption to communities.

6.18 Designated EA Flood Alert codes are assigned to areas. Each code gives an indication of the expected level of danger. Although some members of the public find Flood Watches useful, they are predominantly targeted towards professional partners, alerting them to expected flooding of low lying land and roads.

6.19 All stages of warning are disseminated via the 'Floodline Warnings Direct', which is a free service that provides warnings to registered customers by telephone, mobile, email, SMS text message and fax. Local radio, TV, loudhailers, sirens and Floodline are also used to deliver flood warning messages. The Floodline number is 0845 988 1188, and it is always kept up to date with the EA's latest flooding information.

6.20 More detailed information on the likely extent and time scale of these warnings can be obtained by request from the EA, by their 'Quickdial' recorded information service, or via their website.

6.21 For any proposed commercial or industrial developments within a designated floodplain (as in the case of the Proposed Development), a system for monitoring flood warnings should be developed with designated responsible persons (site managers) able to monitor and disseminate the warnings. This will provide more time to enable emergency access and egress of staff occupants away from the local area which may become flooded during a flood event (including routes for egress) prior to inundation. They should also enable sufficient time to implement protection measures for any equipment on site through sealing all external doors to prevent flood inflow into such buildings as a precaution.

6.22 The Site is located within a designated EA Flood Alert Area (short code **053WAT600SHBa** covering tidal flooding of areas near the South Humber Bank from Winteringham to Humberston).

6.23 The Site is located within two designated EA Flood Warning Areas (FWA) (short code names **053FWTIMM2** covering the wider area at risk of tidal flooding from Immingham to Pyewipe, and **053FWTGRIM1** covering low-lying areas in Grimsby and Pyewipe). Due to the 24 hour a day nature of the operations at the Site, the Site will be registered with the EA's Flood Warnings Direct service and monitoring of the warnings is adopted at the Site to mitigate the residual risk of tidal/ fluvial flooding in the event of defence failure in the vicinity.

Emergency Access and Egress to/ from the Site

6.24 An emergency access and egress route is a route that is 'safe' for use by occupiers without the intervention of the emergency services or others. A route can only be completely 'safe' in flood risk terms if it is dry at all times.

6.25 For developments located in areas at flood risk, the EA consider 'safe' access and egress to be in accordance with paragraph 039 of the NPPF PPG, and 'FRA Guidance for new Developments FD2320' (Defra and Environment Agency, 2005), where the requirements for safe access and egress from new developments are as follows in order of preference:

- safe, dry route for people and vehicles;
- safe, dry route for people;
- if a dry route for people is not possible, a route for people where the flood hazard (in terms of depth and velocity of flooding) is low and should not cause risk to people; and
- if a dry route for vehicles is not possible, a route for vehicles where the flood hazard (in terms of depth and velocity of flooding) is low to permit access for emergency vehicles.

6.26 For 'essential infrastructure' development, it is considered that dry access and egress from the Site will be desirable during times of extreme floods. However, areas behind sea defences are at particular risk from rapid onset of fast-flowing and deep water flooding, with little or no warning if defences are overtopped or breached. The EA's breach modelling has illustrated that the Site and immediate surrounding area is located in an area of 'high' hazard during the event of a breach. The Site will be evacuated upon receipt of a flood warning unless it is unsafe to do so, in which case a place of safe refuge will be provided and sought on Site.

Place of Safe Refuge

6.27 Places of safe refuge are generally considered an acceptable approach to flood risk management in areas adjacent to sea defences as in the event of a defence breach, inundation is likely to be rapid and therefore evacuation from the Site and local area can sometimes be an unsafe option.

6.28 Parts of the main building for the Proposed Development will include a minimum of three floors. It is currently proposed that the control room will be allocated and adapted to provide adequate facilities to provide a place of safe refuge including welfare facilities for all employees occupying the Site in the extremely unlikely event that the sea defences were to breach. The internal finished floor level of this refuge area will be elevated above the EA's modelled 0.1% AEP (1 in 1000 chance) event defence breach maximum flood level, defined by EA North Area Tidal Modelling to be around 4.60 mAOD.

Drainage System Failure, Capacity Exceedance and Maintenance

6.29 Following the completion of the Proposed Development, an additional residual risk relates to maintenance of the on-site drainage infrastructure. Failure, blockage and capacity exceedance above that of the design events for the drainage system are a potential risk to the Site and the surrounding area.

6.30 In order to reduce the risks, maintenance of the system will be incorporated in general site management and will remain the responsibility of the Applicant. A manual will be

prepared detailing each drainage feature on Site, the maintenance required, timescales for maintenance and who is responsible for undertaking the maintenance. It is expected the Site owners will ultimately be responsible for maintenance of the site drainage system including all pipes, discharge structures and any SuDS implemented on site in accordance with the recommendations in the SuDS Manual.

6.31 CIRIA C635 (Ciria, 2006) provides guidance on measures that can be incorporated into the detailed design of developments to steer surface water that has exceeded the capacity of the drainage system away from buildings and route it towards the intended point of attenuation and discharge (for example along swales and roads using raised kerbing and through parking areas). The overspill feature of the surface water attenuation solution on the Site will be designed to convey water towards either of the land drains found along the southern or northern boundary of the Site, in the event of overtopping.

7.0 SUMMARY AND CONCLUSIONS

Flood Risk Summary

Tidal Sources

7.1 Based on the information provided by the EA, it has been determined that during the existing scenario the Site is at a 'low' risk of flooding from tidal sources resulting from overtopping of the defences during events that exceed a 0.5% AEP (1 in 200 chance) of flooding. If these defences were to fail and breach during the existing scenario, the Site would be at a 'high' risk of flooding during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

7.2 During a future scenario resulting from climate change up to 2115 however, the impacts are more significant. The Site is potentially at a 'high' residual risk of flooding as a result of the defences overtopping during events that exceed a 0.5% AEP (1 in 200 chance) of flooding, or in the event that the defences were to breach during either the 0.5% or 0.1% AEP (1 in 1000 chance) events.

7.3 Appropriate mitigation measures are therefore required to be implemented at the Site to mitigate this residual risk and ensure the occupiers of the site are safe and critical equipment can continue to function at the Site in the event of such inundation, thus satisfying the requirements of the Exception Test.

Fluvial Sources

7.4 The information provided by the EA (see Annex 1), identifies the Proposed Development area within the Site to be at 'very low' risk of fluvial flooding from Oldfleet Drain or Middle Drain.

7.5 The new access at the north-eastern corner of the Main Development Area has the potential to increase the risk of flooding from Land Drain 1. During the detailed design phase, a detailed assessment will be undertaken to determine the flow capacity and flow estimates likely to be conveyed along the drain to inform the adequate sizing and levels of a culvert/ clear-span bridge necessary to prevent any obstruction to floodwater.

Surface Water Runoff to the Site

7.6 The risk of surface water flooding within the Main Development Area from elsewhere or generated within the Site is considered to be 'low' to 'very low'.

Groundwater

7.7 The risk of groundwater flooding within the Main Development Area is considered to be 'low' to 'medium'.

Artificial Sources

7.8 There are no artificial sources of flood risk, such as canals or reservoirs in close proximity to the Site. It is therefore considered that there are no flood risks posed to the Site from these sources.

Management of Surface Water Runoff from the Site

7.9 In order to ensure that the Proposed Development does not increase the flood risk elsewhere, surface water discharge from the Main Development Area will be restricted to the existing greenfield runoff rate in accordance with the requirements of the NPPF, EA and NELIDB. Surface water runoff attenuation will be provided to ensure existing greenfield runoff rates are maintained up to the 1% AEP event plus a 40% allowance for climate change.

7.10 It is proposed that a surface water attenuation pond SuDS feature will be located at the eastern edge of the Main Development Area. It is proposed that the discharge rates from this attenuation pond will be controlled through a system such as a HydroBrake and released into an existing ditch along either the southern or northern boundary of the Site. Water will then continue to follow the existing drainage mechanism connecting into a further drain along the western boundary of Site, before out-falling into the Humber Estuary either via two existing flapped outfalls from this land drain, through Middle Drain pumping station, or via the Oldfleet flapped outfall.

7.11 The detailed drainage design will confirm the storage volumes required once the exact impermeable area of the proposed land use is confirmed, and it will confirm the exact location and feasibility of the outfall from the pond into the existing land drainage network.

Residual Risk Mitigation Measures

7.12 The predicted peak flood level for at the Site during a 0.1% AEP (1 in 1000 chance) flood event due to a breach in the tidal flood defences including an allowance for climate change up to the year 2115 is defined by EA Northern Area Tidal Modelling to be around 4.60 mAOD.

7.13 In accordance with the recommendations made by the EA during consultation, it is therefore proposed that an internal floor level providing a place of safe refuge for the occupiers within the control room of the Proposed Development will be elevated above a level of 4.60 mAOD.

7.14 In accordance with the recommendations made by the EA during consultation, the Applicant does not intend to raise existing ground levels of the Main Development Area, but will either elevate all critical equipment assets above a level of 4.60 mAOD or otherwise ensure they are adequately protected.

7.15 A number of additional mitigation strategies will be considered during the design process for the Proposed Development to ensure the operation of the Site is maintained in the event of a flood. These strategies include: developing a Flood Emergency Response Plan and signing up to the Flood Warnings provided by the EA: providing flood resistance and resilience measures into the design of the buildings: and designing for failure, maintenance and capacity exceedance of the surface water drainage network.

Comparison of Consented Development and Proposed Development Flood Risk Assessment

7.16 The overall conclusions of the FRA for the Proposed Development are the same as the conclusions of the FRA for the Consented Development. The only change has been the refinement of the modelled flood level for the Site (based on new data from the EA) at 4.60 mAOD, which will inform the development of mitigation during the detailed design of the Proposed Development.

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ANNEX 1: ENVIRONMENT AGENCY CONSULTATION

Jo Somerton
Joanne.somerton@aecom.com

Our ref: CCN/2018/87235

Date: 5th June 2018

Dear Jo,

Provision of Flood Risk Information for a site on the South Humber Bank near Stallingborough, North East Lincolnshire.

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.

Historic Flood Extent Map

A copy of the Historic Flood Extent Map showing the extent of previous recorded flooding in your area is attached. This only covers information we hold and it is possible other flooding may have occurred which other organisations, such as the Local Authority or Internal Drainage Boards, may have records.

Fluvial Flood Risk Information

Fluvial Defence Information

The fluvial defences reducing the risk of flooding to this site consist of earth embankments until TA 22595 12752. They are in fair condition and reduce the risk of flooding to a 1% (1 in 100) chance of occurring in any year. We inspect these defences routinely to ensure potential defects are identified. From TA 22595 12752 to the sea, there are no formal flood defences reducing the risk of flooding to this site. The nearby 'main river' channel reduces the risk of flooding to a 1% (1 in 100) chance of occurring in any year.

Modelled Levels and Flows

Available modelled fluvial flood levels and flows for the model nodes shown on the attached map are set out in the data table attached. This data is taken from the model named on the data table, which is the most up-to-date model currently available.

Please note these levels are "in-channel" levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

Modelled Flood Extents

Please find attached a map showing available modelled flood extents, taking into account flood defences, for your area. This data is taken from the model named on the map, which is the most up-to-date model currently available.

Tidal Flood Risk Information

Tidal Defence Information

The tidal defences protecting this site consist of concrete floodwalls.

They are in good condition and reduce the risk of flooding to a 0.5% (1 in 200) 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 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

Hazard Mapping – Overtopping
The attached maps show the maximum values of flood depth, velocity and hazard rating (danger to people) resulting from simulated overtopping of defences for the following scenarios:

- 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

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.

Supporting 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 Antonia MacDonald using the details below.

Yours sincerely,

A. MacDonald

FOR Claire Rose
Partnerships and Strategic Overview Team Leader - South Humber and East Coast

Direct dial +44 (0) 2077 140539
Direct e-mail PSO_Coastal@environment-agency.gov.uk

Enc.
Flood Map
Historic Flood Extent Map
Modelled Fluvial and Flows Data Sheet
Modelled Flood Extent Maps
Estimated Tide Levels
Tidal Breach Locations Map
Hazard Mapping – Breaching (4 maps)
Hazard Mapping – Overtopping (4 maps)

CUSTOMER SERVICE EXCELLENCE CSE

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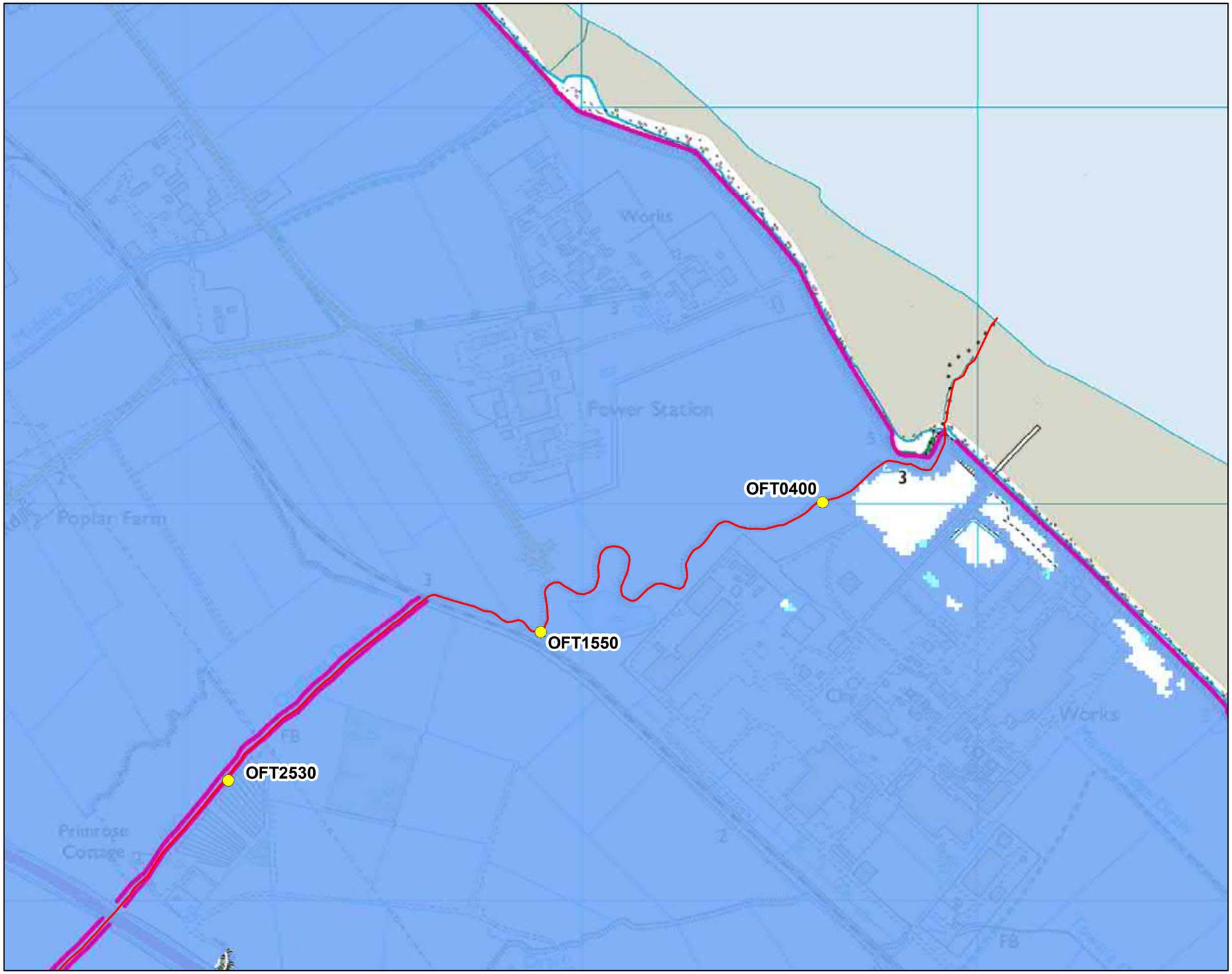
FLOODS DESTROY BE PREPARED

Flood Map centred on TA 23088 13043 - created June 2018 [Ref: CCN-2018-87235]



Environment Agency

Scale 1:10,000

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- Modelled Nodes
- 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.

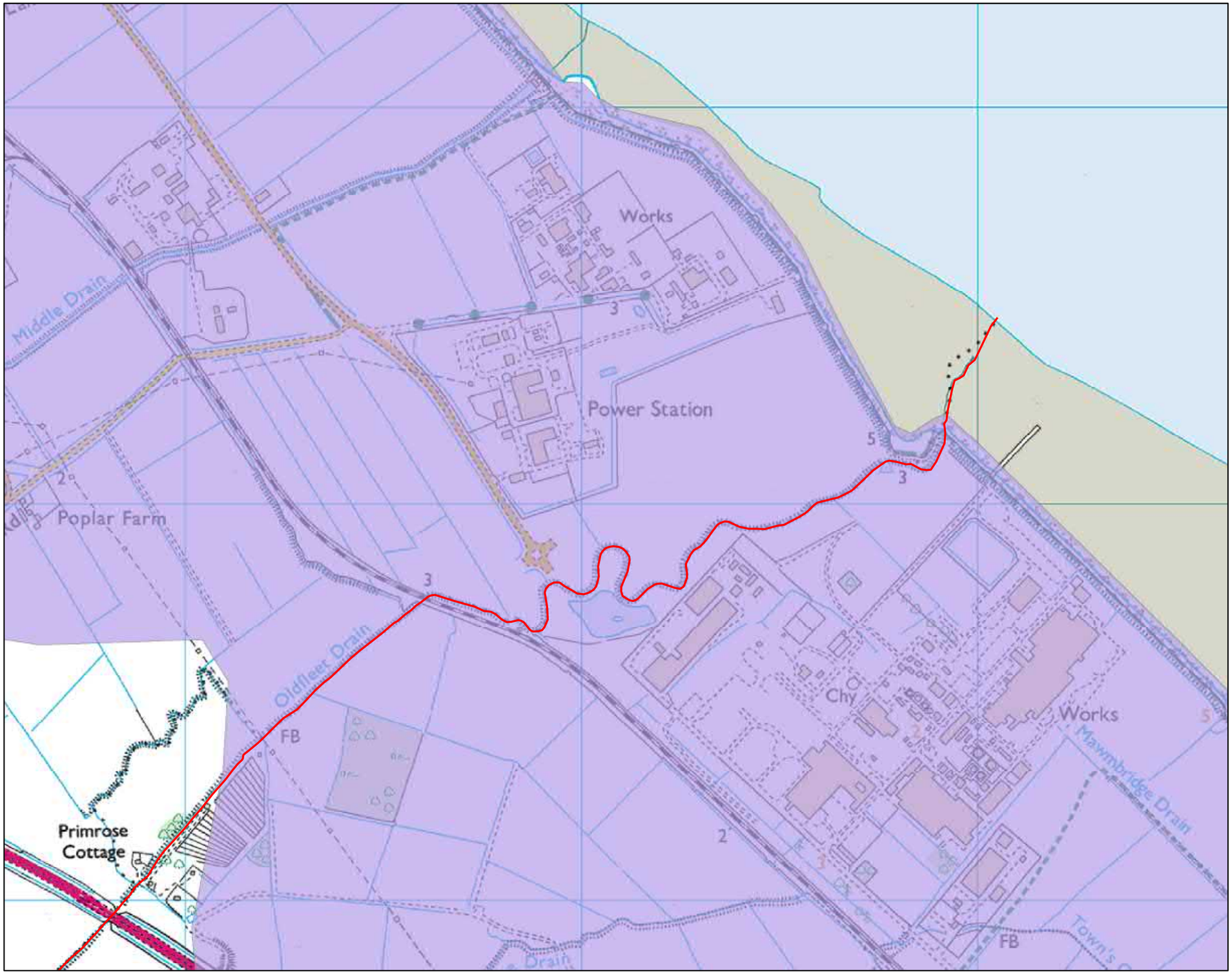
Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

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, Lincoln

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

Historic Flood Extent Map centred on TA 23088 13043 - created June 2018 [Ref: CCN-2018-87235]



Environment Agency

Scale 1:10,000

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Main River

January 1953 along the Lincolnshire Coastline

Created by the Partnerships and Strategic Overview Team, Lincoln

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

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

			Annual Exceedance Probability - Maximum Water Levels (mODN)											
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	4% (1 in 25)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
OFT2530	522109	412303	2.45	2.54	2.56	2.57	2.57	2.58	2.58	2.58	2.58	2.58	2.58	2.58
OFT1550	522898	412678	2.44	2.54	2.55	2.57	2.57	2.58	2.58	2.58	2.58	2.58	2.58	2.58
OFT0400	523610	413005	2.43	2.54	2.55	2.56	2.57	2.58	2.58	2.58	2.58	2.58	2.58	2.58

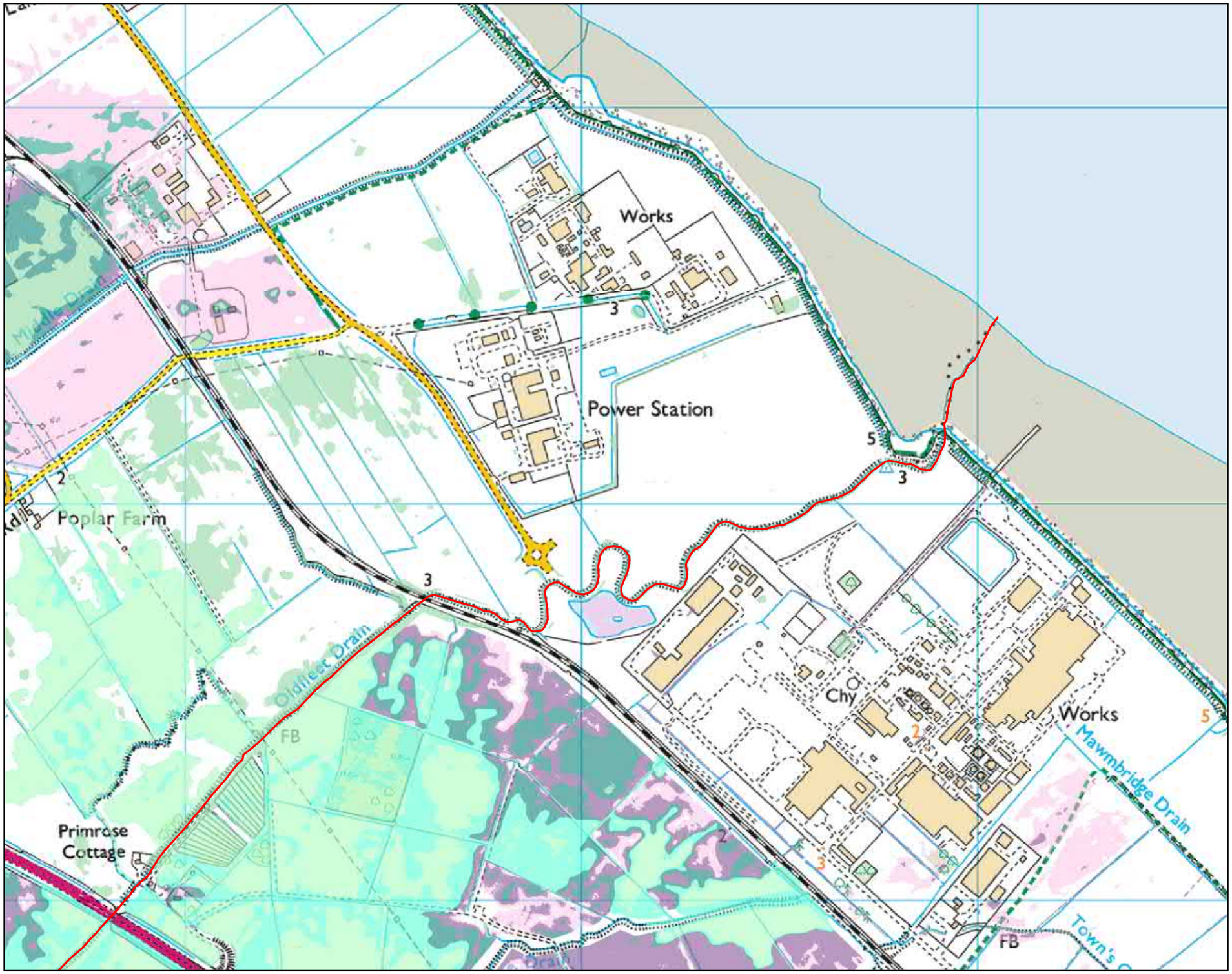
Fluvial Flood Flows (m^3/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m^3/s).

			Annual Exceedance Probability - Maximum Flows (m^3/s)											
Node Label	Easting	Northing	50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	4% (1 in 25)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
OFT2530	522109	412303	1.81	2.33	2.64	2.93	3.05	3.21	3.24	3.25	3.27	3.26	3.29	3.29
OFT1550	522898	412678	2.55	2.98	3.05	3.36	3.51	3.31	3.32	3.33	3.34	3.33	3.33	3.33
OFT0400	523610	413005	4.88	5.36	5.06	5.90	6.40	4.33	4.33	4.33	4.27	4.33	4.34	4.27

Modelled Flood Extents (with defences) Oldfleet Drain and Stallingborough North Beck Model - April 2009

Map centred on TA 23088 13043 - created June 2018 [Ref: CCN-2018-87235]



Environment Agency

Scale 1:10,000

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Modelled Flood Extents (with defences)

- Main River
- 5% (1 in 20) Fluvial Event
- 1% (1 in 100) Fluvial Event
- 1% (1 in 100) Fluvial Event inc Climate Change
- 0.1% (1 in 1000) Fluvial Event
- 0.1% (1 in 1000) Fluvial Event inc Climate Change

Created by the Partnerships and Strategic Overview Team, Lincoln

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

Produced May 2017

Produced by Partnerships & Strategic Overview Team

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**

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.

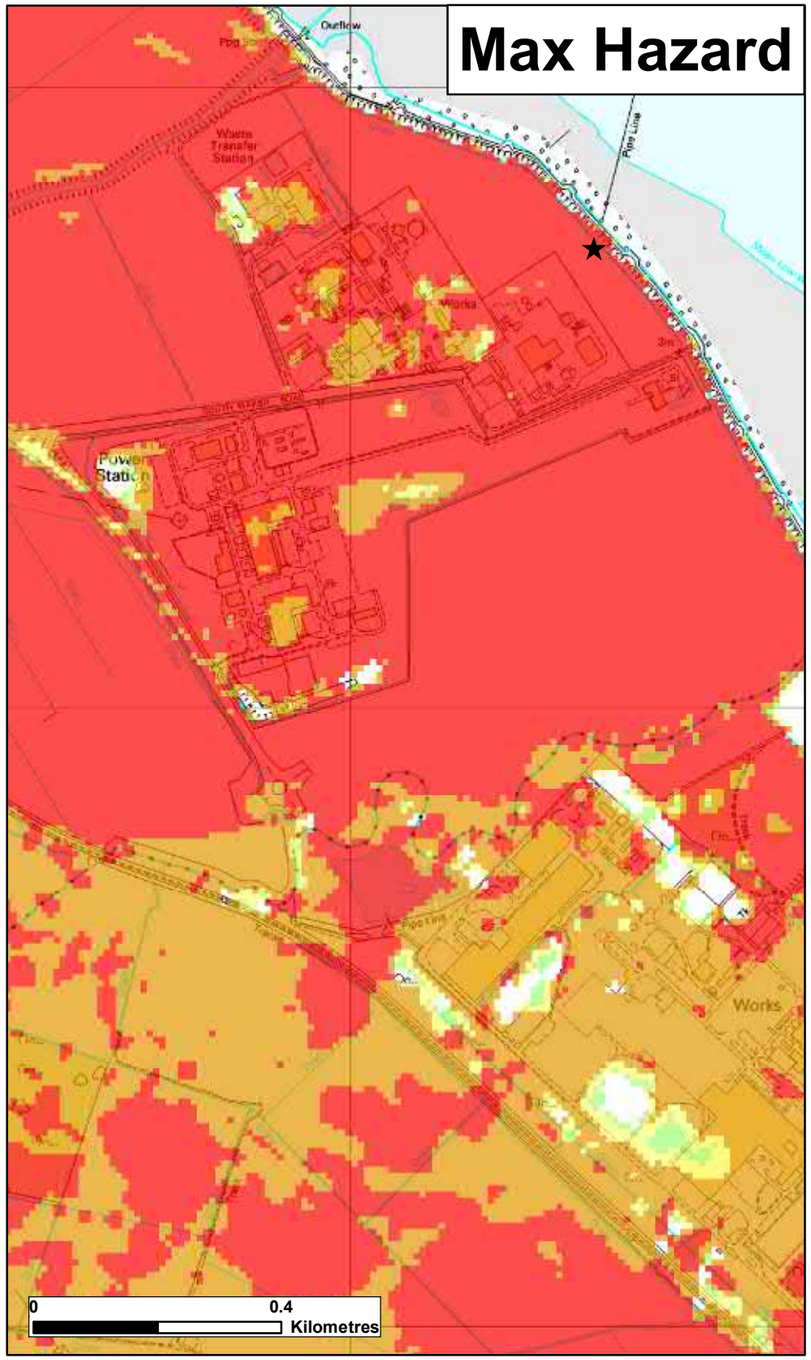
General Enquiries No: 03708 506 506.
Weekday daytime calls cost 5p plus up to 6ppm from BT Weekend Unlimited. Mobile and other providers charges may vary

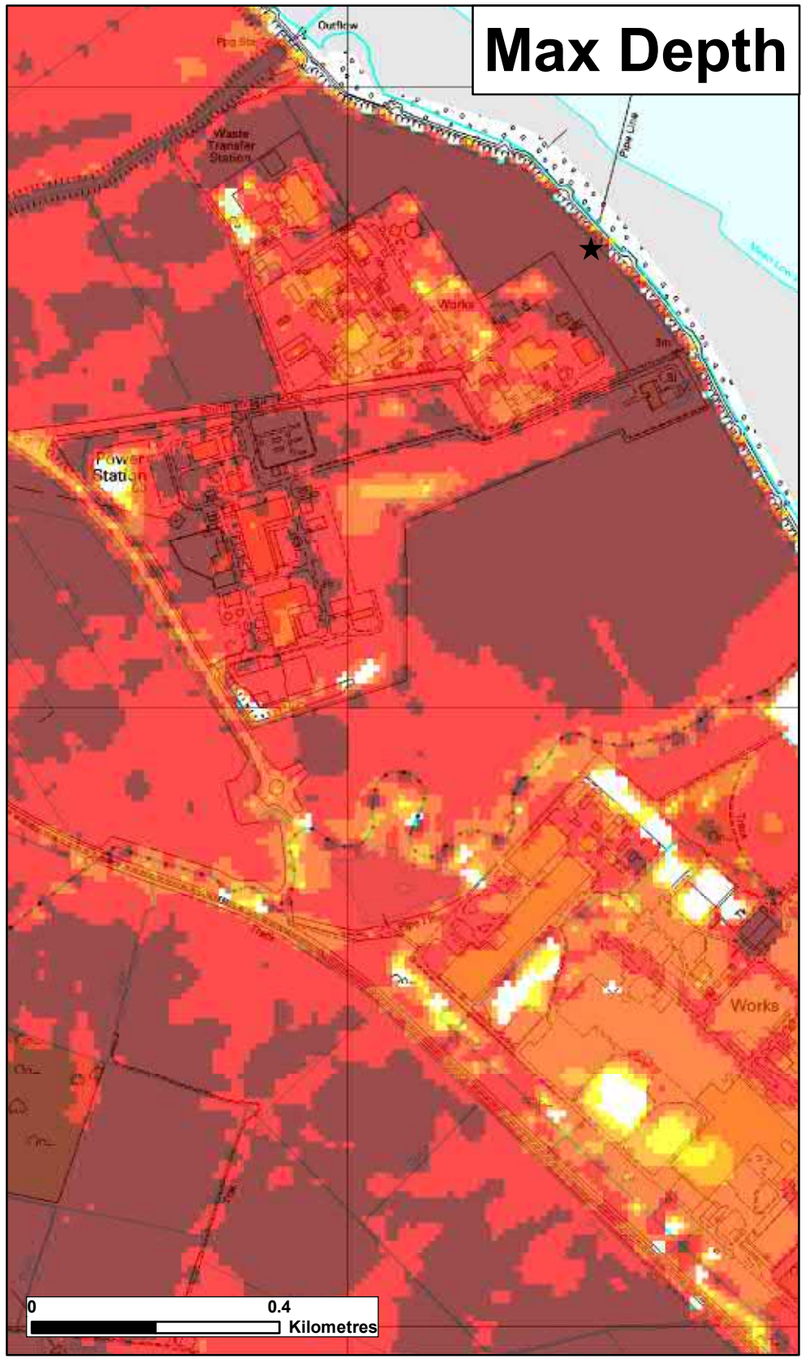
Environment Agency

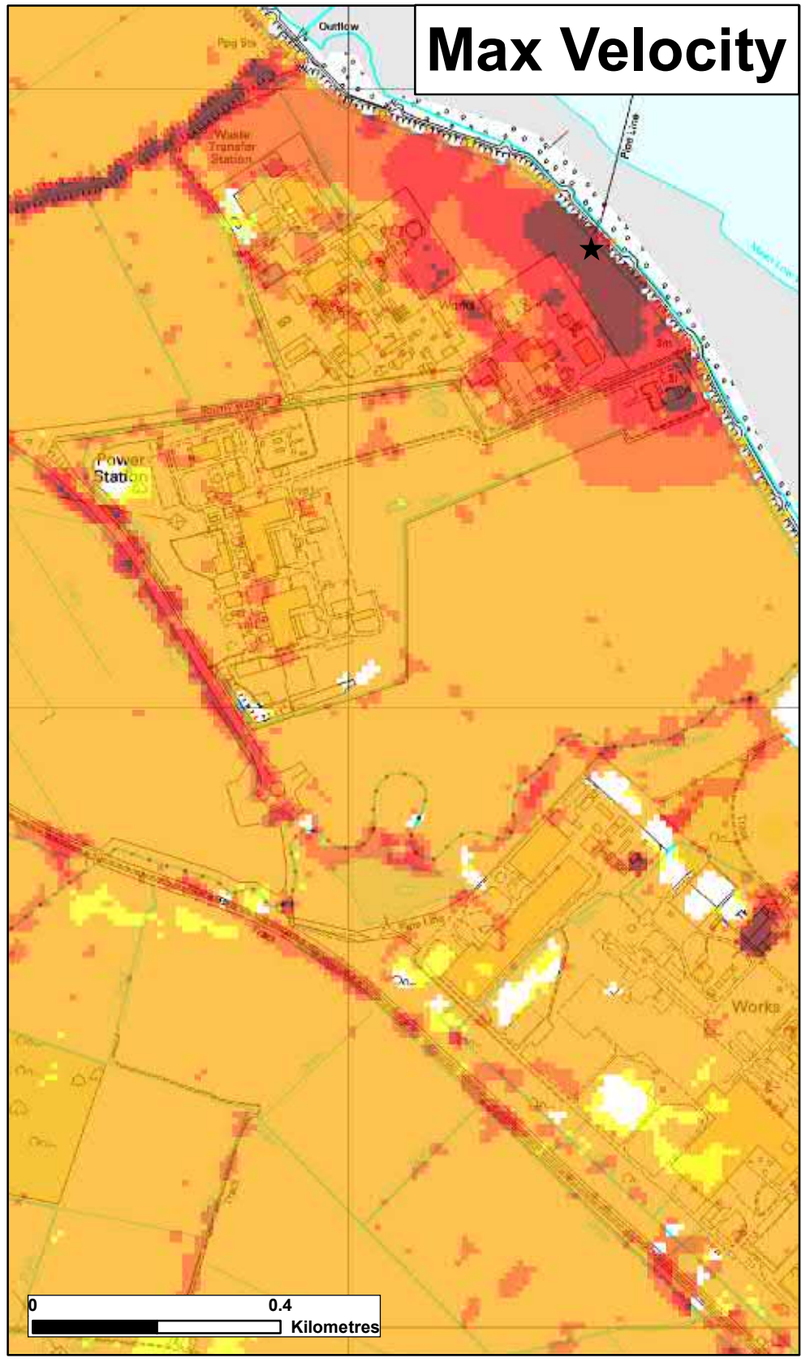
Produced by the Partnership and Strategic Overview Team, Lincoln
General Enquiries No: 03708 506 506

Northern Area Tidal Hazard Mapping

Location of Modelled Breaches







★ **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	June 2018	Scenario year	2006	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-87235

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.

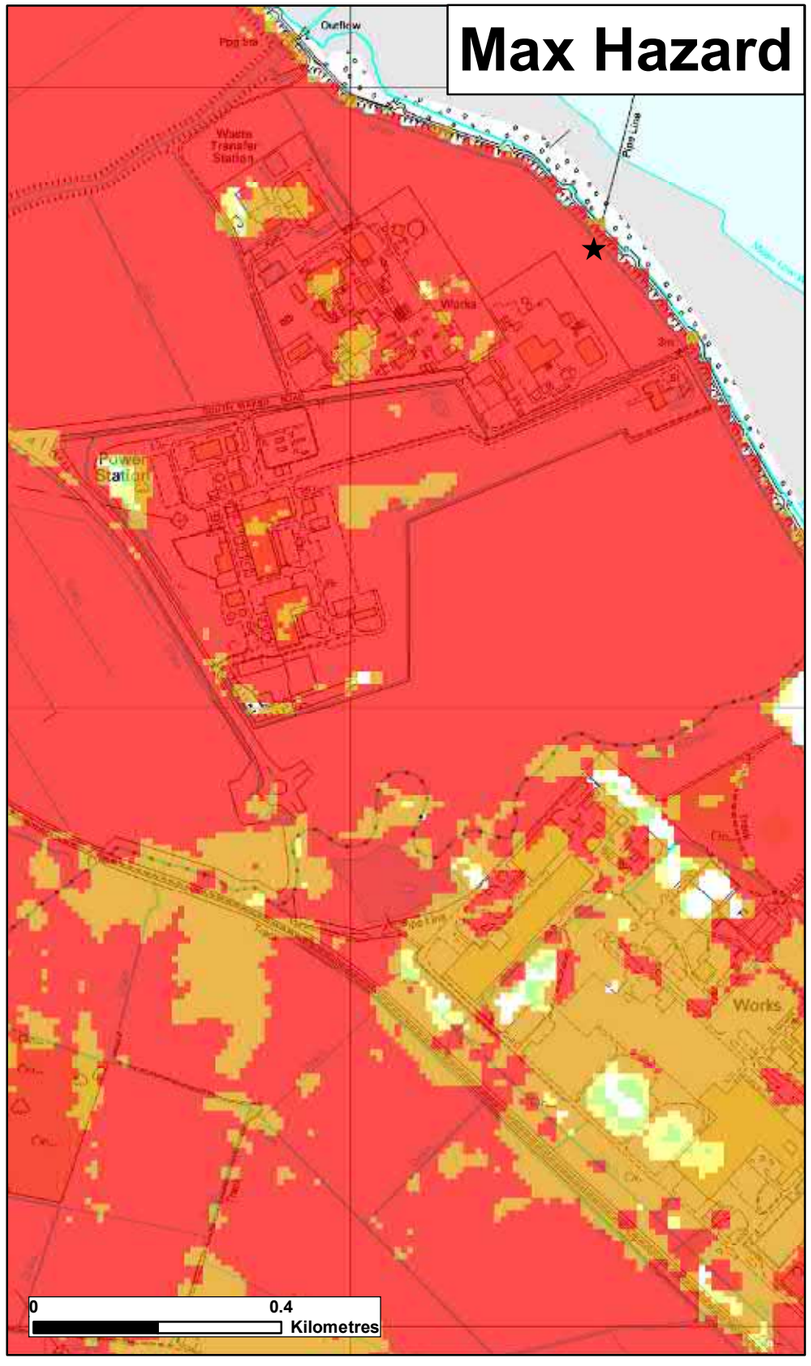
The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely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

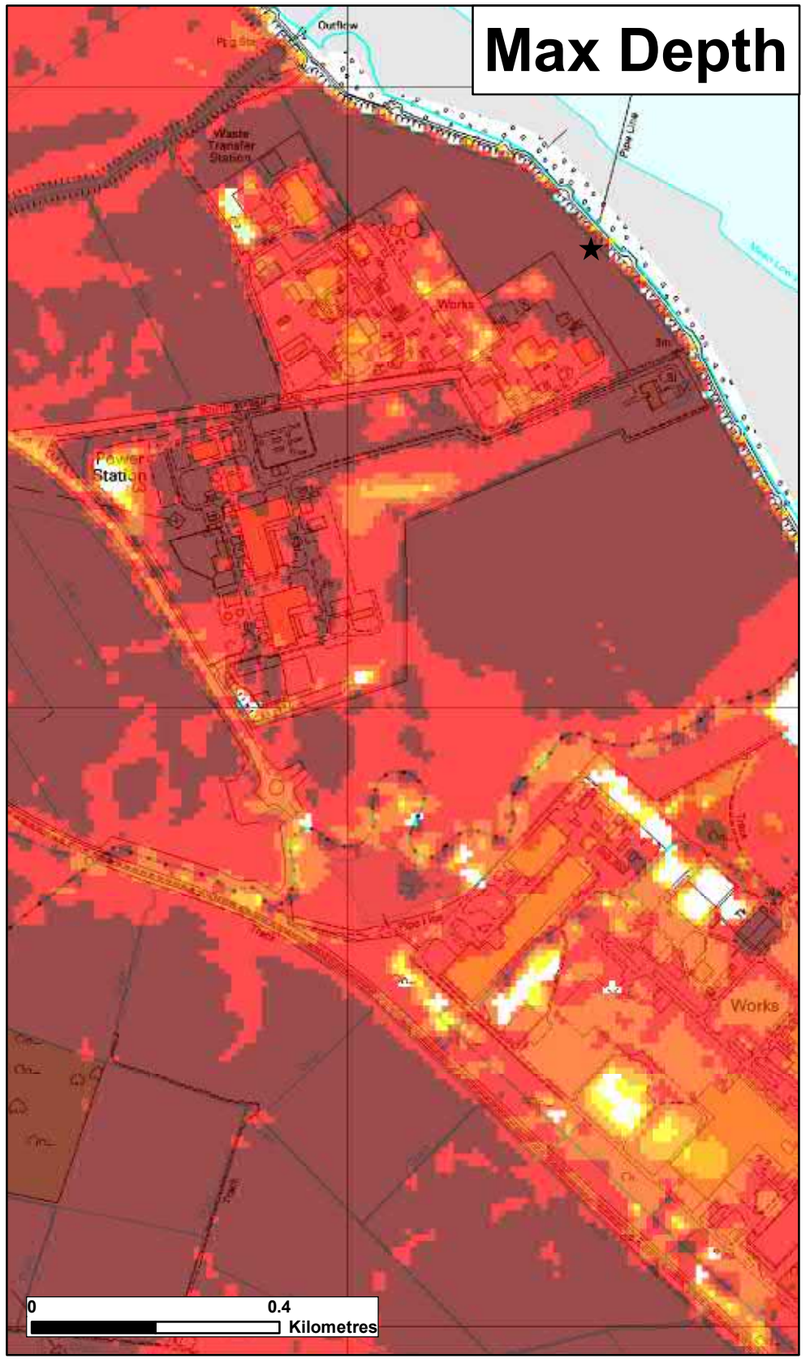
General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

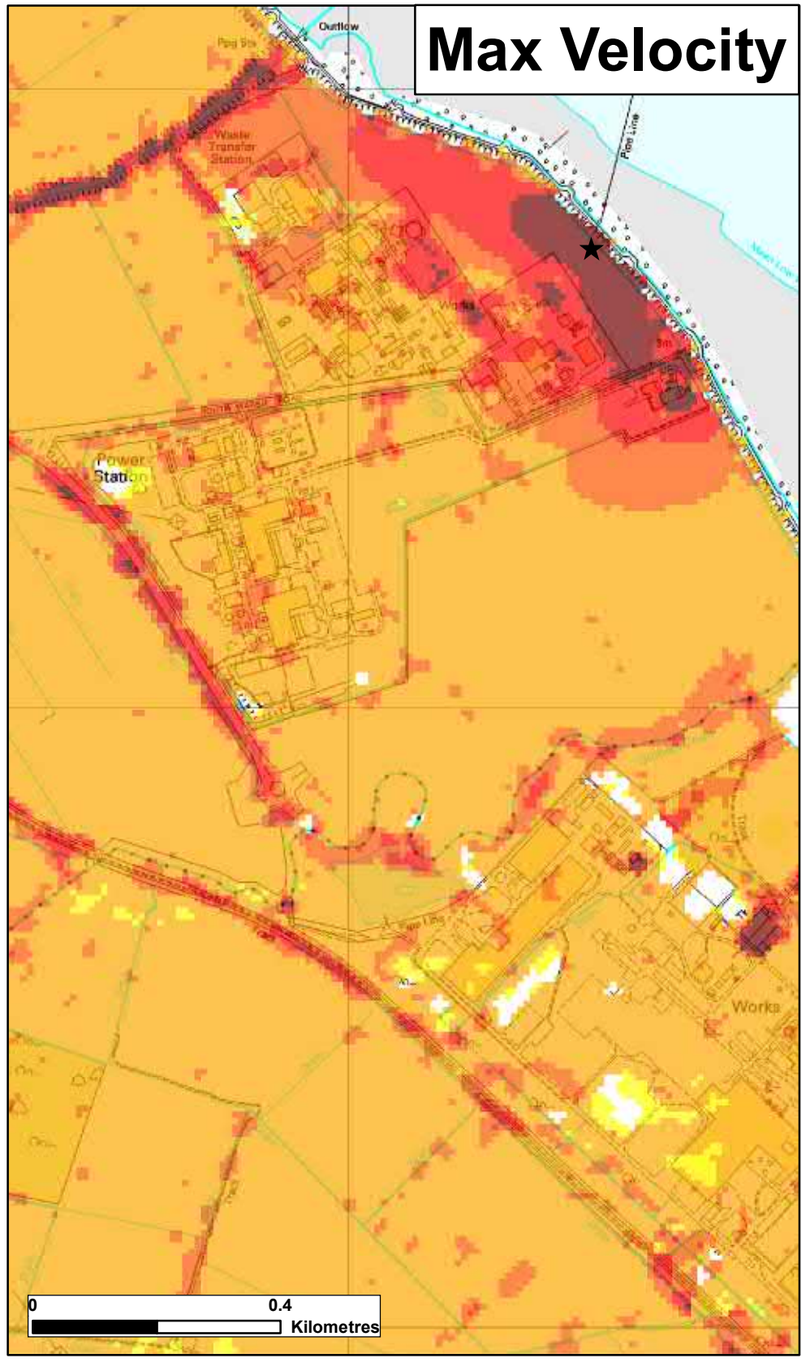
Environment Agency

Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 23088 13043







★ **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	June 2018	Scenario year	2006	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-87235

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.

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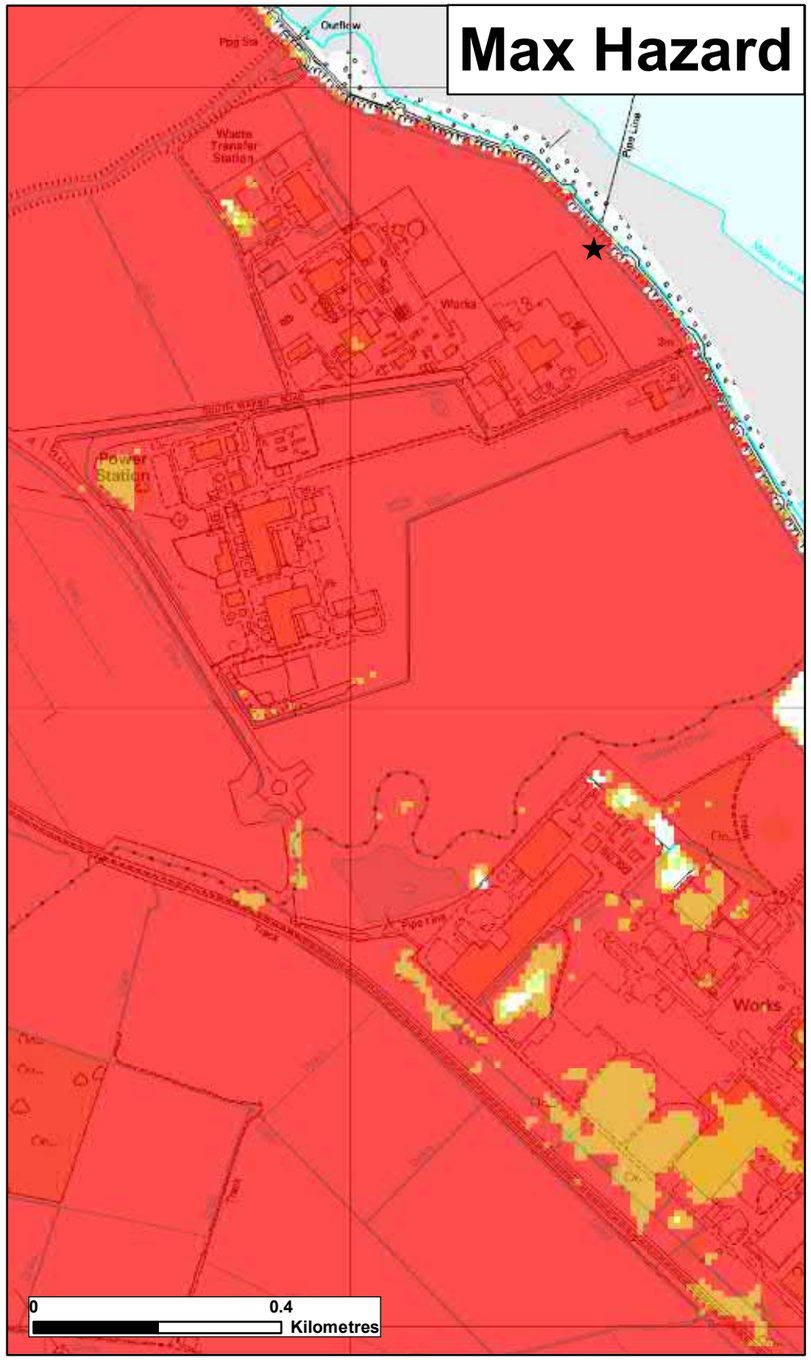
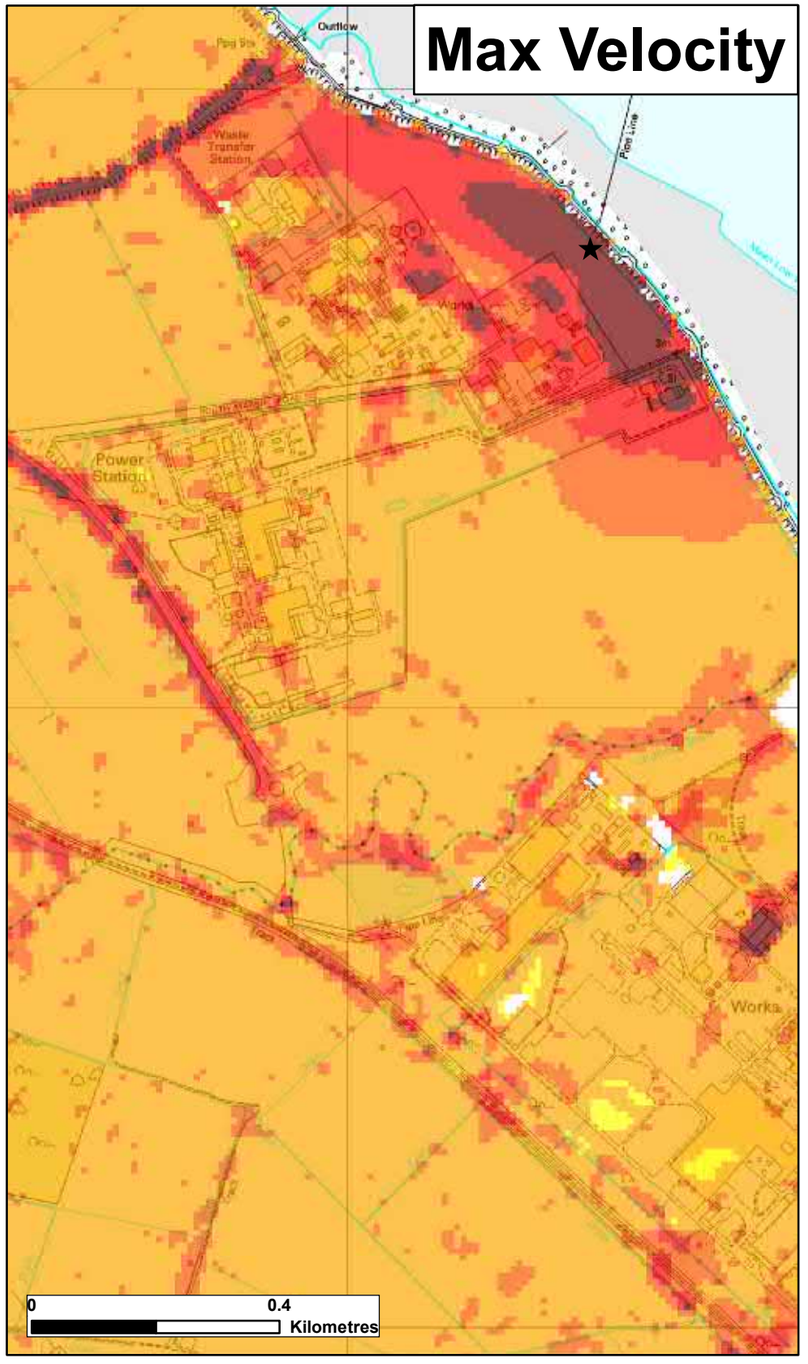
Environment Agency

Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 23088 13043





★ **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	June 2018	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-87235

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.

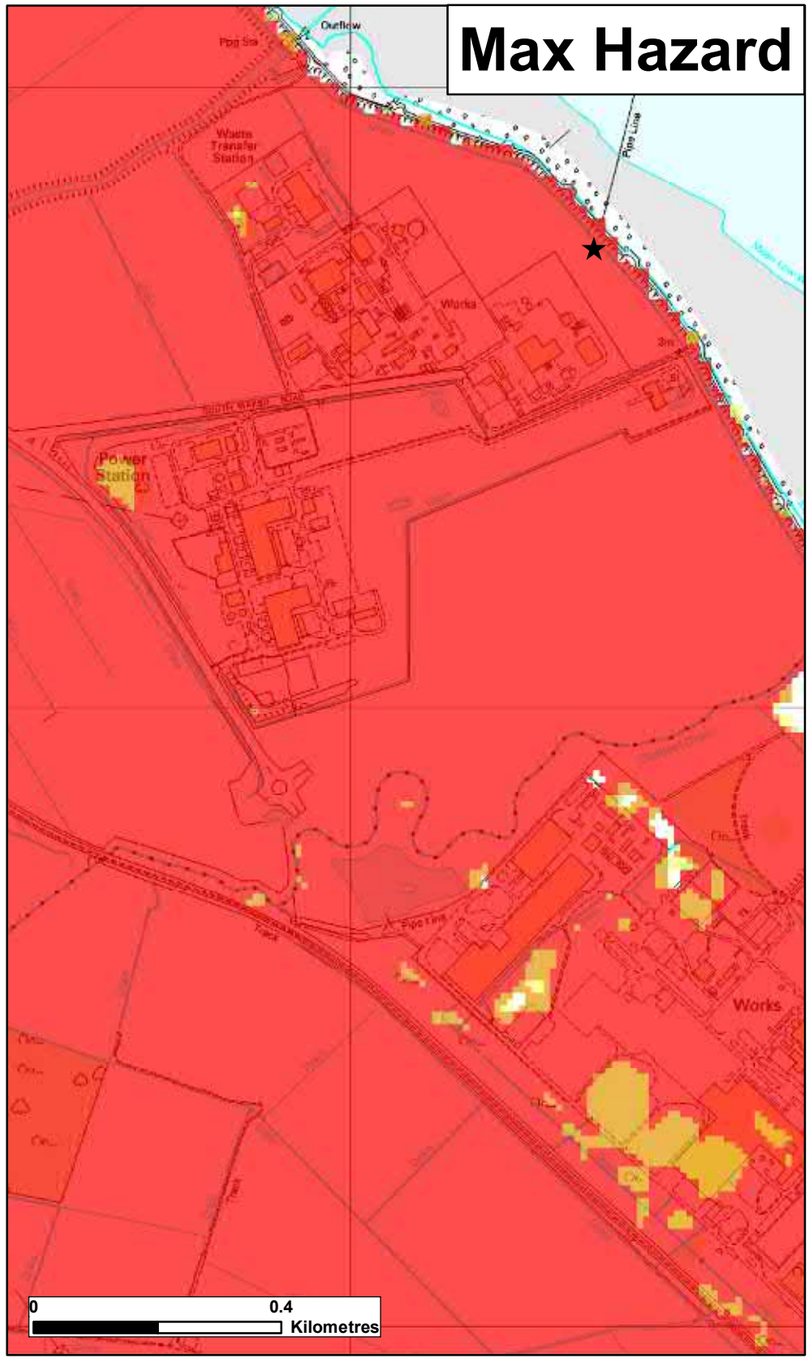
The map only considers the consequences of a breach, it does not make any assumption about the likelihood of a breach occurring. The likelihood of a breach occurring will depend on a number of different factors, including the construction and condition of the defences in the area. A breach is less likely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

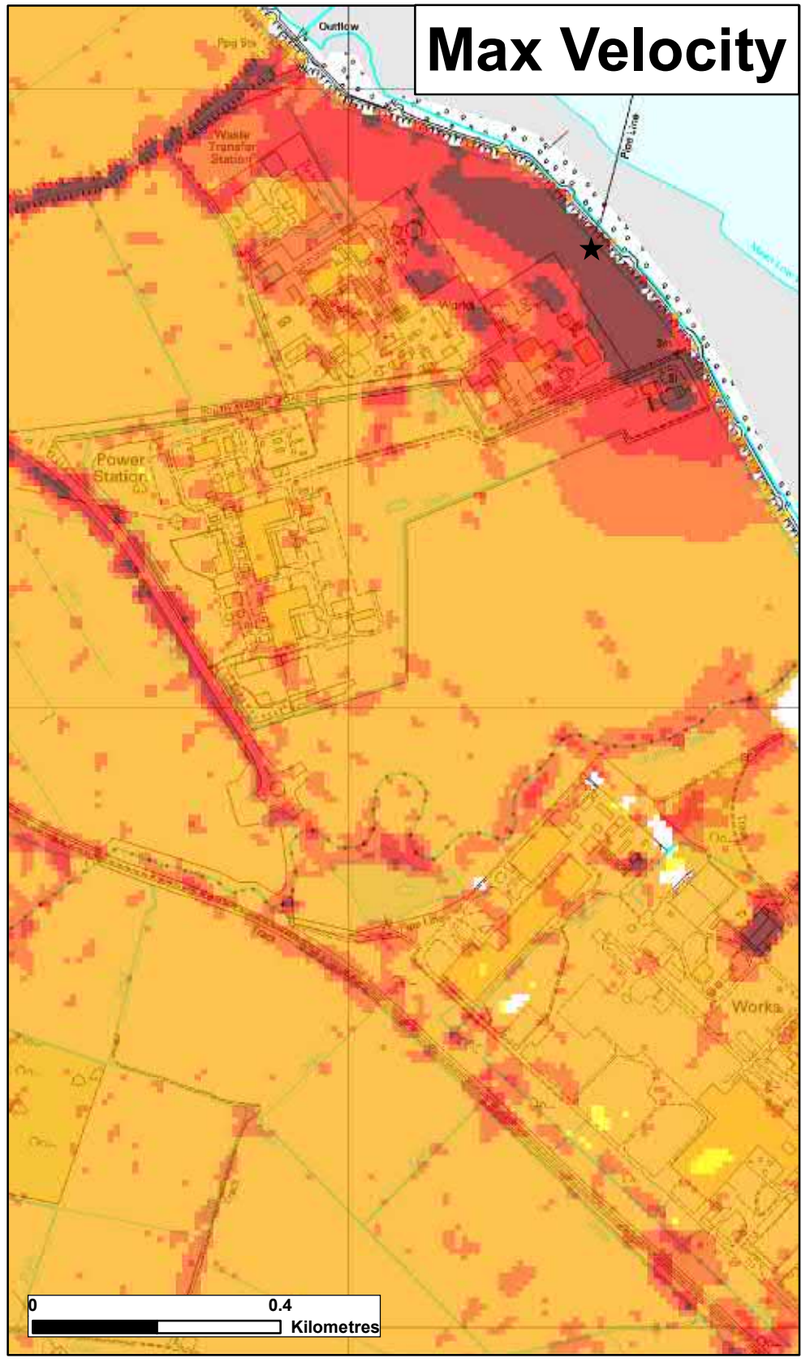
General Enquiries No: 03708 506 506. Weekday Daytime calls cost 5p plus up to 6p per minute from BT Weekend Unlimited. Mobile and other providers' charges may vary

Environment Agency

Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 23088 13043





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Date Printed	June 2018	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-87235

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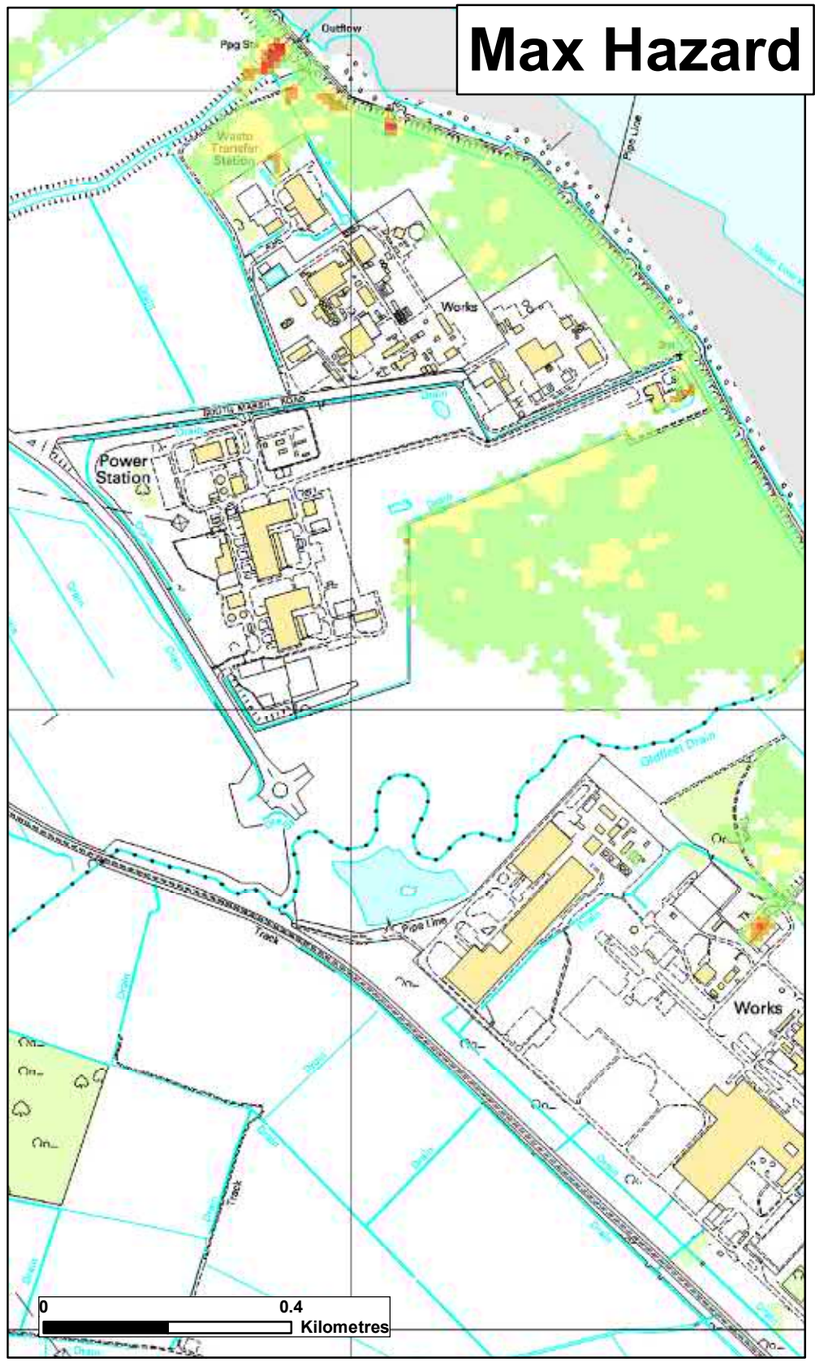
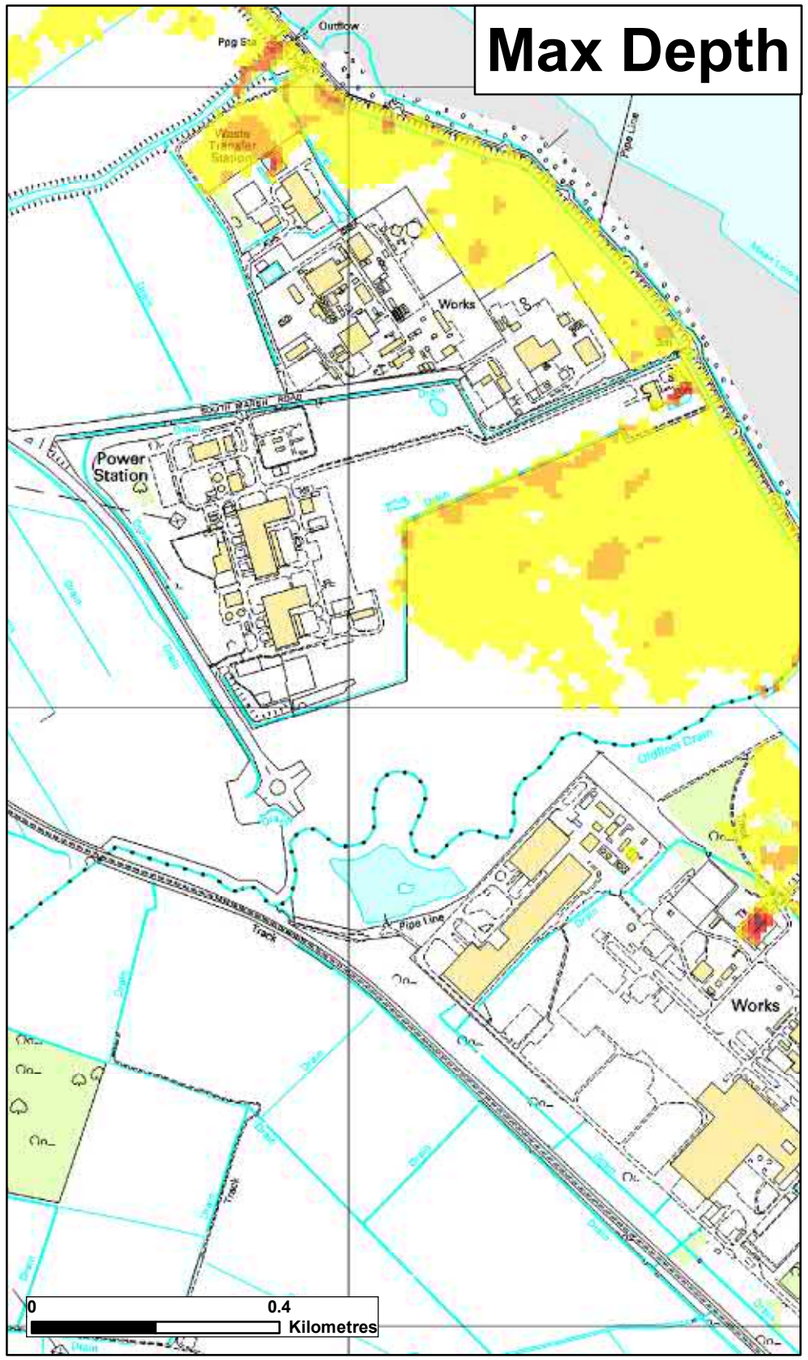
Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 23088 13043

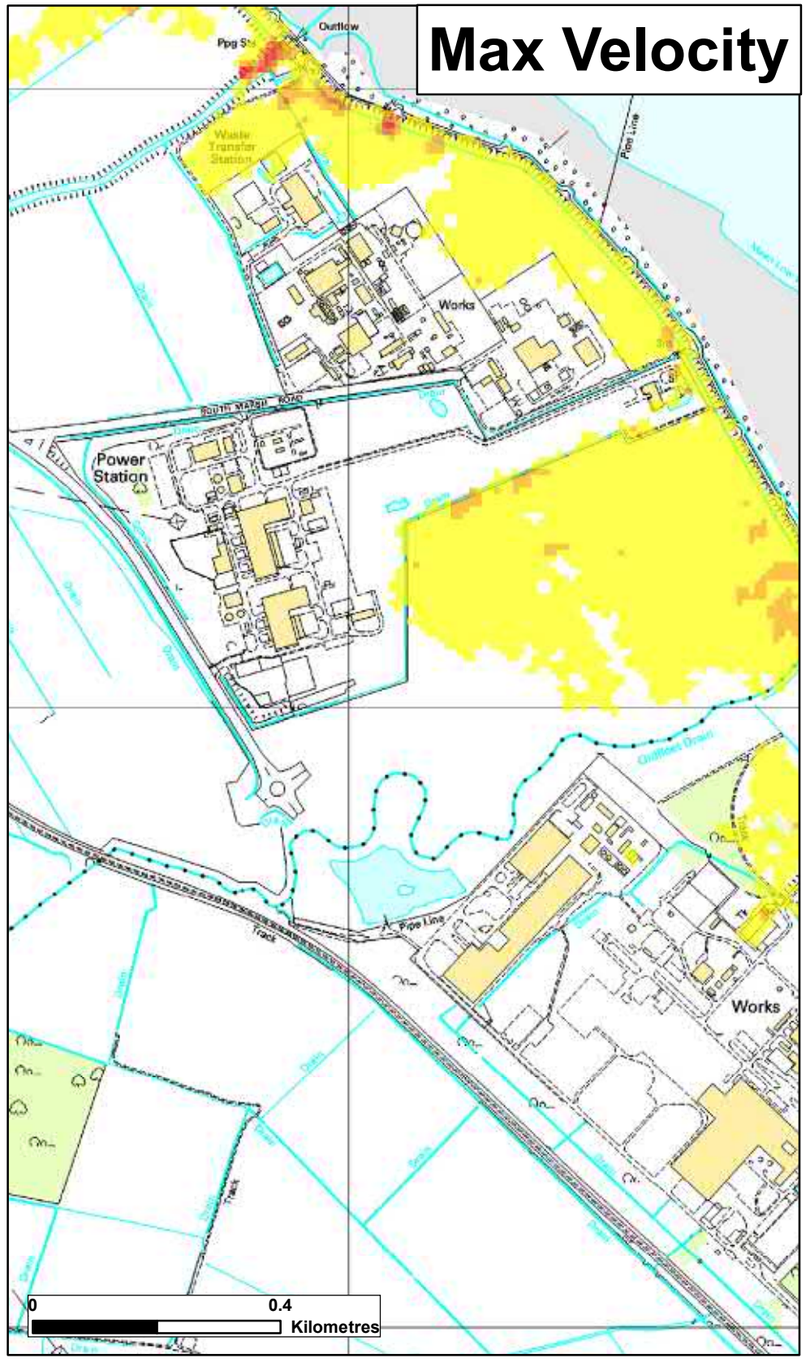
Max Hazard



Max Depth



Max Velocity



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Date Printed	June 2018	Scenario year	2006	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-87235

The map is based on computer modelling of simulated overtopping of the main coastal defences for specific tidal scenarios. It does not include overtopping along the following tidal rivers which are currently being investigated: Witham Haven (upstream of Hobhole), and Welland (upstream of Fosdyke Bridge)

The map only considers the consequences of overtopping of the defences, and does not show the possible consequences of breaches of the tidal defences. Separate maps of the flood extent from just breaching of the defences are available.

For future climate change scenarios it is assumed that defences remain at 2006 heights.

These maps do not replace the flood zone maps used in the National Planning Policy Framework (NPPF)

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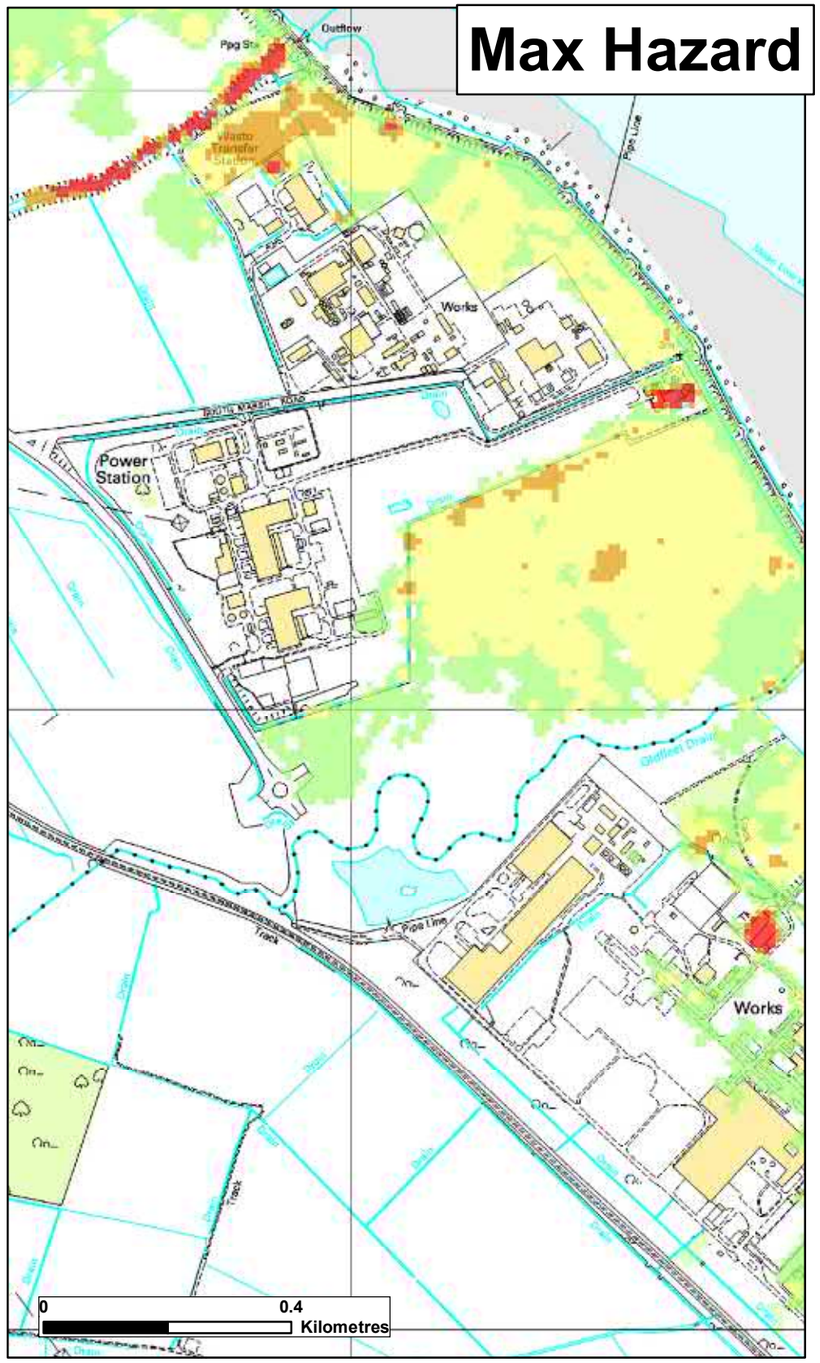
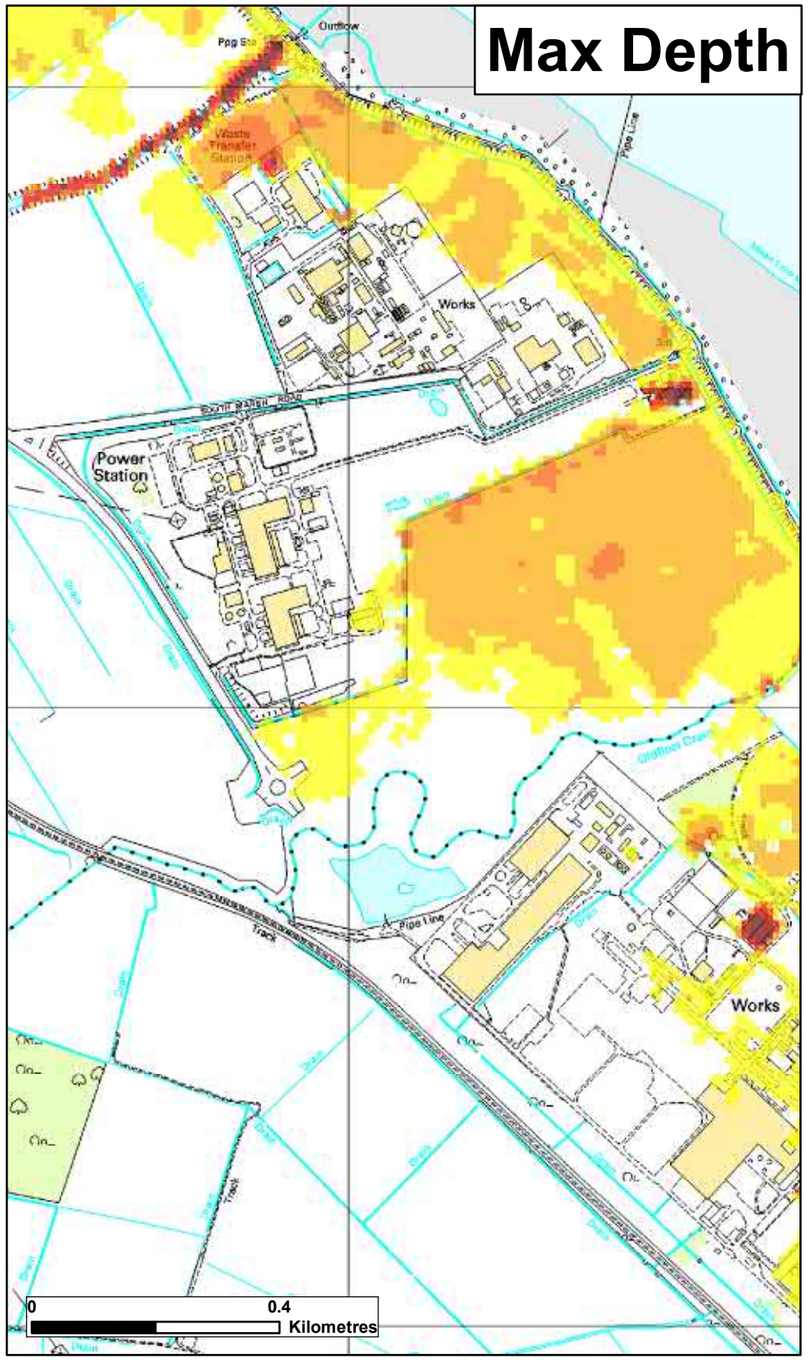
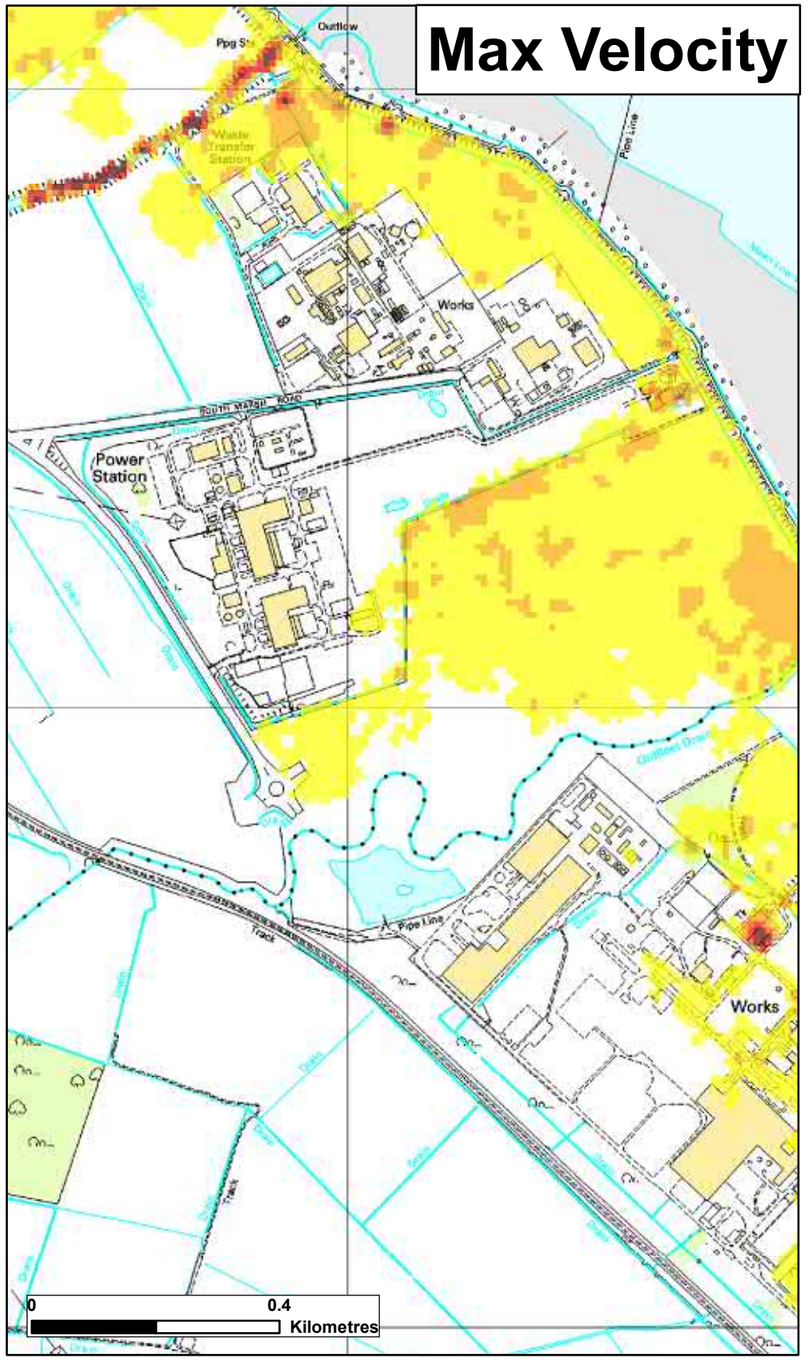
Environment Agency

Lincolnshire and Northamptonshire Overtopping Hazard Mapping

Map Centred on TA 23088 13043







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Date Printed	June 2018	Scenario year	2006	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-87235

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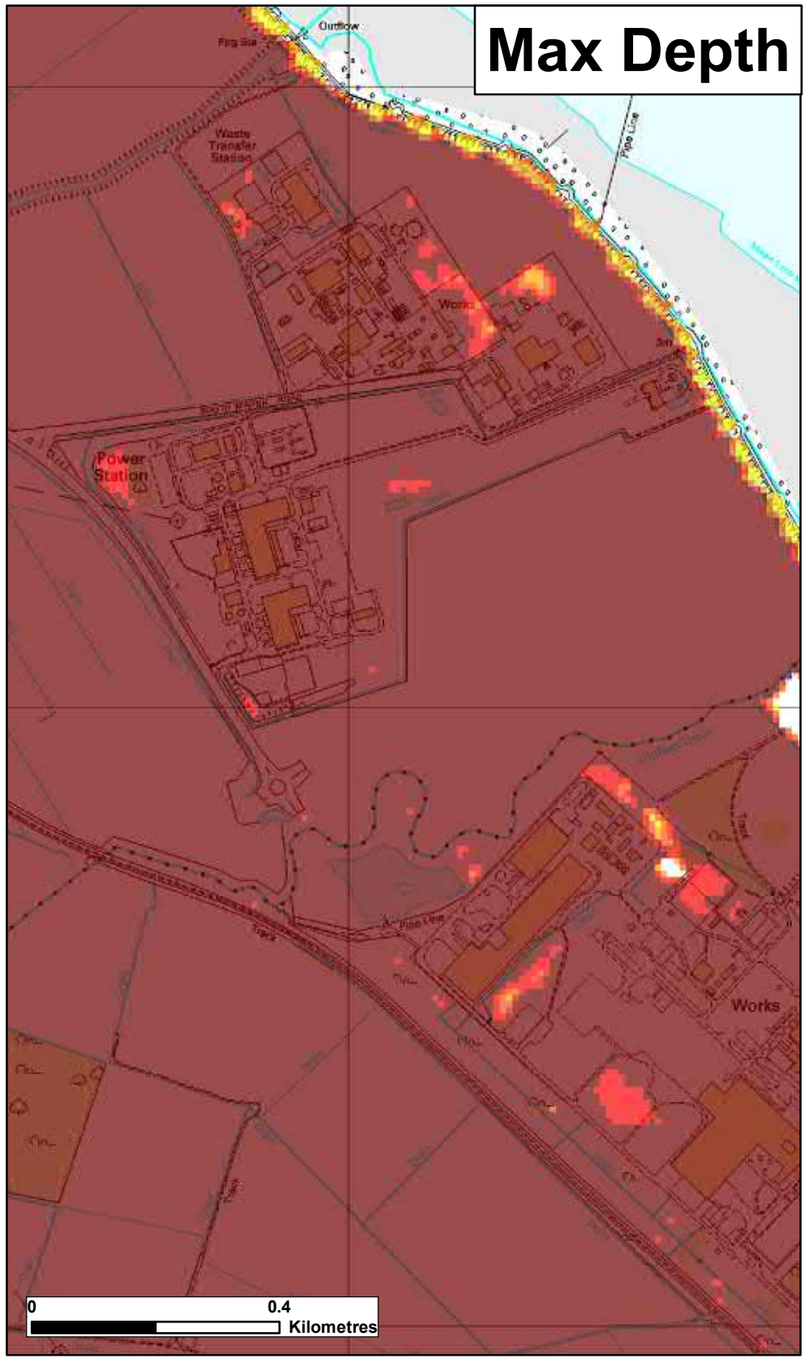
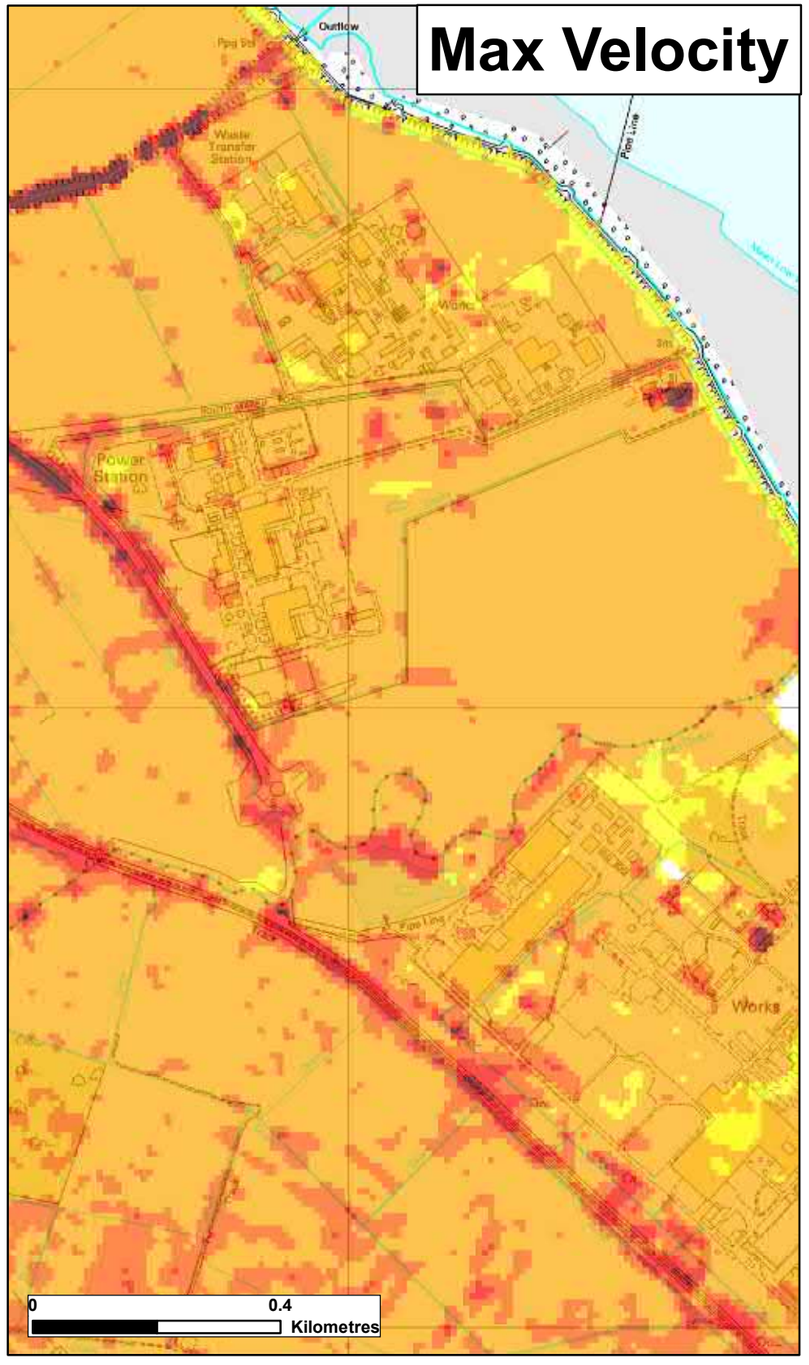
Map Centred on TA 23088 13043





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Date Printed	June 2018	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-87235

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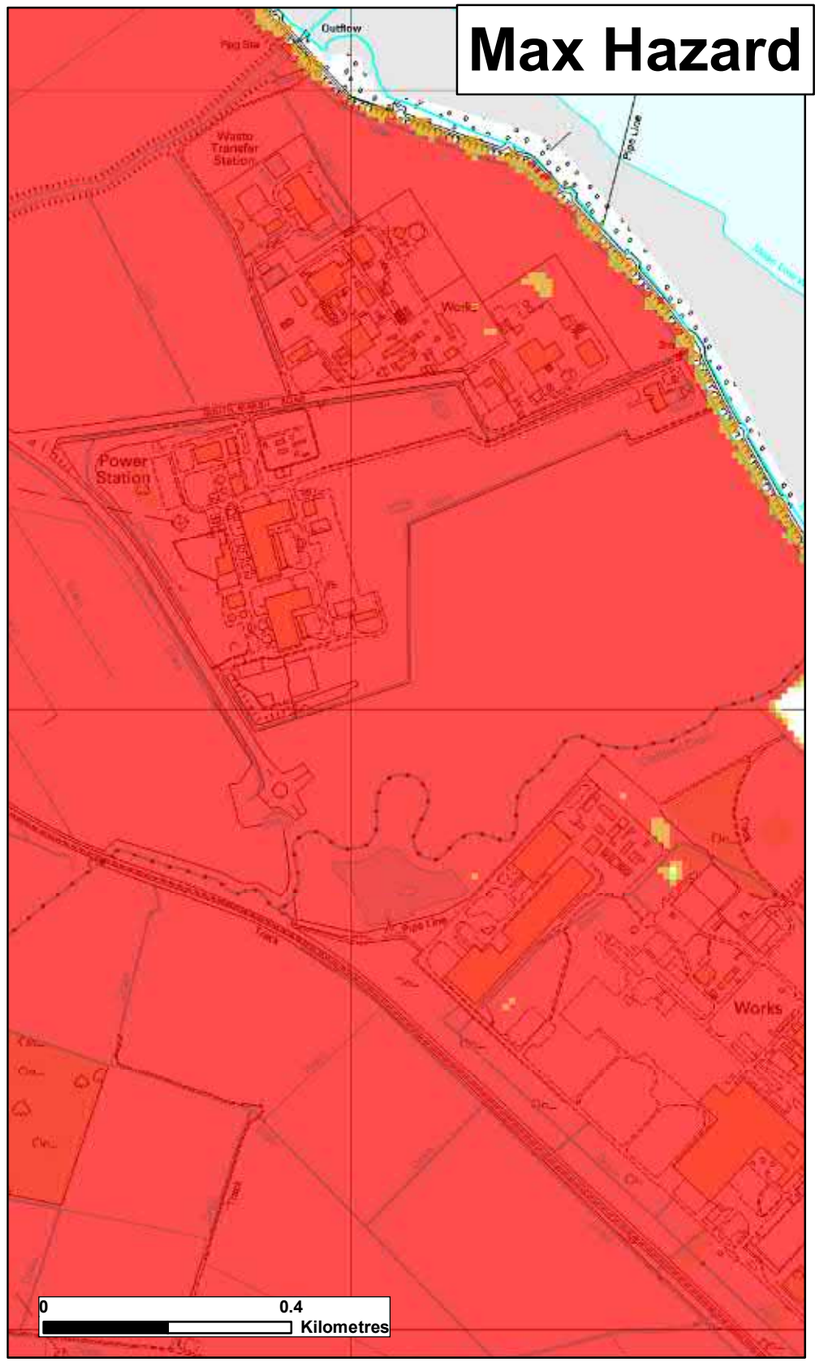

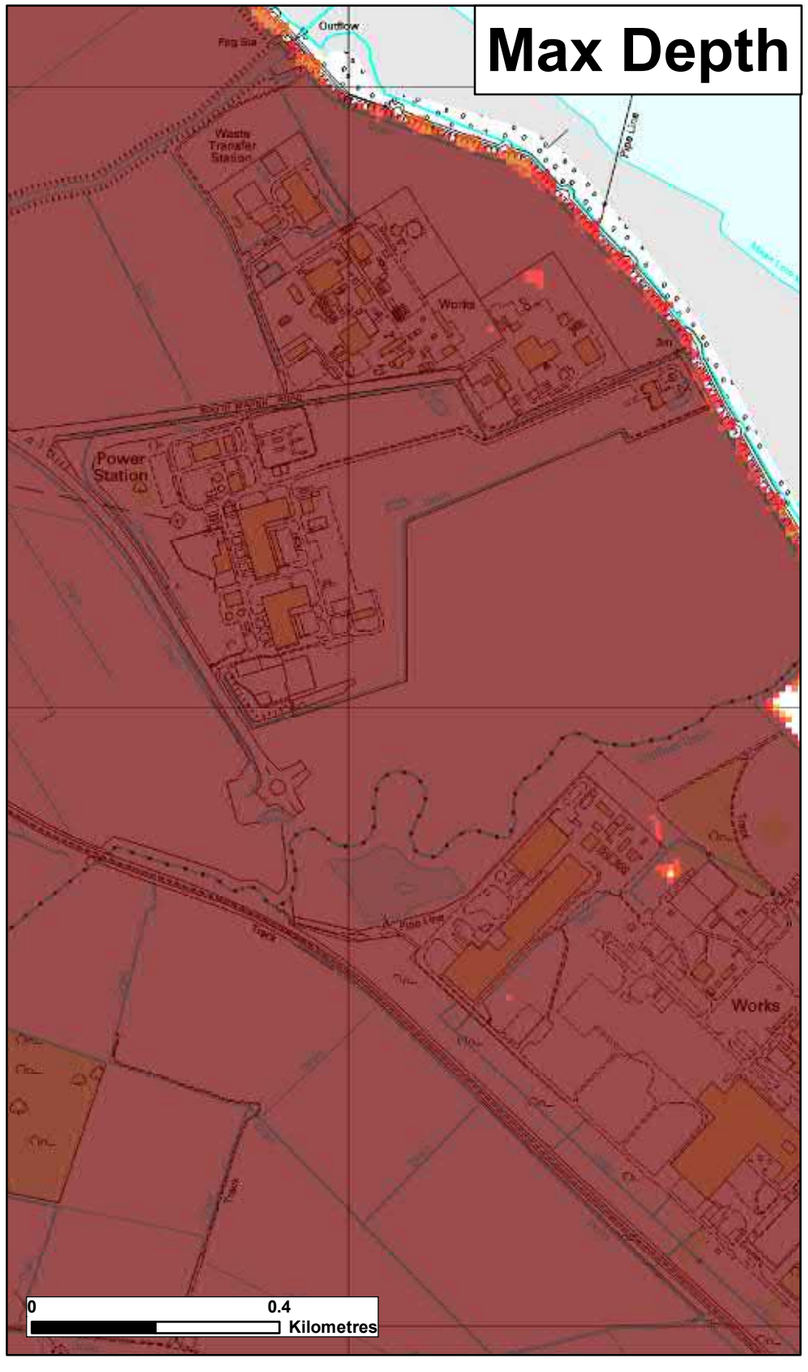

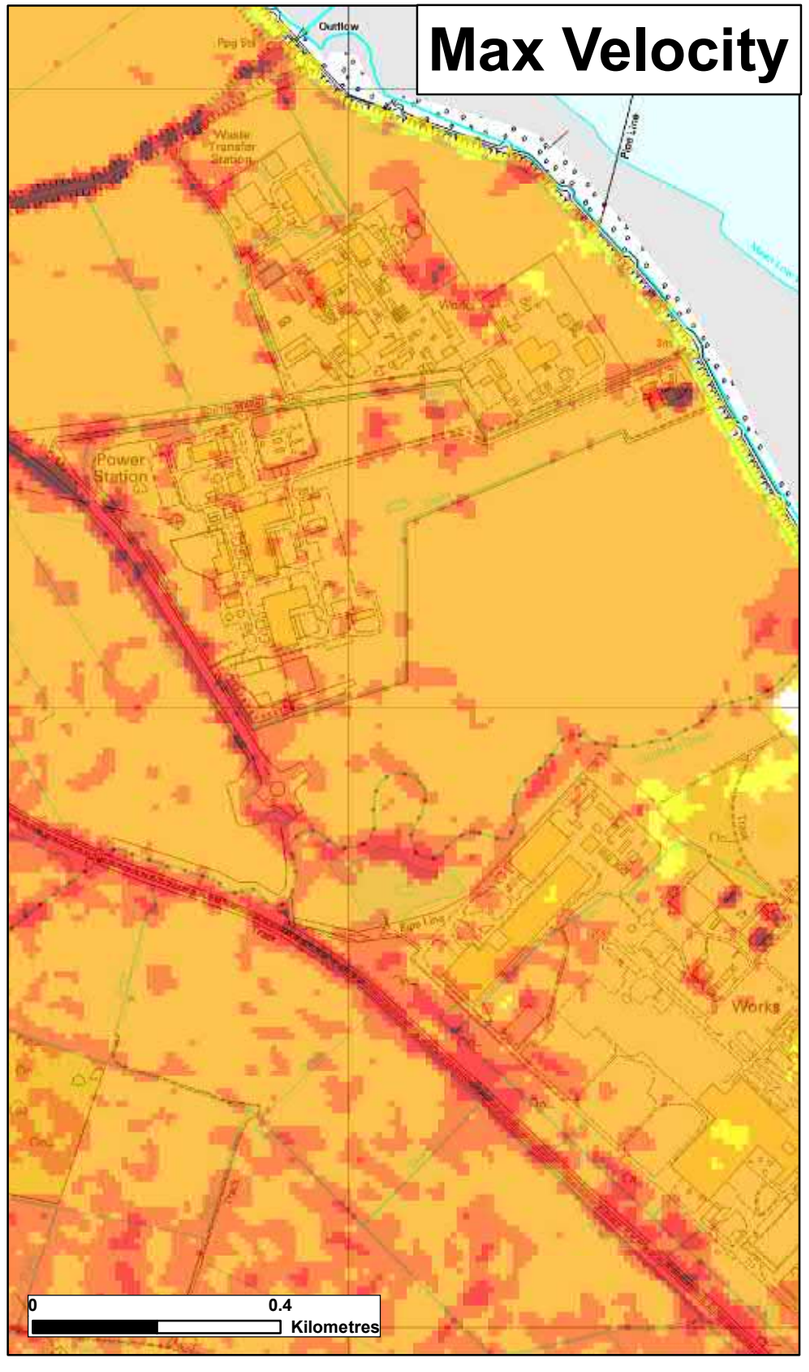

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Date Printed	June 2018	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-87235

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Environment Agency

Lincolnshire and Northamptonshire Overtopping Hazard Mapping

Map Centred on TA 23088 13043

Burton, Helen

From: Eames, Rob <Rob.Eames@environment-agency.gov.uk>
Sent: 12 November 2018 18:16
To: Burton, Helen
Cc: Kearns, Laura; Farr, Nicola; Cobb, Kirsty
Subject: RE: Proposed Energy Centre Development at South Humber Bank Power Station

Hello Helen

I'm sorry for taking so long to get you a response on this. Since the meeting I've been politely chasing to see if the modelling team would be able to action the request. Unfortunately I still haven't been able to get a firm response so I'm afraid I'll have to say I am unable to provide the information you are after.

If there is any other way I can be of assistance then please let me know. I appreciate you were after the data to enable you to determine the flood depth in mAOD so if you want to discuss a proposed level before you submit the application then please let me know.

Apologies again

Rob

Robert Eames
Partnerships and Strategic Overview Officer, Lincolnshire and Northamptonshire Area
Environment Agency | Ceres House, 2 Searby Road, Lincoln, LN2 4DW
rob.eames@environment-agency.gov.uk
+44 (0) 2084 749436

www.gov.uk/floodsdestroy

From: Burton, Helen [mailto:helen.burton@aecom.com]
Sent: 12 November 2018 17:45
To: Eames, Rob <Rob.Eames@environment-agency.gov.uk>
Cc: Kearns, Laura <laura.kearns@aecom.com>; Farr, Nicola <nicola.farr@environment-agency.gov.uk>; Cobb, Kirsty <kirsty.cobb@aecom.com>
Subject: RE: Proposed Energy Centre Development at South Humber Bank Power Station
Importance: High

Good afternoon Rob,

I hope you are well.

In understand you attended a telecon last week (6th November, 9am) with my colleagues Laura Kearns and Kirsty Cobb. They mentioned you were going to further chase your internal Flood Modelling/Mapping team for the Humber breach model maximum water level information that I requested a while ago below.

Have they managed to respond to your query yet at all? We now urgently need to submit our final reports ready for planning submission on the 21st November. I therefore cannot complete the Flood Risk Assessment on time for review by the client unless we receive this information in the next couple of days.
Do you think it is at all possible that they will be able to provide it in that timeframe?

Many thanks.

Kind regards,
Helen Burton BSc (Hons), MCIWEM, C.WEM, CSci, CEnv
Principal Consultant | Water, Ports & Power | AECOM
Direct: +44 (0)1246 244 795
Mobile: +44 (0)7799 611 735

From: Burton, Helen
Sent: 06 September 2018 12:04
To: Eames, Rob <Rob.Eames@environment-agency.gov.uk>
Cc: Kearns, Laura <laura.kearns@aecom.com>; Metcalfe, Phil <Phil.Metcalfe@aecom.com>; Bolton, Alannah <Alannah.Bolton@aecom.com>; Campbell, Ian <ian.campbell@aecom.com>; nicola.farr@environment-agency.gov.uk
Subject: RE: Proposed Energy Centre Development at South Humber Bank Power Station

Good morning Rob,

Many thanks for providing the additional information and maps below. The difficulty with providing only depth bands in meters (m) is that if we apply those above varying LiDAR ground levels (GL), we cannot accurately define a consistent minimum level in meters Above Ordnance Datum (mAOD) above which the critical equipment and designated place of refuge at the site should be elevated to be considered safe in the unlikely event of a defence breach.

For example, see data for the 5 locations highlighted below. If I compare the EA 1m LiDAR against the 0.1% AEP to 2115 depth bands provided, this results in a large range in potential water levels (WL) (approx. 800 mm). I understand that the peak water level may vary slightly across a large area where the land exhibits a gradient, but the wider area is relatively flat so we would not expect such a large variance in ponded WLs behind defences. Even if we include a freeboard to account for the uncertainty (usually up to 300 mm requested by the EA), it leaves it widely open to interpretation as to which value to choose to apply that to, and being overly conservative may significantly increase costs to the developer.

ID	Breach_Max_Depth_m_1000YRCC	EA_LiDAR_1m_GL_mAOD	Estimated_Min_WL_mAOD	Estimated_Max_WL_mA
1	2.0 - 2.25	2.16085	4.16	4
2	2.5 - 2.75	1.9022	4.40	4
3	1.0 - 1.25	3.709	4.71	4
4	2.0 - 2.25	2.48981	4.49	4
5	1.75 - 2.0	2.6186	4.37	4

It is my understanding that any hydraulic model that produces an ASCII grid of depth results across the flood extent should also produce an ASCII grid of coincident WL/stage results in mAOD units, as it is from that which the model calculated the depths from above the ground terrain model that was used in the model geometry. If the EA do possess the breach model output ASCII grids with mAOD units, would it be possible for these to be provided across the site and local vicinity either in ASCII format via your 'Sharefile' facility, or in a plan illustrating the WLs in a grid of spot points across the site? From this we are intending to identify the highest WL in the areas proposed for development above which to recommend the equipment/safe place of refuge are elevated above. We usually receive this sort of information from other EA areas as part of a Product 6/8 data request.

If it is not possible to provide this, would the EA be able to recommend how we reconcile the large margin of potential inaccuracy incurred from the depth bands in relation to the widely varying GLs in the site boundary (1.9 to 3.7 mAOD) to determine the necessary recommendation?

I'll be in the office until 6pm today should you wish to discuss at my number below.
Many thanks.

Kind regards,
Helen Burton BSc (Hons), MCIWEM, C.WEM, CSci, CEnv
Principal Consultant | Water, Ports & Power | AECOM
Direct: +44 (0)1246 244 795

From: Eames, Rob [mailto:Rob.Eames@environment-agency.gov.uk]
Sent: 05 September 2018 17:58
To: Burton, Helen
Cc: Somerton, Joanne; Kearns, Laura; Bolton, Alannah; Campbell, Ian; Farr, Nicola
Subject: RE: Proposed Energy Centre Development at South Humber Bank Power Station

Hello Helen

I'm sorry for the confusion – I mistakenly thought the CCN was the information you were waiting for. Looking back at the minutes I can see we agreed to send you more detailed information to inform you of the depths on the site.

As the modelling shows that the depths are significantly greater than the 1.6m (+) maximum banding I have attached two breach depth maps – one for the 2115 0.5% (1 in 200) scenario and one for the 2115 0.1% (1 in 1000) scenario. I have reduced the bandings to 250mm and increased the number for the upper depths to cover the depths we discussed. I can't give you a definitive answer for depth but the maps will give you an idea of what the modelling has highlighted.

Unfortunately I'm not able to easily give you depths in mAOD. The breach hazard mapping is created without specific land levels being referenced in mAOD as the accuracy of this information is subject to change. You can however reference against the latest LIDAR available here.

If you want to discuss further please feel free to give me a ring on my number below. I am in the office tomorrow (Thursday) but out on Friday.

Kind regards

Rob

Robert Eames
Partnerships and Strategic Overview Officer, Lincolnshire and Northamptonshire Area
Environment Agency | Ceres House, 2 Searby Road, Lincoln, LN2 4DW
rob.eames@environment-agency.gov.uk
+44 (0) 2084 749436

www.gov.uk/floodsdestroy

From: Burton, Helen [mailto:helen.burton@aecom.com]
Sent: 03 September 2018 12:03
To: Eames, Rob <Rob.Eames@environment-agency.gov.uk>
Cc: Somerton, Joanne <joanne.somerton@aecom.com>; Kearns, Laura <laura.kearns@aecom.com>; Bolton, Alannah <Alannah.Bolton@aecom.com>; Campbell, Ian <ian.campbell@aecom.com>
Subject: Proposed Energy Centre Development at South Humber Bank Power Station

Good morning Rob,

I am working with Jo Somerton preparing the Flood Risk Assessment for the proposed South Humber Bank Energy Centre development north of Grimsby for which I understand you attended a meeting on the 17th July (see Environment Agency internal meeting notes that were circulated attached).

Following provision by the EA of the breach event depth maps behind the sea defences (your ref. CCN/2018/87235), I understand that the maps illustrate that the Site is potentially at a residual risk of flooding up to a depth of band of '>1.6 m', but you confirmed at the meeting that the approximate depth of would be in the

region of 2.2 to 2.4 m for the 1 in 200 to 1 in 1000 year events. It was noted in our minutes (also attached) that there was an action for you to subsequently forward us the more accurate depth information for the 1 in 200 and 1 in 1000 year events.

We are intending on specifying the level in mAOD at which the critical equipment and safe refuge area for people at the Site should be elevated above to in order to protect it from this residual risk. Therefore, would it possible for you to please send me the modelled maximum breach water levels in mAOD in the vicinity that results in these depths, rather than depth in m? According to the Table presented on page 10 of the CCN/2018/87235 PDF, I've assumed at present that the peak tide levels for these 2 events would be somewhere between 5.14 and 5.47 mAOD (interpolated been Haborough Marsh and Grimsby, but with a defence breach this may be lower once ponded behind the defences?

I've provided 2 figures to assist. Due to the length of time passed since this meeting, it would be greatly appreciated if you could provide this as at your earliest convenience to assist us in meeting the planning submission deadline.

I look forward to hearing from you.
Many thanks.

Kind regards,
Helen Burton (BSc Hons)**,** MCIWEM, C.WEM, C.Sci, C.Env
Principal Consultant | Water, Ports & Power
D +44-01246-244-795
M +44-07861-305-838
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T +44-01246-209 221
aecom.com

Imagine it. Delivered.

LinkedIn Twitter Facebook Instagram

Ms Cheryl Jarvis
Development Management
Engie/North East Lincolnshire Council
1 Origin Way
Grimsby
DN37 9TZ

Our ref: AN/2018/127698/01-L01
Your ref: DM/0575/18/SCO

Date: 03 August 2018

Dear Cheryl

Request for Scoping Opinion - construction and operation of an energy from waste power station with a maximum gross electrical output of 49.9 MW
South Humber Bank Power Station, South Marsh Road, Stallingborough, Grimsby

Thank you for consulting us on to the above Scoping Opinion Request.

We have reviewed the submitted Scoping Report (ref Scoping 1.0, AECOM) and consider the proposed content of the EIA appropriate in relation to issues within our remit, which include flood risk, hydrogeology and land contamination.

Environmental permitting
Operation of the proposed power station would be subject to an environmental permit under the Environmental Permitting (England and Wales) Regulations 2016. The applicant is fully aware of this and has already met with us and received permit pre-application advice.

Any importation of recycled materials for construction purposes may require appropriate permits or exemptions.

Flood risk – advice to the applicant
The report acknowledges that a Flood Risk Assessment (FRA) based on the requirements of the National Planning Policy Framework (NPPF) should be prepared to accompany the future planning application.

The FRA should consider all sources of flooding, which may include tidal, fluvial, ground water, drainage systems, reservoirs, canals and ordinary watercourses. It should demonstrate that the proposal will be safe for the lifetime of the development, without increasing risk elsewhere and where possible reducing flood risk overall. Evidence should be included that appropriate mitigation measures including flood resilience techniques have been incorporated into the development.

We note the applicant has already received a flood risk product from the Environment Agency. This includes coastal hazard mapping, which shows the consequences should a breach of the sea defences occur, including the potential flood depths, velocities and overall hazard over the lifetime of the development.

Areas behind sea defences are at particular risk from rapid onset of fast-flowing and deep water flooding, with little or no warning if defences are overtopped or breached. Our advice on mitigation measures for new development is based on the potential consequences of a breach over the lifetime of the development – the residual risk of flooding. We do not take into account the probability of defence failure, which is in line with current government guidance.

In this case we would not expect the whole of the proposed development be raised above breach flood levels. If land raising is undertaken on a large scale, we would want to see evidence in the FRA that flood risk has not been increased elsewhere.

The FRA should identify the vulnerability classification of the proposal, the expected lifetime of the development and whether or not the site needs to remain operational in a flood event.

For development defined as essential Infrastructure, all critical equipment should be located above the flood depths expected for the 0.1% (1 in 1000) scenario including climate change allowance depending on lifetime of development. The FRA should identify the types of equipment considered critical following discussion with the applicant.

To manage the safety of people at the site, an area or areas of safe refuge should be provided above the maximum potential breach flood depths and a flood warning and evacuation plan developed and agreed with the local authority.

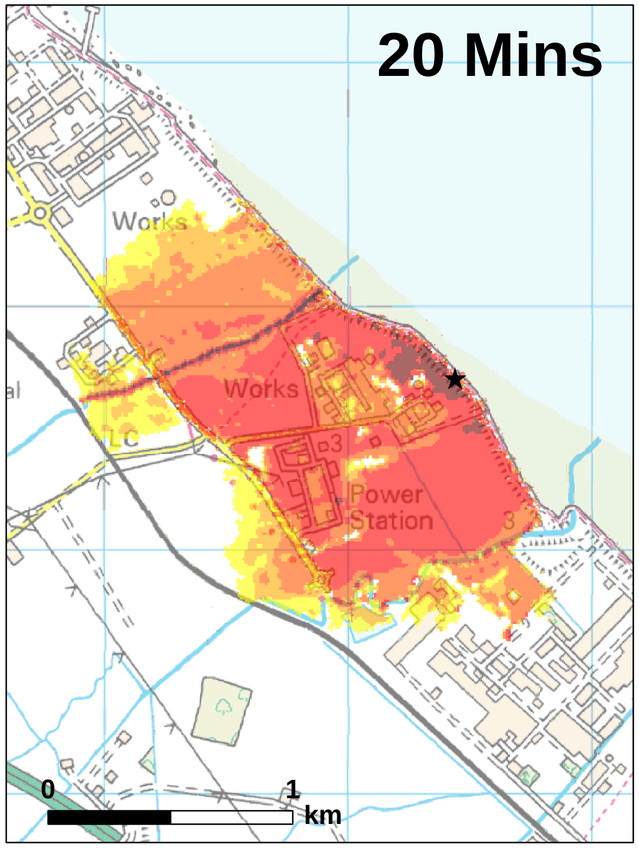
For other buildings, plant and equipment the FRA should identify appropriate mitigation based on the business needs of the operator. This would include resistance and resilience techniques in line with ‘Improving the flood performance of new buildings: flood resilient construction’.

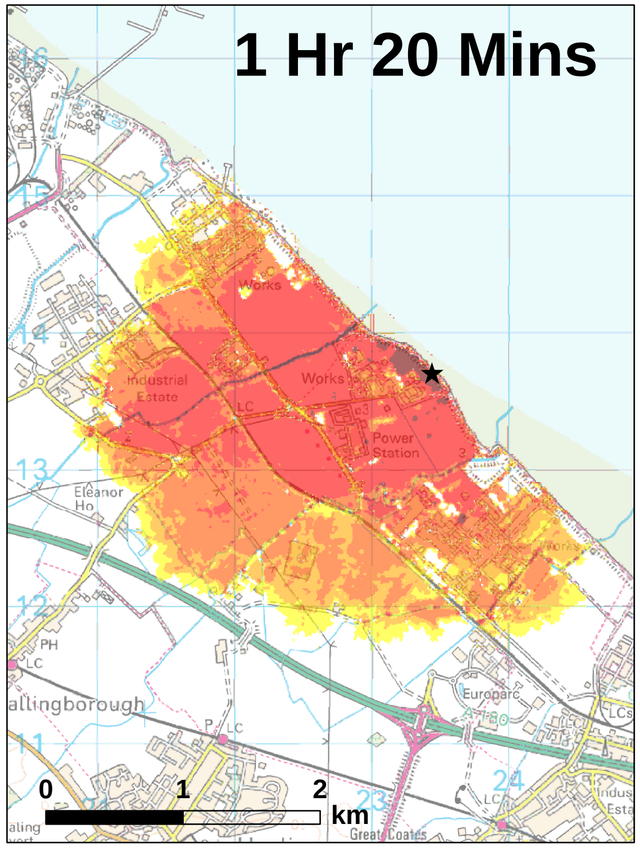
Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

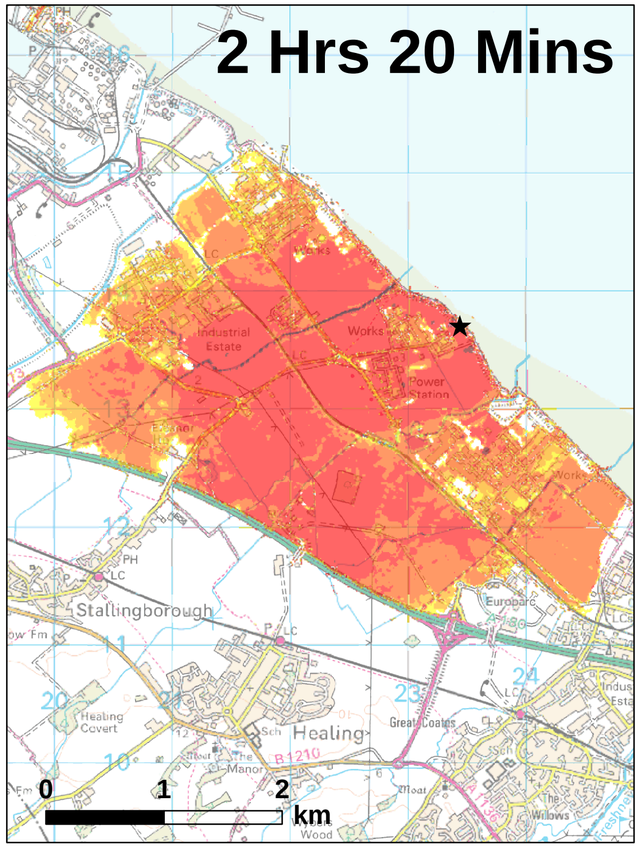
Yours sincerely

Nicola Farr
Sustainable Places - Planning Advisor

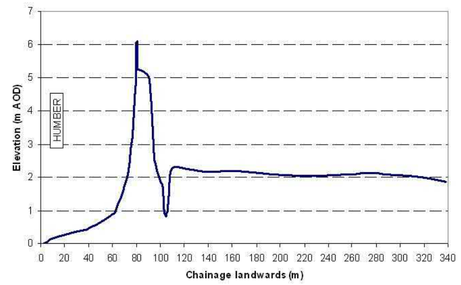
End

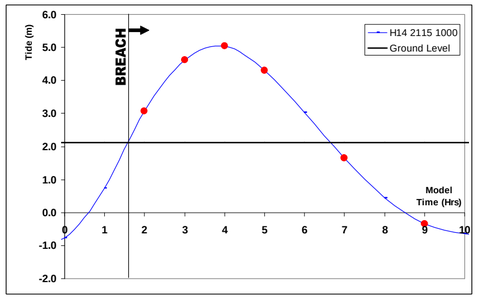


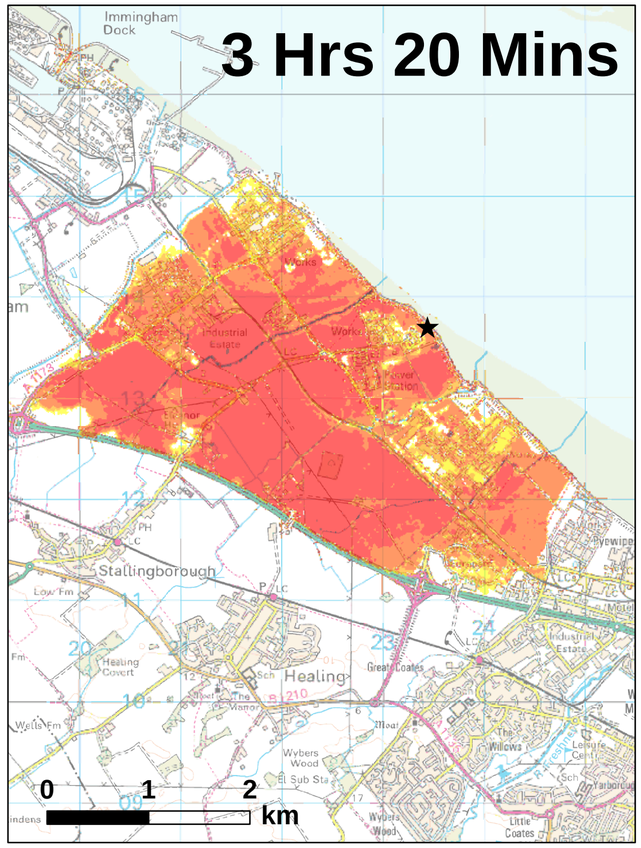


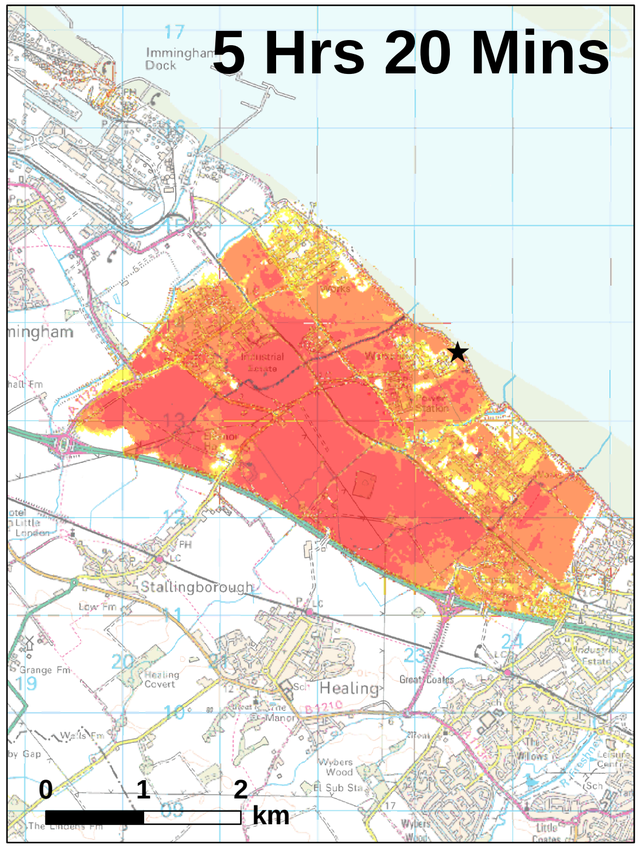


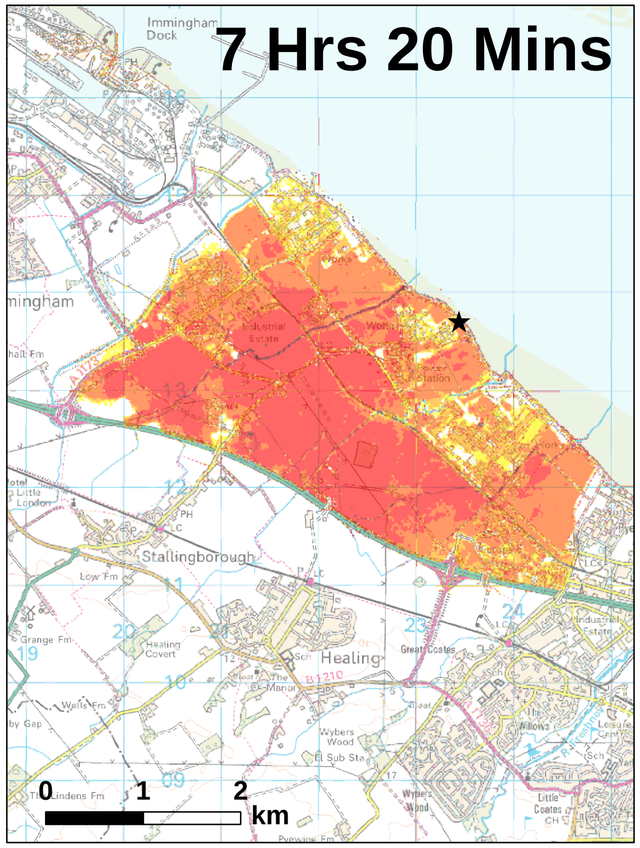
Legend		
Depth (m)	Breach	H14
0 - 0.25	Type	Earthbank
0.25 - 0.5	Near	South of Immingham
0.5 - 1	Width	50m
1 - 2	Storm	1000 years
>2	Year	2115











ALL MAP TIMES ARE DISPLAYED AS TIME AFTER A BREACH OCCURING

Mott MacDonald for Environment Agency

Hazard Mapping Northern Area AN785: DEPTH

ISSUE	PREPARED BY	CHECKED BY	APPROVED BY
1	KS	MP	SYE

DATE	PURPOSE OF MAP
SEPT 2009	Northern Tidal Flood Mapping

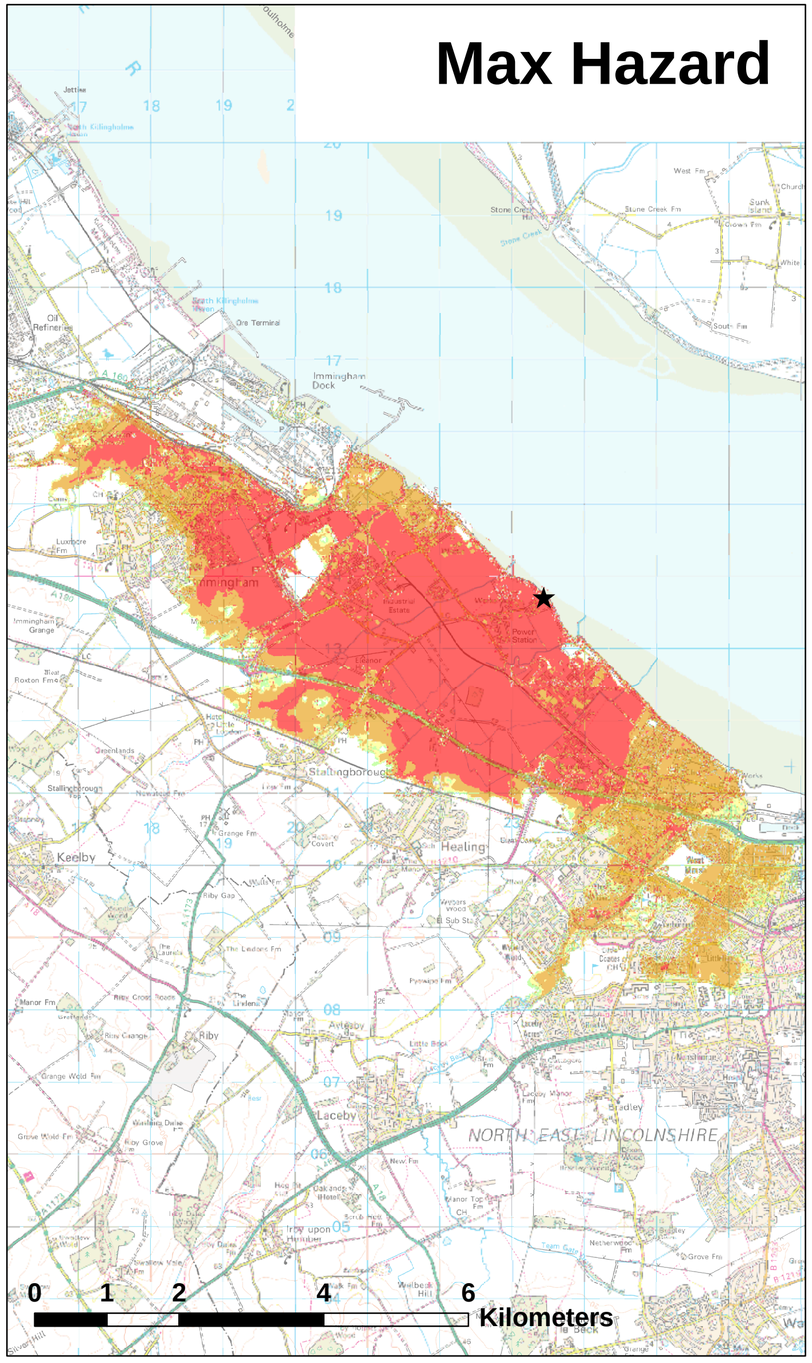
DIGITAL FILE PATH

P:\Cambridge\Demeter - Daedalus\WEM\PROJECTS\241496_Hazard Mapping\Report\Maps

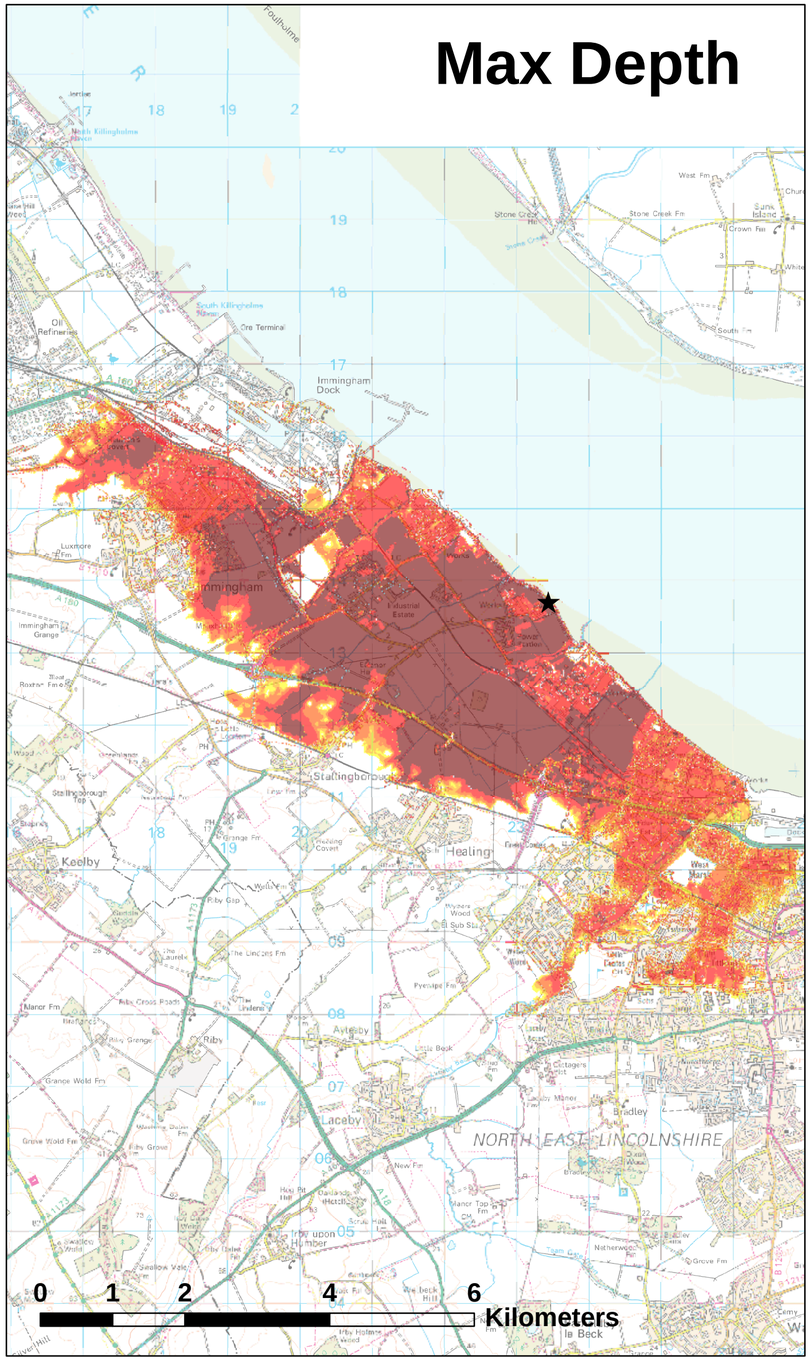
MAP REFERENCE (PROJECT NR./FIGURE NR./REVISION)

257248/H14.2115.1000/1

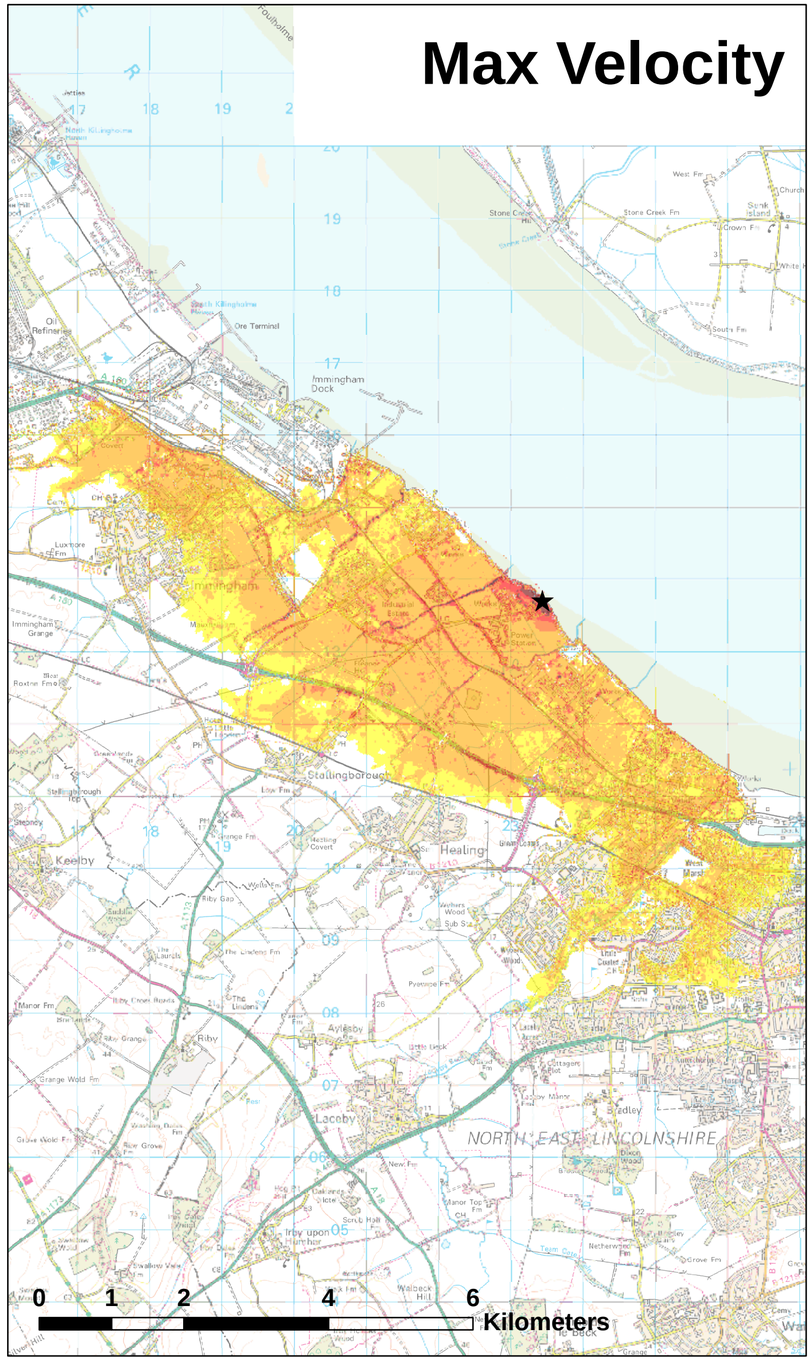
Max Hazard



Max Depth



Max Velocity



Hazard Rating

- 0 - 0.75
- 0.75 - 1.25
- 1.25 - 2
- >2

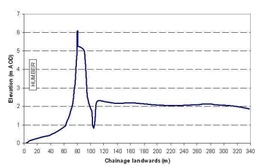
Depth (m)

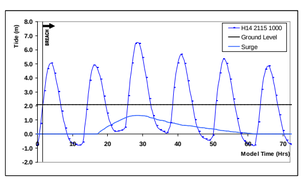
- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 2
- >2

Velocity (m/s)

- 0 - 0.3
- 0.3 - 1
- 1 - 1.5
- 1.5 - 2.5
- >2.5

Breach	**H14**	**Near**	**South of Immingham**	**Storm**	**1000 years**
Type	**Earth Bank**	**Width**	**50m**	**Year**	**2115**





Hazard Mapping Northern Area AN785: Maximums

ISSUE	PREPARED BY	CHECKED BY	APPROVED BY
1	KS	MP	SYE

DATE	PURPOSE OF MAP
SEPT 2009	Northern Tidal Flood Mapping

DIGITAL FILE PATH

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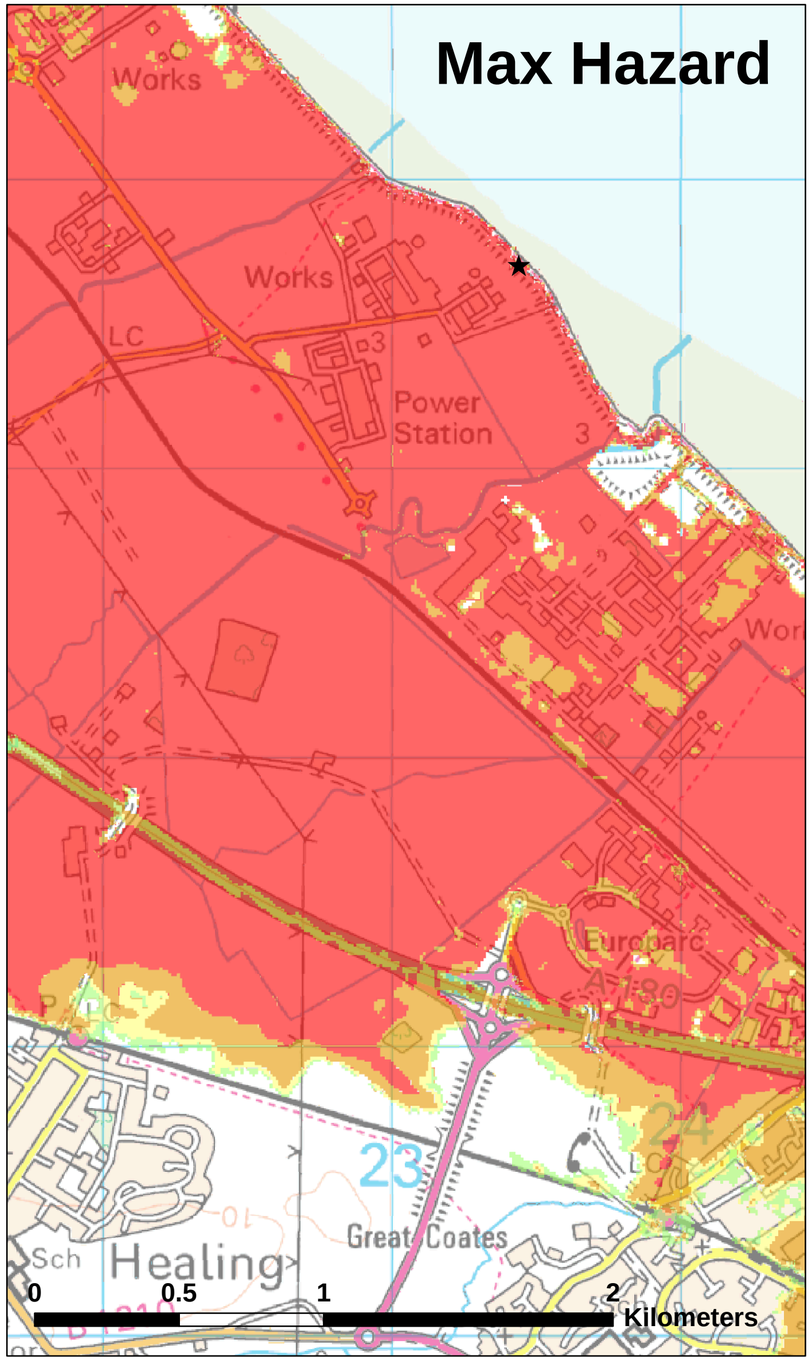
MAP REFERENCE (PROJECT NR./FIGURE NR./REVISION)

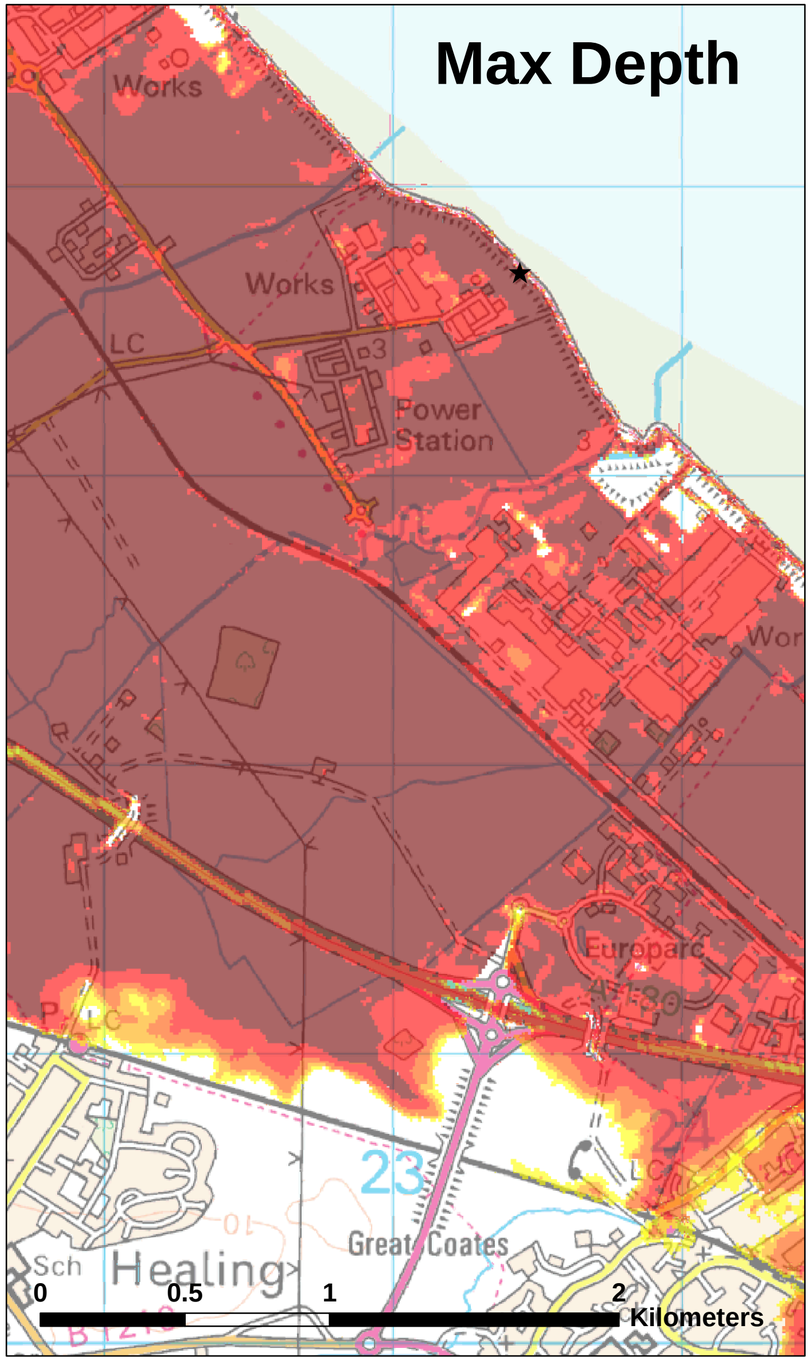
257248/H14.2115.1000/1

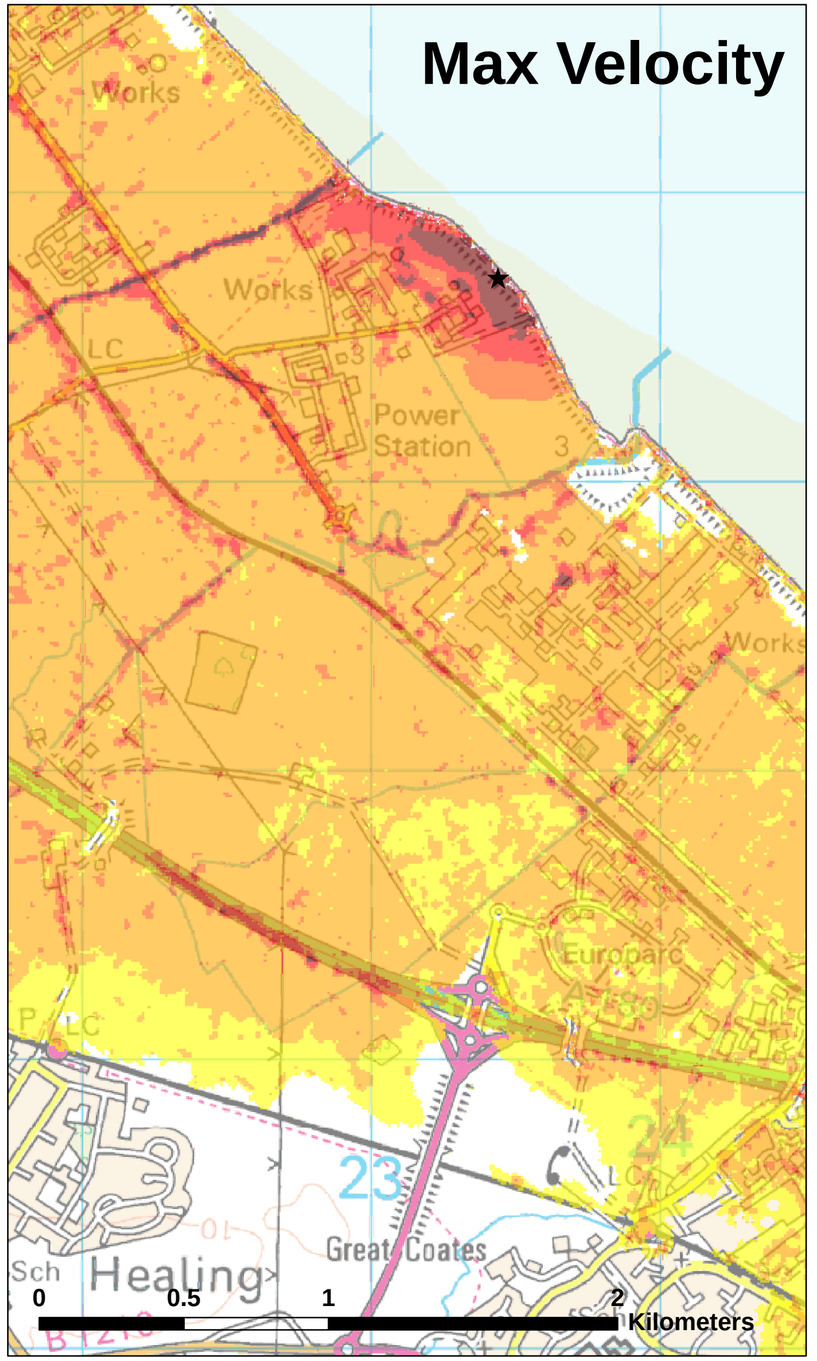
Mott MacDonald

for

Environment Agency







Hazard Rating

- 0 - 0.75
- 0.75 - 1.25
- 1.25 - 2
- >2

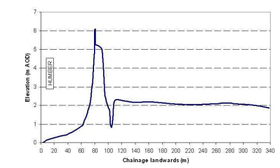
Depth (m)

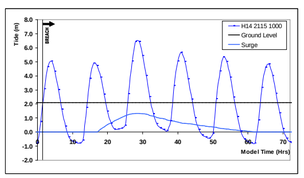
- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 2
- >2

Velocity (m/s)

- 0 - 0.3
- 0.3 - 1
- 1 - 1.5
- 1.5 - 2.5
- >2.5

Breach	**H14**	**Near**	**South of Immingham**	**Storm**	**1000 years**
Type	**Earth Bank**	**Width**	**50m**	**Year**	**2115**





Hazard Mapping Northern Area AN785: Maximums

ISSUE	PREPARED BY	CHECKED BY	APPROVED BY
1	KS	MP	SYE

DATE	PURPOSE OF MAP
SEPT 2009	Northern Tidal Flood Mapping

DIGITAL FILE PATH

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MAP REFERENCE (PROJECT NR./FIGURE NR./REVISION)

257248/H14.2115.1000/1

Mott MacDonald

for

Environment Agency

ANNEX 2: NORTH EAST LINDSEY INTERNAL DRAINAGE BOARD CONSULTATION

Burton, Helen

From:	Richard Wright <richard.wright@witham3idb.gov.uk>
Sent:	16 October 2018 10:36
To:	Burton, Helen
Cc:	Guy Hird; Martin Shilling
Subject:	RE: Application Number: DM/0575/18/SCO - South Humber Bank Power Station South Marsh Road Stallingborough Grimsby North East Lincolnshire DN41 8BZ

ND-4146-2018-PLN

Morning Helen,

RE: Application Number: DM/0575/18/SCO - South Humber Bank Power Station South Marsh Road Stallingborough Grimsby North East Lincolnshire DN41 8BZ

Thank you for your email of the 5th October 2018 regarding the above project, we confirm the suggested '1 in 1 Total Runoff from Existing Site' of 5l/s has been deemed acceptable.

As you have previously noted, Under the terms of the Board's Byelaws, the prior written consent of the Board is required for the introduction of any water into the District whether directly or indirectly. Additionally, the prior written consent of the Board is required for any proposed temporary or permanent works or structures in, under, over or within the byelaw distance of the top of the bank of a Board maintained watercourse.

All drainage routes through the Site should be maintained both during the works on Site and after completion of the works. Provisions should be made to ensure that upstream and downstream riparian owners and those areas that are presently served by any drainage routes passing through or adjacent to the Site are not adversely affected by the development. Drainage routes shall include all methods by which water may be transferred through the Site and shall include such systems as "ridge and furrow" and "overland flows". The effect of raising Site levels on adjacent property must be carefully considered and measures taken to negate influences must be approved by the Local Planning Authority.

Regards,

Richard Wright

Engineering Services Technician

Office: +44 (0) 1522 697123

Witham & Humber Internal Drainage Boards,
Witham House
J1 The Point
Weaver Road
Lincoln
LN6 3QN

www.northeastlindsey-idb.org.uk
www.witham3idb.gov.uk
www.upperwitham-idb.gov.uk
www.witham-1st-idb.gov.uk

From: Burton, Helen <helen.burton@aecom.com>
Sent: 05 October 2018 13:23
To: Planning and Consents <planning@witham3idb.gov.uk>
Cc: Cobb, Kirsty <kirsty.cobb@aecom.com>; Campbell, Ian <ian.campbell@aecom.com>; Nicoll, Chris <chris.nicoll@aecom.com>; Kearns, Laura <laura.kearns@aecom.com>
Subject: Application Number: DM/0575/18/SCO - South Humber Bank Power Station South Marsh Road Stallingborough Grimsby North East Lincolnshire DN41 8BZ

FAO Mr. Guy Hird
RE: Application Number: DM/0575/18/SCO - South Humber Bank Power Station South Marsh Road Stallingborough Grimsby North East Lincolnshire DN41 8BZ

Good afternoon Guy,

I have been co-ordinating production of the Flood Risk Assessment (FRA) and Outline Drainage Strategy that will be appended to the Environmental Statement for the proposed development detailed above. Thank you for your response to the EIA Scoping consultation attached. In response to this, I wish to confirm with the North East Lindsey IDB an agreement in principle to our outline approach that that the Proposed Development will include attenuation of surface water runoff on-site (SuDS) and the discharge to the local IDB land drains around the perimeter of the Site will be controlled to greenfield runoff rates, such that there will be no change to the existing situation.

The existing surface water greenfield runoff rates for the Proposed Development area within the Site (6.5Ha) as depicted in the attached plan were calculated (please note that this location plan is confidential at the pre-planning application stage, please therefore do not distribute this further). The table below details the existing runoff rates that were calculated using the ReFH2 method during the 1 in 1 annual probability (AP), 1 in 30 AP and 1 in 100 AP rainfall events including climate change using the FEH2013 rainfall profiles as recommended by the Environment Agency's latest Flood Estimation Guidelines (May 2017). It is proposed that an outfall structure from the proposed attenuation SuDS feature will be designed to limit the discharge to these rates. In principle, does this approach meet North East Lindsey IDB's requirements?

Table 1: Calculated Greenfield Surface Water Runoff Rates for the Proposed Development Area within the Site (6.5 Ha)

Rainfall Event (1 in X Annual Probability)	**Greenfield Runoff Rate (ReFH2) (l/s/Ha)**	**Total Runoff from the Existing Site (6.5 Ha) (l/s)**
1 in 1	0.5	3.2* *(5)*
1 in 30	1.2	7.8
1 in 100	1.6	10.2
1 in 100 + 50% for climate change**	2.4	15.6

*the minimum achievable discharge from outfall control structures, for example a HydroBrake, is usually 5 l/s

**as per the requirements of the EA latest climate change allowances for FRAs (February 2016)

As part of the detailed design stage for the drainage system, the exact extent of new impermeable area and the associated surface water runoff volumes from the proposed development required to be attenuated within the SuDS feature will be confirmed to maintain these rates. At that stage we will contact you and NELC again to consult

further regarding discharge consent to the local land drains around the perimeter of the Site and potential adoption of the SuDS feature respectively.

I look forward to hearing from you soon at your earliest convenience.
Many thanks.

Kind regards,
Helen Burton (BSc Hons)**,** MCIWEM, C.WEM, C.Sci, C.Env
Principal Consultant | Water, Ports & Power
D +44-01246-244-795
M +44-07861-305-838
helen.burton@aecom.com
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aecom.com

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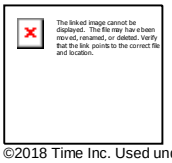

Consultee Comments for Planning Application DM/0575/18/SCO

Application Summary
Application Number: DM/0575/18/SCO
Address: South Humber Bank Power Station South Marsh Road Stallingborough Grimsby North East Lincolnshire DN41 8BZ
Proposal: Request for Scoping Opinion - Construction and operation of an energy from waste power station with a maximum gross electrical output of 49.9 MW
Case Officer: Cheryl Jarvis

Consultee Details
Name: Mr Guy Hird
Address: North East Lindsey IDB, Lincoln LN6 3QN
Email: planning@witham3idb.gov.uk
On Behalf Of: North East Lindsey Drainage Board

Comments
ND-4156-2018-PLN

Thank you for the opportunity to comment on the above application. The site is within the North East Lindsey Drainage Board area. It is within the catchment of the Board maintained Middle Drain Pumping Station.

No development should be commenced until the Local Planning Authority has approved a scheme for the provision, implementation and future maintenance of a surface water drainage system. The Board would support the use of SuDS and the drainage policies of NELC. Any discharge should be limited to the greenfield rate, however Middle Drain Pump Station was designed to allow for areas of development (to the design standard of the day). Any potential increase in discharge would be subject to the drainage system being able to convey the flows (modelling required) and a development charge payable to the Board.

Under the terms of the Land Drainage Act. 1991 the prior written consent of the Board is required for any proposed temporary or permanent works or structures within any watercourse including infilling or a diversion.

ANNEX 3: NORTH EAST LINCOLNSHIRE COUNCIL CONSULTATION

Consultee Comments for Planning Application DM/0575/18/SCO

Application Summary
Application Number: DM/0575/18/SCO
Address: South Humber Bank Power Station South Marsh Road Stallingborough Grimsby North East Lincolnshire DN41 8BZ
Proposal: Request for Scoping Opinion - Construction and operation of an energy from waste power station with a maximum gross electrical output of 49.9 MW
Case Officer: Cheryl Jarvis

Consultee Details
Name: Mr Dan Harrison
Address: Origin Two, 2 Origin Way, Healing Grimsby, North East Lincolnshire DN37 9TZ
Email: daniel.harrison@nelincs.gov.uk
On Behalf Of: Drainage

Comments
This development will require sustainable surface water drainage techniques to be used.

D04 Provision of Drainage - Surface Water

No development approved by this permission shall be commenced until a scheme for the provision of surface water drainage works has been approved in writing by the Local Planning Authority. Such scheme shall be implemented to the satisfaction of the Local Planning Authority.

Reason: To prevent the increased risk of flooding by ensuring the provision of a satisfactory means of surface water disposal.

ANNEX 4: ANGLIAN WATER CONSULTATION

Anglian Water Services Ltd
Thorpewood House
Thorpewood
Peterborough
PE3 6WT

Tel 0345 0265 458
www.anglianwater.co.uk

North East Lincs District Council

Sent by email.

15 August 2018

Scoping Opinion – South Humber Bank DM-0575-18

Thank you for the opportunity to comment on the scoping report for the above development. Anglian Water is the sewerage and water undertaker for the proposed site.

Construction Phase

It is unclear at this stage what the requirement for wastewater services will be during the construction phases. Discussions with Anglian Water should take place as soon as possible to ensure this issue is considered.

Water Resources and Flood Risk

We would recommend that reference is made to the existing foul sewerage networks and sewerage treatment.

The use of sustainable drainage systems for the development is encouraged. There is information regarding SuDS available on our website via the following link: http://www.anglianwater.co.uk/developers/suds.aspx

Pre Planning

Anglian Water would encourage early engagement with the developer in order to address foul water infrastructure issues.

We provide a pre-planning service for used water to identify feasible drainage solutions. Further details of the service provided by Anglian Water is available to view at the following address: :
http://www.anglianwater.co.uk/developers/pre-planning-service-.aspx

If you wish to discuss any aspect of this response please do not hesitate to contact me.

Registered Office
Anglian Water Services Ltd
Lancaster House, Lancaster Way,
Ermine Business Park, Huntingdon,
Cambridgeshire. PE29 6YJ
Registered in England
No. 2366656.

an AWG Company

Hannah Wilson
Pre-Development Planning Manager