Environmental Statement: Volume III

Appendix 12A: Flood Risk Assessment

VPI Immingham OCGT Project

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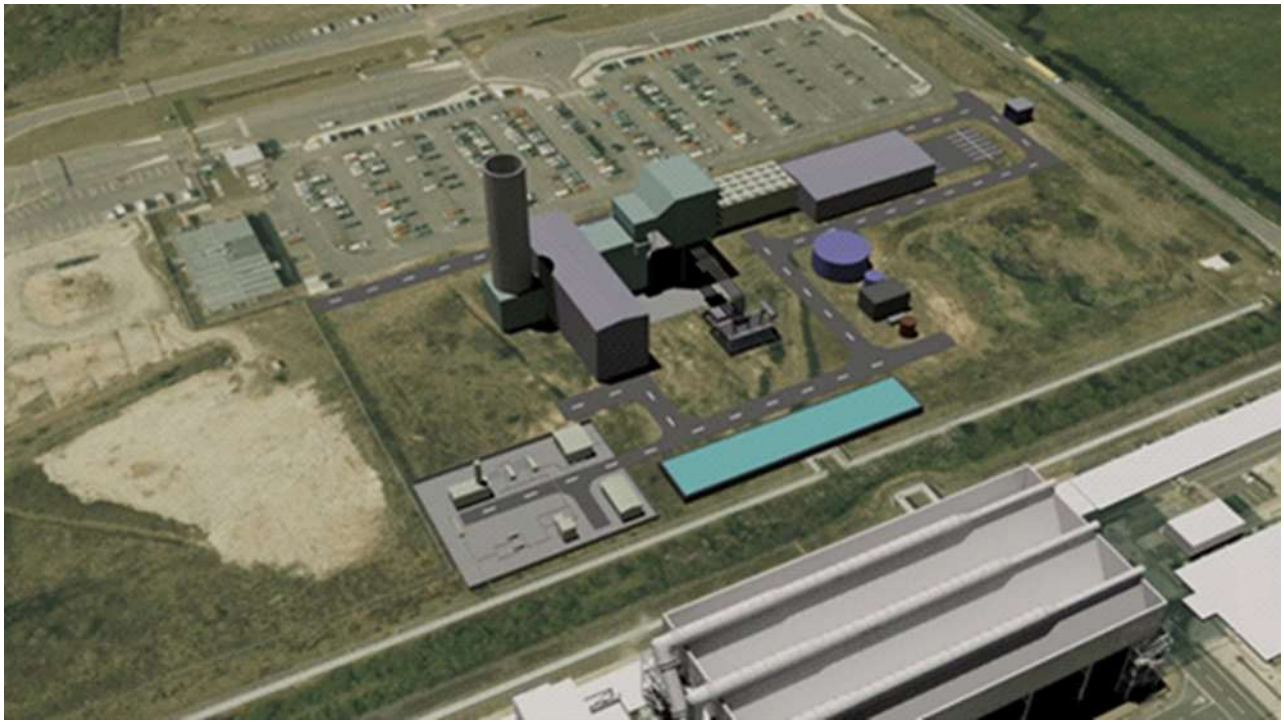
The Immingham Open Cycle Gas Turbine Order

Land to the north of and in the vicinity of the VPI Immingham Power Station, Rosper Road, South Killingholme, Lincolnshire, DN40 3DZ

Environmental Statement Volume III
Appendix 12A: Flood Risk Assessment

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(e)



Applicant: VPI Immingham B Ltd

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GLOSSARY

Abbreviation	Description
AEP	Annual Exceedance Probability
AGI	Above Ground Installation
AOD	Above Ordnance Datum
bgl	below ground level
BGS	British Geological Survey
CDA	Critical Drainage Area
CEMP	Construction Environmental Management Plan
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association.
CHP	Combined Heat and Power
CRT	Canals and River Trust
DCO	Development Consent Order
DDF	Depth/Duration/Frequency
EA	Environment Agency
EMR	Energy Market Reform
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FWD	Flood Warning Direct
FWEP	Flood Warning and Evacuation Plan
GW	Gigawatts
ha	Hectare
HFRMS	Humber Flood Risk Management Strategy
IED	Industrial Emissions Directive
IDBs	Internal Drainage Boards
km	Kilometre
LDF	Local Development Framework
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
m	metres
MW	Megawatts
NGR	National Grid Reference
NPPF	National Planning Policy Framework
NELC	North East Lincolnshire Council
NELIDB	North East Lindsey Internal Drainage Board
NLC	North Lincolnshire Council
NPPG	National Planning Policy Guidance
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project

Abbreviation	Description
OCGT	Open Cycle Gas Turbine
OS	Ordnance Survey
PEI	Preliminary Environmental Information
PIG	Pipe Inline Gauging
PFRA	Preliminary Flood Risk Assessment
PINS	Planning Inspectorate
PPG	Planning Practice Guidance
ReFH2	Revitalised Flood Hydrograph model 2
SFRA	Strategic Flood Risk Assessment
SoS	Secretary of State
SuDS	Sustainable Urban Drainage System

CONTENTS

TABLES

1.0 INTRODUCTION

1.1 Background

1.1.1 AECOM Infrastructure and Environment Ltd (AECOM) has been commissioned by VPI Immingham B Ltd ('the Applicant') to prepare this Flood Risk Assessment (FRA) to accompany a Development Consent Order (DCO) application for a new Open-Cycle Gas Turbine (OCGT) Power Station on land to the north of the Existing VPI CHP Plant at South Killingholme, Immingham Rosper Road, South Killingholme, Immingham, DN40 3DZ (the 'Proposed Development').

1.1.2 The land associated with the Proposed Development (the 'Site') consists of several parcels of land, with the principal development (the OCGT Power Station) taking place on a primarily undeveloped parcel of land of approximately 2.6 hectares (ha) (the OCGT Power Station Site) located to the north of the Existing VPI CHP Plant. The location of the site and the areas within it are shown of Figures 1.1 and 3.1 of the Environmental Statement Volume II (Document Reference 6.3).

1.1.3 The DCO would provide the necessary authorisations and consents for the construction, operation and maintenance of the Proposed Development. The main components of the Proposed Development are summarised below:

- Work No. 1 – an OCGT power station (the 'OCGT Power Station') with a gross electrical output capacity of up to 299MW;
- Work No. 2 – access works (the 'Access'), comprising access to the OCGT Power Station Site and access to Work Nos. 3, 4, 5 and 6;
- Work No. 3 – temporary construction and laydown area ('Temporary Construction and Laydown') comprising hard standing, laydown and open storage areas, contractor compounds and staff welfare facilities, vehicle parking, roadways and haul routes, security fencing and gates, gatehouses, external lighting and lighting columns;
- Work No. 4 – gas supply connection works (the 'Gas Connection') comprising an underground and overground gas pipeline of up to 600 millimetres (nominal internal diameter) and approximately 800 m in length for the transport of natural gas from the Existing Gas Pipeline to Work No. 1;
- Work No. 5 – an electrical connection (the 'Electrical Connection') of up to 400 kilovolts and controls systems; and
- Work No 6 – utilities and services connections (the 'Utilities and Services Connections').

1.1.4 More detail on the elements of the Proposed Development is included in Chapter 4: The Proposed Development (Environmental Statement (ES) Volume I, DCO Document Reference 6.2).

1.1.1 In addition to the Site, the Application includes provision for the use of an existing gas pipeline (the 'Existing Gas Pipeline') to provide fuel (gas) to the Proposed Development. The Existing Gas Pipeline runs from the Existing AGI Site to an existing tie in the National Grid (NG) Feeder No.9 located to the west of South Killingholme.

1.1.2 The Applicant is not seeking consent to carry out any works to the Existing Gas Pipeline; however, it is included in the Order Land of the DCO application on the basis that the Applicant is seeking powers of compulsory acquisition over it, to use and maintain it to ensure that the Proposed Development can operate. The area of land covered by the Existing Gas Pipeline, including a stand-off either side of it, is hereafter referred to as the 'Existing Gas Pipeline Site'. The Site and the Existing Gas Pipeline Site are collectively referred to as the 'Project Land'.

1.1.3 The Environment Agency (EA) Flood Map for Planning[1] (refer to Annex 2) shows the flood zone extent in the vicinity of the Site. Table 12A-1 summarises the areas of the Site and the associated flood zone..

Table 12A-1 Work Area and Associated Flood Zones

Work Area	Associated Flood Zone*
OCGT Power Station	Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding).
Access	Eastern section - Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding), Western section - Flood Zone 2 (medium risk from tidal and/or fluvial flooding).
Temporary Construction Laydown	East of the Existing VPI CHP Plant - Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding), North of the OCGT Power Station – Predominantly in Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding) with a small area to the west located in Flood Zone 2 (medium risk from tidal and/or fluvial flooding) and Flood Zone 1 (low risk from tidal and/or fluvial flooding). North west of the OCGT Power Station –Flood Zone 1 (low risk from tidal and/or fluvial flooding).
Gas Connection	Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding).
Electrical Connection	Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding).
Utilities and Services Connection	Flood Zone 3a (high risk of flooding from tidal and/or fluvial flooding).

Note *See Table 1-2 for full definitions of Flood Zones

1.1.4 No parts of the Proposed Development are located within an area defined as Functional Floodplain (Flood Zone 3b). The definition of Flood Zones, in accordance with the Planning Practice Guidance[2] (PPG) are summarised in Table 12A-2.

1.1.5 Although the flood mapping shows the Site in Flood Zone 3a, the area is in fact protected by flood defences.

[1] Environment Agency. *Flood Map for Planning*. Available at: https://flood-map-for-planning.service.gov.uk/

[2] Communities and Local Government, (2014); *Planning Practice Guidance*. Available at: http://planningguidance.planningportal.gov.uk

Table 12A-2 EA 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% Annual Exceedance Probability (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 based on flood modelling of a 5% AEP event (1 in 20 chance of flooding in any one year) or greater, or land purposely designed to be flooded in an extreme flood event (0.1% AEP).

1.1.6 Paragraph 5.7.4 of the Overarching National Policy Statement for Energy (EN-1)[3] states that planning applications for energy projects of 1 hectare 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. This approach is also confirmed within the National Planning Policy Framework[4] for Sites of 1 hectare or greater in Flood Zone 1 in England and all proposals for energy projects located in Flood Zones 2 and 3.

1.2 Scope of Study

1.2.1 The aim of this FRA is to undertake a flood risk study that is appropriate to the nature and scale of the Site. The FRA considers the risk of flooding from all sources, including, tidal, fluvial, surface water flow, artificial sources, groundwater, and sewerage and drainage infrastructure, assesses how the Proposed Development will affect flood risk to the Site and surroundings, and recommends suitable mitigation measures, where required.

1.2.2 The objectives of the FRA are to:

- Collect and review existing information relating to the flood risk posed to the Site from all sources (including tidal, fluvial, surface water, groundwater, artificial sources and sewerage and drainage infrastructure);

[3] Department of Energy and Climate Change (2011), *Overarching National Policy Statement for Energy (EN-1)*. (available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf [Accessed August 2018])

[4] Ministry of Housing, Communities and Local Government (2019) *National Planning Policy Framework*

- Consult with North Lincolnshire Council (NLC), in their role as the Lead Local Flood Authority (LLFA), North East Lindsey Internal Drainage Board (NELIDB) and the EA in relation to flood risk and their requirements for management of any risk;
- Assess the flood risk to the Proposed Development under both existing and post-development conditions (taking into account climate change), including assessing the impact that the development may have on flood risk elsewhere; and
- Outline any mitigating measures needed to ensure the Proposed Development will be safe for the lifetime of the development and will meet the requirements of the NPPF.

1.3 Data Sources

1.3.1 The baseline conditions for the Site have been established through a desk study and via consultation with the EA, NELIDB and NLC, where required. This information has been utilised to inform the assessment made within the FRA.

1.3.2 Data collected during the course of this assessment is described in Table 12A-3.

Table 12A-3 Sources of data

Purpose	Source	Comments
Identification of Hydrological Features	1: 10,000 Ordnance Survey (OS) mapping	Identifies the location of local hydrological features
Identification of Land Use	Street Check	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 Planning1	Identifies fluvial/ tidal inundation extents
	EA Longterm Risk of Flooding Map[5]	Identification of flood risk from surface water and provides information on the risk of flooding from reservoirs (artificial sources)
	EA Groundwater Conditions Map[6]	Identification of groundwater designations through geology
	British Geological Survey (BGS) records[7]	Provides details of geology and hydrogeology in the vicinity of the Site

[5] Environment Agency. *Longterm Risk of Flooding Map* Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=SurfaceWater

[6] Environment Agency. *Groundwater*. Available at: http://magic.defra.gov.uk/MagicMap.aspx

[7] British Geological Survey. *Geology Viewer* Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Purpose	Source	Comments
	North Lincolnshire Preliminary Flood Risk Assessment[8] (PFRA)	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[9] (SFRA)	Assesses local flood risk from fluvial/tidal, sewers, overland flow, groundwater and artificial sources
	North Lincolnshire Local Flood Risk Management Strategy[10] (LFRMS)	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.
	Grimsby and Ancholme Catchment Flood Management Plan[11] (CFMP)	Outlines flood risk sources within the plan area and how these may be managed in the future.
Identification of Historical Flooding	North Lincolnshire PFRA	Details of historical flooding and local flooding records
	North and North East Lincolnshire SFRA	
	North Lincolnshire LFRMS	
	Environment Agency pre-development response	
Details of the Scheme	Indicative Development Plans (Annex1)	Provides the layout of the Proposed Development
Surface Water Drainage	1:10,000 OS Mapping	Identified existing site drainage, public drainage system near the Site and details of existing surface water runoff from the site. Conceptual surface water management design based on Site layout

[8] Entec (2011). *North Lincolnshire Preliminary Flood Risk Assessment*. Available at: http://webarchive.nationalarchives.gov.uk/20140328094437/http://www.environment-agency.gov.uk/research/planning/135526.aspx#15

[9] North Lincolnshire Council and North East Lincolnshire Council (2011). *North and North East Lincolnshire Strategic Flood Risk Assessment*. Available at: http://www.planning.northlincs.gov.uk/PlanningReports/SFRA/2011/SFRA_November_2011.pdf

[10] Amec Foster Wheeler (2016). *North Lincolnshire Council Local Flood Risk Management Strategy*. Available at: http://www.northlincs.gov.uk/transport-and-streets/roads-highways-and-pavements/flooding-drains/local-flood-risk-management-strategy/

[11] Environment Agency (2009). *Grimsby and Ancholme Catchment Flood Management Plan*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/288839/Grimsby_and_Ancholme_Catchment_Flood_Management_Plan.pdf

2.0 SITE INFORMATION

2.1 Site Location and Context

2.1.1 The Site is primarily located on land immediately to the north of the Existing VPI CHP Plant Site, as previously stated. Immingham Dock is located approximately 1.5 kilometres ('km') to the south east of the Site at its closest point. The Humber ports facility is located approximately 500 metres ('m') north and the Humber Refinery is located approximately 500m to the south.

2.1.2 The villages of South Killingholme and North Killingholme are located approximately 1.4 km and 1.6 km to the west of the Site respectively, and the town of Immingham is located approximately 1.8 km to the south east. The nearest residential property comprises a single house off Marsh Lane, located approximately 325 metres ('m') to the east of the Site.

2.1.3 The Site is located entirely within the boundary of the administrative area of North Lincolnshire Council (a unitary authority)

The Site

2.1.4 The Site consists of an undeveloped parcel of land of approximately 11.1 ha located predominantly between the Existing VPI CHP Plant to the south, and Rosper Road to the east. The Order Limits includes some areas of the Existing VPI CHP Plant (i.e. the proposed gas and electrical connection areas, access and temporary construction laydown area to the east). Immediately to the north of the Site there is a private car park and a number of single storey structures associated with access to the TLOR. This is owned and operated by Total, as is the Oil Refinery.

2.1.5 The surrounding land uses are as follows:

- **North:** The Site is bounded to the north by the current car park and access to the TLOR. North of this is a drainage ditch and a training centre associated with the TLOR;
- **South:** To the south of the Site is an area of vacant land and the railway spur with the Humber Refinery on the other side;
- **East:** Rosper Road, with agricultural fields on the other side; and
- **West:** To the west of the Site is an area of land that is currently subject to a planning application to North Lincolnshire Council (reference PA/2018/918P) by a sister company of the Applicant for a <50MW gas fired power station. Beyond that area is a pond associated with the surface water management of TLOR, the railway spur servicing the refinery and TLOR itself.

The Surrounding Area

2.1.6 The Site is located in an area comprising a mix of industrial and agricultural activities. In addition to the activities identified above, the land to the east of the Site on the other side of Rosper Road comprises agricultural fields extending approximately 1km toward the Humber Estuary before industrial activities associated with the storage and export of gas

and oil and other port activities commence along the banks of the estuary itself, approximately 1.4km from the Site at is closest point.

2.1.7 A railway spur runs north-south to the immediate west of the Site. This spur services the TLOR and joins the main line approximately 400m south west of the Site. This line is the principal railway line in north east Lincolnshire running between Cleethorpes and Barton on Humber.

2.2 Topography

2.2.1 A topographic survey of the OCGT Power Station Site indicates the site slopes from north to south and from north west to south east, with levels ranging from approximately 5.86m Above Ordnance Datum (AOD) to 3.94m AOD.

2.2.2 Localised areas of higher land (thought to be spoil stored on site with maximum ground levels of 6.3m AOD) are present within the OCGT Power Station Site boundary to the south and south east.

2.2.3 Ground levels increase to 6.67m AOD to the north west of the Site.

2.2.4 Spot levels on OS mapping show ground levels at the junction of Rosper Road and Station Road, to the north of the Site, are approximately 6m AOD whilst at the junction of Rosper Road and Marsh Lane, to the south east of the Site ground levels are approximately 4m AOD.

2.2.5 Ground levels are shown to increase from east to west in the general area.

2.3 Local Water Features

2.3.1 The following notable watercourses have been identified in close proximity to the Site:

- A land drain running east to west through the corridor of land between the OCGT Power Station Site and the Existing VPI CHP Plant;
- A land drain running parallel with and adjacent to the eastern OCGT Power Station Site boundary and Rosper Road;
- A land drain running parallel with and directly adjacent to the Access Area and approximately 105m to the north of the OCGT Power Station Site boundary;
- A land drain running from north to south approximately 138m to the west of the OCGT Power Station Site boundary;
- A series of land drains approximately 129m to the west of the Site;
- A series of land drains approximately 145m to the north of the Site;
- Watercourse 9A located approximately 100m south of the Existing VPI CHP Plant (south drain) and to the east of the Site adjacent and parallel to Rosper Road (north drain);
- Watercourse 9 located to the east of Rosper Road approximately 23m from the Site to the east of the Existing VPI CHP Plant;

- Watercourse 8G crossed by the existing pipeline route south of Manor Farm in South Killingholme;
- The Humber Estuary, located approximately 1.4km to the west;
- A water storage lagoon and settlement lagoon, approximately 160m to the west and 175m to the south west of the OCGT Power Station Site, located within the TLOR Site boundary; and
- Rosper Road Pools, an artificial flood relief reservoir, located approximately 660m to the south east of the Site.

2.3.2 In addition, the area surrounding the Site is drained via a network of small land drainage ditches that convey surface water from the surrounding greenfield areas located between the Site and the Humber Estuary.

2.4 The Proposed Development

2.4.1 The Proposed Development comprises the construction and operation of a gas-fired OCGT power station with a gross electrical output of up to 299MW. The power station will not be designed to run continuously but to run intermittently to respond quickly to shorter term periods of high electrical demand.

2.4.2 The design of the Proposed Development incorporates a degree of flexibility in the dimensions and configuration of structures and buildings to allow for the selection of the preferred technology and contractor. This allows the Applicant to optimise the plant to help meet UK energy demands.

2.4.3 For example, as well as choosing which option will be developed, the scale of the buildings within the Proposed Development may vary depending upon the contractor appointed and their specific selection and configuration of the plant and process equipment. The design of the Proposed Development therefore needs to incorporate a degree of flexibility to allow for such circumstances.

2.4.4 In order to ensure a robust assessment this FRA has been undertaken adopting the principles of the 'Rochdale Envelope'. This involves assessing the maximum (and where relevant, minimum) parameters for the elements where flexibility needs to be retained.

2.4.5 Subject to the planning and other consents being granted (and an investment decision being made), work on site could commence in Q1 2021 and will consist of approximately 20 months of construction work with the Proposed Development expected to commence commercial operation from Q1 2023.

2.4.6 Further information with regards the Proposed Development can be found in Chapter 4: The Proposed Development (ES Volume I, Document Reference 6.2).

3.0 PLANNING POLICY AND GUIDANCE

3.1 Introduction

3.1.1 The sections below consider the planning policies and guidance of relevance to the Proposed Development with regards to flood risk and surface water management.

3.2 Planning Policy Context

National Policy

National Policy Statements

3.2.1 A number of National Policy Statements (NPS) for energy Infrastructure were designated by the Secretary of State (SoS) under the Planning Act 2008 on 19th July 2011. NPS EN-2[12], NPS EN-4[13] and NPS EN-5[14] together with the Overarching NPS for Energy (EN-1)[3], provide the primary basis for decisions on applications for 'nationally significant fossil fuel and gas supply infrastructure'.

3.2.2 EN-1 states that "*applications for energy projects of 1 hectare or greater in Flood Zone 1 and all proposals for energy projects located in Flood Zones 2 and 3 should be accompanied by a NPPF compliant flood risk assessment*".

3.2.3 The minimum requirements for FRAs set out in NPS EN-1 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;

[12] Department of Energy and Climate Change (2011), *National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2)* (available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47855/1939-nps-for-fossil-fuel-en2.pdf [Accessed August 2018])

[13] Department of Energy and Climate Change (2011), *National Policy Statement for Fossil Fuel Electricity Generating Infrastructure* (EN-4) (available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47857/1941-nps-gas-supply-oil-en4.pdf [Accessed August 2018])

[14] Department of Energy and Climate Change (2011), *National Policy Statement for Fossil Fuel Electricity Generating Infrastructure* (EN-5) (available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47858/1942-national-policy-statement-electricity-networks.pdf [Accessed August 2018])

- 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.

3.2.4 In determining an application for development consent, NPS EN-1 goes on to state that those determining the application 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 (See Paragraph 3.2.12 and Paragraph 3.2.15);
- 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.
- .

3.2.5 The Proposed Development will comply with the requirements of the NPPF and Section 5.7 of EN-1.

National Planning Policy Framework and Guidance

3.2.6 The National Planning Policy Framework[4] (NPPF) outlines the Government's economic, environmental and social planning policies for England. The NPPF is a matter which the Secretary of State is likely to consider 'important and relevant' in determining an application for a Development Consent Order (DCO).

3.2.7 The NPPF sets out 12 planning principles as guidance for local councils for the creation of their local plan; the following principles are directly applicable to flood risk:

> *"10. Meeting the challenge of climate change, flooding and coastal change – support the transition to a low carbon future in a changing climate taking full account of (inter alia) flood risk and coastal change; and*
>
> *11. Conserving and enhancing the natural environment – development should minimise pollution and other adverse effects on the local and natural environment and should plan positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure".*

3.2.8 The policies contained within the NPPF are expanded upon and supported by Flood Risk and Coastal Change 'Planning Practice Guidance'[15] (PPG), which was originally published in March 2014 and has been updated incrementally since.

3.2.9 The PPG contains guidance in relation to water supply, wastewater and water quality, and flood risk management. It also provides advice and information on how planning can and should protect water quality; ensure the delivery of adequate water and wastewater infrastructure for new development and ensure development is protected from flood risk, and does not increase flood risk elsewhere.

Development and Flood Risk Vulnerability

3.2.10 The NPPF considers the vulnerability of different forms of development and infrastructure to flooding and classifies proposed uses accordingly. Section 7, Paragraph 066 of the PPG illustrates a matrix which identifies which vulnerability classifications are appropriate within each Flood Zone. This can be seen below in Table 12-1.

3.2.11 As mentioned in Section 2.4, the Proposed Development comprises a new gas-fired power station. Based on Table 2 of the PPG, the Proposed Development is considered 'Essential Infrastructure' under the heading "Essential utility infrastructure which has to be in a flood risk area for operational reasons, including electricity generating power stations".

[15] Department for Communities and Local Government (2014) Flood Risk and Coastal Change *Planning Practice Guidance.*

Table 12A-4 Flood Risk Vulnerability and Flood Zone Compatibility

Flood risk vulnerability classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	×	Exception test required	✓
Zone 3b 'Functional Floodplain'	Exception test required	✓	×	×	×

Key

✓ Development is appropriate.

× Development should not be permitted.

3.2.12 Based on the classification shown in Table 3-1 the Proposed Development is appropriate in Flood Zones 1 and 2. The Proposed Development may be appropriate in Flood Zone 3a providing the development can satisfy the requirements of the Exception Test.

The Sequential and Exception Tests

3.2.13 The overall aim of the Sequential Test is to steer new development to areas designated as located in Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, LPAs allocating land in Local Plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. 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.

3.2.14 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 SFRA 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.

3.2.15 Both elements of the test will have to be passed for development to be allocated or permitted.

The Sequential Test

3.2.16 The Site is allocated in the North Lincolnshire Local Plan and Local Development Framework as an area for employment growth. The Site forms a part of the South Humber Bank Area that is subject to Policy SHBE-1 of the Housing and Employment Land Development Plan Document[16]. This policy identifies the area as being suitable for B1 office/light industry, B2 general industry, B8 storage and distribution and port related development. On the basis of this allocation it is assumed that the proposed development has passed the Sequential Test.

The Exception Test

3.2.17 The Energy White Paper 'Meeting the Energy Challenge' published in 2007 by the Department for Trade and Industry, which formed the basis of the Energy Act 2008, sets out the Government's plans for tackling climate change by reducing carbon emissions whilst ensuring the availability of secure, clean, affordable energy.

3.2.18 The White Paper and NPS EN-1 both emphasise the importance of a diverse mix of energy generating technologies, including renewables, nuclear and fossil fuels, to avoid over-dependence on a single fuel type and thereby ensure security of supply.

3.2.19 In the transition to the low carbon economy, the large-scale deployment of renewable technologies and construction of new nuclear power plant will change the energy mix of the UK. This is compounded by the Government's commitment to close all coal-fired power stations by 2025, which would remove plant currently providing a balancing service to the national grid when the need should arise. As a result, there is a need for power plants that can operate flexibly. This need is underpinned by a combination of Government policy drivers and the Industrial Emissions Directive (IED) resulting in the closure of fossil generation plant and is reflected in future generation projections.

3.2.20 Energy Market Reform (EMR) is intended to deliver low carbon energy and reliable supplies that the UK needs, while minimising costs to consumers. EMR introduces a mechanism to provide incentives for the investment required in low carbon generation infrastructure, the Capacity Market. The Capacity Market provides a regular retainer payment to reliable forms of capacity (both demand and supply side) in return for such capacity being available when needed.

3.2.21 The reformed electricity market is intended to transform the UK electricity sector to one in which low-carbon generation can generate in an affordable way, while maintaining security of supply and ensuring a cleaner, more sustainable energy mix. In the run up to 2050, gas generation is envisaged to still be required to meet electricity demand. It is preferable over coal generation as generating electricity from gas is more efficient and of lower carbon intensity, resulting in significantly lower CO_2 emissions per generated megawatt from gas-fired power stations compared to coal-fired power stations.

[16] North Lincolnshire Council (2016) *Housing and Employment Land Allocations Development Plan Document*. Adopted March 2016

3.2.22 The Site comprises brownfield land which is currently undeveloped. The Proposed Development will provide socio-economic benefits in that it will provide additional employment opportunities to the area and will regenerate a currently undeveloped area of land adjacent to an existing power station and utilising existing connections.

3.2.23 This FRA provides evidence and concludes that the Proposed Development will be safe for its lifetime taking account of climate change over the lifetime of the development and will not increase flood risk elsewhere.

3.2.24 As the Proposed Development provides wider sustainability benefits to the community that outweigh flood risk and will remain safe over the lifetime of the development it is considered that the Site passes the Exception Test.

Planning Practice Guidance: Climate Change (2016)

3.2.25 Based on data from the UK Climate Projections 2009[17] (UKCP09), guidance on the consideration of climate change within the planning system was updated and replaced in February 2016 by the Environment Agency's Flood Risk Assessments: Climate Change Allowances[18] document, which provides catchment / region specific uplift factors for three future scenarios:

- Total potential change anticipated for the '2020s' (2015 to 2039);
- Total potential change anticipated for the '2050s' (2040 to 2069); and
- Total potential change anticipated for the '2080s' (2070 to 2115).

3.2.26 Within each of the three scenarios, the estimates can be further divided into Central, Higher Central and Upper End; the specific scenario chosen should be reflective of the development's vulnerability and potential to impact flood risk elsewhere. Climate change is discussed further in Section 5.

UK Climate Projections 2018

3.2.27 The publication of the UK Climate Projections 2018[19] (UKCP18) represents the most up-to-date assessment of how the climate of the UK may change over the 21st century and the first major update of UK climate projections in nearly 10 years.

3.2.28 Over land the projected general trends of climate changes in the 21st century are similar to UKCP09, with a move towards warmer, wetter winters and hotter, drier summers. However, natural variations mean that some cold winters, some dry winters, some cool summers and some wet summers will still occur.

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[17] Centre for Environmental Data Analysis (2009) UKCP09: Land and marine past climate and future scenario projections data for the UK.

[18] Environment Agency (2016) *Flood Risk Assessments Climate Change Allowances*. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances (Accessed August 2018)

[19] https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

3.2.29 From a coastal perspective:

- UK coastal flood risk is expected to increase over the 21st century and beyond under all future emission scenarios considered. However, there are large regional differences in projections of future mean sea level;
- The UKCP18 sea level projections are consistently larger than in the previous set of UK climate projections (UKCP09) for similar emissions scenarios;
- UKCP18 now provides some exploratory projections of mean sea level out to 2300. (UKCP09 only considered to 2100). Based on these results, sea levels continue to increase beyond 2100 even with large reductions in greenhouse gas emissions;
- UKCP18 finds no evidence for significant changes in future storm surges; and
- The annual maximum significant wave height is projected to change by up to +/- 1m or 20% by the end of the 21st century: increases are found to occur off the south west of the UK, in parts of the Irish Sea and to the north of the UK but reductions are seen off the west of Ireland and in the southern North Sea. However, uncertainty with projections is high.

3.2.30 Climate change, including an assessment based on UKCP18 is discussed further in Section 5.

Local Planning Policy

North Lincolnshire Core Strategy

3.2.31 The Core Strategy[20] was adopted by NLC in June 2011. This Core Strategy sets-out the long term spatial planning framework for the development of North Lincolnshire up to 2026 by providing strategic policies and guidance to deliver the vision for the area including the scale and distribution of development, the provision of infrastructure to support it and the protection of the natural and built environment.

3.2.32 Policies within the NLC Core Strategy relevant to flood risk and surface water management include:

- **Policy CS2: Delivering More Sustainable Development** - A 'sequential approach' will also be applied to ensure that development is, where possible, directed to those areas that have the lowest probability of flooding, taking account the vulnerability of the type of development proposed, its contribution to creating sustainable communities and achieving the sustainable development objectives of the plan. Where development does take place in the floodplain, mitigation measures should be applied to ensure that the development is safe;
- **Policy CS12: South Humber Bank Strategic Employment Site (SHBSES)** - Development will be assisted by a drainage programme. The outcome will be to include surface water and sewage management solutions to accommodate development of the SHBSES without harming the natural environment. Safeguard

[20] North Lincolnshire Council (2011) *North Lincolnshire Core Strategy Adopted 2011*

and improve the flood defences of the SHBSES from tidal flooding through partnership working with the Environment Agency and its Humber Flood Risk Management Strategy, North Lincolnshire and North East Lincolnshire Councils, Yorkshire Forward, landowners and industry. This will include managing the predicted effects of climate change in harmony with the development of port related activities by managing and minimising the risk of flooding;

- **Policy CS18: Sustainable Resource Use and Climate Change** - Requiring the use of Sustainable Urban Drainage Systems (SuDS) where practicable and supporting the necessary improvement of flood defences and surface water infrastructure required against the actions of climate change, and preventing development in high flood risk areas wherever practicable and possible; and
- **Policy CS19: Flood Risk** - The council will support development proposals that avoid areas of current or future flood risk, and which do not increase the risk of flooding elsewhere. This will involve a risk based sequential approach to determine the suitability of land for development that uses the principle of locating development, where possible, on land that has a lower flood risk, and relates land use to its vulnerability to flood. Development in areas of high flood risk will only be permitted where it meets the requirements of the Exception Test and, in addition, development will be required, wherever practicable, to incorporate SuDS to manage surface water drainage.

Other Relevant Policy and Guidance

North and North East Lincolnshire SFRA

3.2.33 The SFRA was prepared to assist North East and North Lincolnshire Councils in spatial planning decisions that are required to inform the Local Development Framework preparation. Using information and analysis gathered during the assessment, a strategic overview of the flood risk was carried out to identify potential conflicts between development pressures and flood risk now and in the future.

North Lincolnshire PFRA

3.2.34 The NLC PFRA was published in 2011 and is a high level screening exercise that compiles information on significant 'local flood risk' from past and future floods, based on readily available and derivable information. The PFRA also includes the identification of flood risk areas where the subsequent two stages of the Flood Risk Regulations[21] apply; Stage Two delivers Flood Risk Maps and Stage Three delivers Flood Risk Management Plans.

3.2.35 Local flood risk is defined as flood risk originating from sources other than Main Rivers, the sea and large reservoirs and principally meaning flood risk from surface water runoff, groundwater and Ordinary Watercourses.

[21] HM Government (2009) The Flood Risk Regulations

North Lincolnshire LFRMS

3.2.36 The Local Flood Risk Management Strategy (LFRMS) details the Council's preferred strategy to manage the risk from local sources of flooding initially over the next 3 years and with revised editions every 6 years. Local sources of flooding are those from Ordinary Watercourses (small streams and channels), pluvial (surface water runoff as a result of heavy rainfall) and groundwater (where water held beneath the ground reaches the surface). The LFRMS includes a Flood Risk Action Plan which identifies the practical steps that the Council and other partners need to take to reduce their risks from flooding.

Grimsby and Ancholme CFMP

3.2.37 The role of CFMPs is to establish flood risk management policies which will deliver sustainable flood risk management for the long term. CFMPs can be used to help target limited resources where the risks are greatest.

3.2.38 The Site lies within the Grimsby and Ancholme CFMP, and in the sub-area of 'Immingham, Grimsby and Buck Beck'. This CFMP identifies flood risk management policies to assist all key decision makers in the catchment. It was produced through a wide consultation and appraisal process, however it is only the first step towards an integrated approach to flood risk management.

3.2.39 The CFMP identifies that flood defences have historically been constructed in the Immingham, Grimsby and Buck Beck' sub-area to reduce the probability of river and tidal flooding. However, in the future the standard of protection offered by existing defences may decline. Therefore the preferred policy for the Immingham, Grimsby and Buck Beck' sub-area is "*Policy Option 4: Areas of low, moderate or high flood risk where the EA are already managing the flood risk effectively but where further actions may need to be undertaken to keep pace with climate change".* The preferred approach to manage flood risk in Immingham is *"to work with partners to develop a flood risk study to investigate how further action can be taken to manage flood risk in the future".*

4.0 ASSESSMENT OF FLOOD RISK

4.1 Overview

4.1.1 The NPPF and EN-1 requires the effects of all sources of flood risk to and from the Site to be considered within a FRA. The FRA should demonstrate how these risks should be managed so that the development remains safe throughout its lifetime, taking into account climate change.

4.2 Tidal Flooding

4.2.1 The EA Flood Map for Planning (Rivers and Sea) (Provided within Annex 2 Environment Agency Consultation) indicates that the predominant flood risk on the Site is associated with tidal flooding from the Humber Estuary located approximately 1.4km to the east of the Site. As outlined in Table 1.1, the EA Flood Map shows:

- The OCGT Power Station Site, Gas Connection, Electrical Connection and Utilities and Services Connection are located entirely within Flood Zone 3a (high risk of flooding);
- The eastern section of the Access Site is located in Flood Zone 3a (high risk of flooding) whilst the western section is located within Flood Zone 2 (medium risk of flooding);
- The Temporary Construction and Laydown Site:
  - East of the Existing VPI CHP Plant - Flood Zone 3a (high risk of flooding);
  - North of the OCGT Power Station – Predominantly in Flood Zone 3a (high risk of flooding) with a small area to the west located in Flood Zone 2 (medium risk of flooding) and Flood Zone 1 (low risk of flooding); and
  - North west of the OCGT Power Station –Flood Zone 1 (low risk of fluvial flooding).

4.2.2 The Existing VPI CHP Plant is located entirely within Flood Zone 3 (high risk of flooding).

4.2.3 The Flood Map for Planning (Rivers and Sea) indicates that the Site is not located in an area benefitting from flood defences and therefore does not take into account the presence of existing flood defences along the Humber Estuary which protects the Site and the Existing VPI CHP Plant.

Flooding History

4.2.4 The EA have provided mapping showing historical flood extents in proximity to the Site (Annex 2). The historical flood map and the North and North East Lincolnshire SFRA indicate that the only significant record of tidal flooding in the area occurred in 1953. Major flooding occurred at numerous locations on the east coast of England and the Site was partially inundated (to the east and central area) during this event.

4.2.5 The flooding that occurred in the summer of 2007 caused extensive flooding in nearly all parts of the Louth, Grimsby and Ancholme catchment. The flooding that occurred was caused by prolonged rainfall saturating the catchment followed by a short period of extremely heavy rainfall. It is not known if the Site was flooded during this event.

4.2.6 On the 5th December 2013, many of communities along the coast and South Humber Bank were flooded by the largest tidal surge ever recorded in this location. The Site is not recorded as having been inundated during this event by either the EA or NLC.

Modelled Tidal Water Levels

4.2.7 The EA has provided tidal flood water levels for the South Humber, East Coast and The Wash. Water levels for Ref. H130 (North Killingholme located at 516350, 420000) have been used to assess tidal flood risk at the Site and are presented in Table 4-1 below. The model node locations are presented in Annex 2.

Table-12A-5. Tidal Water Levels at North Killingholme (mAOD)

Assessment Year	Annual Chance (1 in X) of Tide Level	
	1 in 200 (0.5% AEP)	1 in 1000 (0.1% AEP)
2014	5.42	5.77
2018*	5.58	5.93
2062**	5.79	6.14
2115***	6.35	6.70

* Present day adjustment

** Assumed operational life of development – 40 years from commencement of commercial operation in 2022

*** The operational life of the power station is assumed to be 40 years from commencement of commercial operation, but will be assessed for climate change based on an operational life of 100 years as a worst case scenario (See Section 5).

4.2.8 The base date for the EA data is 2014 therefore the tidal water level for a 1 in 200 (0.5% AEP) and a 1 in 1000 (0.1% AEP) flood events have been adjusted, using the latest EA climate change guidance, to reflect the current 2018 tidal water level. Based on this guidance, tidal levels are estimated to increase by 4mm per year up to 2025. For the purpose of this assessment a total increase in tidal level from 2014 to 2018 equating to 16mm has been added to the EA data and is shown in Table 4-1.

4.2.9 Topographic data indicates that ground levels in the north of the Site in the location of the Temporary Construction and Laydown Site are elevated above the 2018 0.5% AEP tidal flood level (5.58m AOD) at between approximately 6.67m and 5.86m AOD. Levels within the OCGT Power Station Site are generally below the tidal flood level, with elevations between 5.86m and 3.9m AOD. This data provides good correlation with the EA flood extent map presented in Annex 2.

Flood Defences

4.2.10 There are no formal flood defences in close proximity to the Site; however, there are tidal flood defences in place along the entire south bank of the Humber Estuary (See Annex 2). The existing defences to the north and east of the Site consist of:

- An earth embankment topped by a concrete wave return wall (Asset Ref: 053BBHUMB1501C05) with a crest height of 6.448 m AOD;

- A reclamation area (Asset Ref: 053BBHUMB1501C06) with a crest height of 6.448 m AOD;
- A sea defence protecting reclaimed land (Asset Ref: 053BBHUMB1501C09) with a crest height of 6.4m AOD; and
- An earth embankment topped by a concrete wave return wall (Asset Ref: 053BBHUMB1501C07) with a crest height of 6.16 m AOD.

4.2.11 The EA has stated that the tidal flood defences provide protection against a flood event with a 0.5% (1 in 200) chance of occurring in any year, based on the Still Water Tidal Water Levels.

4.2.12 The flood defences are owned both privately and by the EA and the EA has confirmed that the condition of the flood defences are classed as either 'good' (Condition Grade 2) or 'fair' (Condition Grade 3). The Environment Agency inspects these defences regularly to ensure that any potential defects are identified early.

4.2.13 The NLC SFRA shows the flood defences are located in Compartment IT3 - Immingham and North Killingholme. The NLC 2011 SFRA states '*ignoring freeboard, these defences will protect the area behind against events with a 0.2% annual probability of occurring or better. The standard will remain above the 0.5% annual probability requirement set out in PPS25 for the next 50 years, taking the effect of sea level rise into account'*.

4.2.14 In 2008 the Environment Agency published the Humber Flood Risk Management Strategy[22] (HFRMS). The strategy outlines the flood risk management plan for the Humber Estuary for the next 25 years and beyond. It looks at different ways of managing flood risk; raising defences where appropriate, but also introducing sites for managed realignment and flood storage which will help maintain valuable habitats.

4.2.15 The Site is located within Flood Area 24 Immingham to West Grimsby. The proposed management approach in this area is "*to continue to protect the area and improve the defences that protect existing development*".

4.2.16 As the Site is afforded protection from defences up to and including the 0.5% AEP flood event (still water levels), the primary risk from the Humber Estuary is the residual risk from overtopping and/or from failure of the defences, however the likelihood of either occurring is considered to be low.

Overtopping of the Flood Defences

4.2.17 The EA has provided flood extent maps from the Northern Area Tidal Overtopping Hazard Mapping Study for the 0.5% AEP and the 0.1% AEP overtopping scenarios. The modelling is based on the Still Water Tidal Levels from the Northern Area Tidal Model Analysis 2006 including a 100% AEP (1 in 1) wave height allowance (current year, based on 2006, and 2115). For the climate change scenarios it is assumed that the tidal defences remain at the 2006 heights.

[22] Environment Agency (2008), *Planning for Rising Tides. The Humber Flood Risk Management Strategy*

4.2.18 The hazard classification methodology is based on Flood Risk Assessment Guidance for New Development known as FD2320/TR2[23]. Table 12A-6 summarises the hazard classifications as defined for the overtopping/breach hazard modelling based on FD2320/TR2.

4.2.19 The extent maps, presented in Annex 2, indicate that the OCGT Power Station Site and associated development areas would not flood if overtopping of the flood defences occurred for both the 2006 0.5% AEP and 0.1% AEP events.

4.2.20 For both the 2115 0.5% AEP and 0.1% AEP events, the Site is predominantly located in an 'extreme' hazard area. The Temporary Construction and Laydown Site to the north west of the OCGT Power Station Site and the western section of the Access Site are located in a 'significant' hazard area.

Table-12A-6. Hazard Classifications based on FD2320/TR2

Flood Hazard		Essential Infrastructure	Indicative Depth Range (m)
	Low	Caution - Flood zone with shallow flowing water or deep standing water	Up to 0.25m
	Moderate	Dangerous for some (i.e. Children) – Danger: Flood zone with deep or fast flowing water	Up to 0.5m
	Significant	Dangerous for most people – Danger: Flood zone with deep fast flowing water	0.2 – 2.0m
	Extreme	Dangerous for all – Extreme Danger: Flood zone with deep fast flowing water	0.3 to over 2.0m

4.2.21 Maximum flood depths across the Site for both the 2115 0.5% AEP and 0.1% AEP overtopping events are shown to be greater than 1.6m with velocities of between 0.3 and 1.0 m/s.

4.2.22 Given the proposed management approaches for the area (see above) the likelihood of overtopping is considered to be low, however; current NPPF guidance requires that plans and mitigation are put in place to manage the risks if flooding should occur. Mitigation measures for the Site are outlined in Section 7 Flood Risk Management Measures.

Breach of Defences

4.2.23 The EA has provided breach location and associated breach flood extent maps from the Northern Area Tidal Breach Mapping Study. The Northern Area Tidal Breach Hazard Mapping project provides a modelled representation of tidal breaches along the east coast

[23] Defra/ Environment Agency (2005) *Flood Risk Assessment Guidance for New Development (Phase 2) R & D Technical Report FD2320/TR2*

and the south bank of the Humber Estuary, with breaches in the hard defences set at 20 m wide and the defences assumed to breach down to the ground level behind the defence. The defences were raised within the model to create reservoir cells, ensuring that the most precautionary volumes of water were driven through the breach opening.

4.2.24 The breach modelling was based on the Still Water Tidal Levels from the Northern Area Tidal Model Analysis 2006 including a 100% AEP (1 in 1) wave height allowance (current year 2006 and 2115) on top of the 0.5% AEP and 0.1% AEP (1 in 1000) flood events. The breach location nearest the site is located to the south east of Killingholme High Lighthouse to the east/south east of the Inland and Riverside Caverns area.

4.2.25 Breach modelling was also undertaken as part of the NLC SFRA for the 2115 scenario during a 1 in 200 (0.5%) annual probability event (Annex 3). Whilst the EA's study uses estuary levels based on the Northern Area Tidal Model Analysis the NLC's study uses a worst-case combined fluvial/tidal event and provides a more conservative approach to flood hazard mapping.

4.2.26 The breach location and flood extent maps are presented in Annex 2 (Environment Agency Consultation).

4.2.27 During the 2006 0.5% breach event:

- The southern area of the OCGT Power Station Site is located in a 'low hazard', 'moderate hazard' and 'significant hazard';
- The Temporary Construction and Laydown Site to the east of the Existing VPI CHP Plant is located in an area of 'significant' hazard;
- The Gas Connection, Electrical Connection and Utilities and Services Connections are partially located within areas of 'low to moderate' hazard;
- All other Site areas are not located within a hazard area.

4.2.28 During the 0.1% AEP event:

- The low, moderate and significant hazard extents increase slightly northwards across the OCGT Power Station Site;
- The Temporary Construction and Laydown Site to the east of the Existing VPI CHP Plant remains in an area of 'significant' hazard;
- The Gas Connection and Electrical Connection are located in areas of low to significant hazard;
- The Utilities and Services Connections is located within an area of 'significant' hazard; and
- All other Site areas are not located within a hazard area.

4.2.29 For the 2115 breach events:

- The OCGT Power Station Site and the eastern extent of the Access to the north of the Site are located in areas of 'significant hazard';

- Areas of 'extreme hazard' are located to the south of the OCGT Power Station Site for the 0.5% AEP event and to the east and south west of the OCGT Power Station Site for the 0.1% AEP event.
- The Temporary Construction and Laydown Site to the east of the Existing VPI CHP Plant and the Utilities and Connection Area are located in an area of 'extreme' hazard for both the 0.5% and 0.1% AEP 2115 breach scenarios;
- The Gas Connection and Electrical Connection are located in areas of significant to extreme hazard for the 0.5% AEP breach scenario. The hazard increases to signiciant to extreme for these areas during the 0.1% AEP 2115 breach scenario.
- The western extent of the Access to the north is located in a 'low hazard' and 'moderate hazard' area for the both the 0.5% and 0.1% AEP breach events; and
- The Temporary Construction and Laydown Site to the north west of the OCGT Power Station Site is partially located in an area of 'low to moderate' hazard for both the 0.5% and 0.1% AEP 2115 breach scenarios.

4.2.30 Maximum water depths for the 2006 0.5% AEP and 0.1% AEP breach scenarios are generally between 0 and 1 m across the northern area of the Site increasing to a maximum depth of 1.6 m in the southern area of the Site for the 0.1% AEP breach event. Maximum velocities of flood water for both breach scenarios are generally between 0 and 0.3 m/s with very small areas to the south adjacent to the land drain with maximum velocities of between 0.3 and 1.0 m/s.

4.2.31 Maximum water depths for the 2115 0.5% AEP and 0.1% AEP breach scenarios are generally 1m to greater than 1.6 m across the Site. Maximum velocities of flood water for both the breach scenarios generally remains between 0 and 0.3 m/s with small areas, predominantly located to the northwest and northeast corners of the Site and to the south of the Site adjacent to the land drain, with maximum velocities of between 0.3 and 1.0 m/s.

4.2.32 For the NLC 2115 0.5% breach scenario:

- The OCGT Power Station Site and eastern half of the Access area to the north are located predominantly within a 'severe hazard' area with a localised area of 'extreme hazard' to the south and southeast corner of the OCGT Power Station Site;
- The Temporary Construction Laydown Site to the east of the Existing VPI CHP Plant and the Utilities and Service Connection are located within an area of 'extreme' hazard;
- The western section of the Access area to the north and the Temporary Construction and Laydown Site to the north west of the OCGT Power Station Site are located in areas of 'negligible' to 'moderate' hazard;
- The Gas Connection and Electrical Connection are located in areas of 'severe hazard'; and
- The Rosper Road corridor in close proximity to the Proposed Development is located within a 'severe hazard' area.

4.2.33 Though a breach of the flood defences would represent a significant to extreme hazard, the SFRA states that likelihood of a breach is low. However; current NPPF guidance requires that plans and mitigation are put in place to manage the risks if failure should

occur. Mitigation measures for the Site are outlined in Section 7 Flood Risk Management Measures.

4.3 Fluvial Flooding

4.3.1 With the exception of the River Humber (Humber Estuary), see Section 4.2 above, there are no other EA Main Rivers in close proximity to the Site.

4.3.2 NELIDB have provided a map showing the watercourses under their jurisdiction in close proximity to the Proposed Development. The NELIDB map is presented in Annex 4.

4.3.3 None of these watercourses are currently supported by pumping but there is a proposal for a pumping station at Killingholme Marshes together with the widening of drainage channels in connection with the Able Marine Energy Park, part of which includes Watercourse 9B.

4.3.4 Correspondence with NELIDB (Presented in Annex 4 North Est Lindsey IDB Consultation) reports that the IDB has no records of previous flood extents and no information suggesting flood issues in the past for Watercourse 9B and the area in close proximity to the Site.

4.3.5 The SFRA states that 'the drainage systems managed by the NELIDB are understood to be able to accommodate storm events with 0.1% AEP by a combination of storage and pumping, without flooding the surrounding area'.

4.3.6 For NELIDB watercourses located within Compartment IT3 – Immingham and North Killingholme, the NLC SFRA states: *"The NELIDB have examined conditions in the watercourses they manage on a number of occasions in the recent years to generally assess the drainage implications of large industrial developments in the area. These studies indicate that the existing systems were mostly designed to cater for events with a 1.0% probability of occurrence. The designs generally include a freeboard of between 300 mm and 450 mm between the peak water level and the surrounding ground level. If this additional storage is taken into account the studies suggest that the drainage systems will accommodate the 1% annual probability flood from the area in its undeveloped state without water levels rising above the local ground level"*.

4.3.7 Given the nature of the managed catchment with small watercourses of sufficient capacity, fluvial flood risk is considered to be low.

4.4 Surface Water Flooding (Overland Flow)

4.4.1 Overland flow results from rainfall that fails to infiltrate the surface and travels over the ground surface; this is exacerbated where the permeability of the ground is low due to the type of soil and geology (such as clayey soils) or urban development with impermeable surfaces.

4.4.2 The PFRA details recorded local flood events as defined by NLC and Anglian Water, the local water and wastewater provider. The PFRA refers to the severe pluvial flooding

across large parts of North Lincolnshire during the June/July 2007 storms. An IDB Shire Group Report on the June 2007 floods[24] defined the rainfall event as having a 1 in 150 year return period. Data suggests that the Site did not flood in 2007. The PFRA historical flood map shows no records of pluvial flooding for the Site and the Site is not located within a Critical Drainage Area (CDA).

4.4.3 The majority of the land surrounding the Site (to the east) is undeveloped and greenfield in nature with a low propensity to generate overland flow. Further to this, the North Lindsey IDB have confirmed that land drains serving the area have the capacity to ensure that excess surface water is stored and removed from the area and discharged into the Humber Estuary.

4.4.4 The EA published the updated Flood Maps for Surface Water in December 2013. The maps indicate areas at risk from surface water flooding, when rainwater does not drain away through the normal drainage systems or soak into the ground, but instead lies on or flows over the ground. The mapping can be viewed on the EA website. The EA Risk of Flooding from Surface Water map[25] indicates that the majority of the Site is at very low risk from surface water flooding. Very low risk means that each year this area has a chance of flooding of less than 0.1%.

4.4.5 Small pockets of land at low, medium and high risk from surface water flooding are identified within the Site boundary (See Risk of Flooding from Surface Water map in Annex 2 Environment Agency Consultation). Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. Medium risk means that each year this area has a chance of flooding of between 1% and 3.3% and high risk means that each year this area has a chance of flooding of greater than 3.3%. These areas are likely to correspond to areas of low topography within the Site where surface water ponds rather than draining away.

4.4.6 Pools of standing water were seen on land on the Site during a Site walkover undertaken by ecologists in September 2017 thought to be associated with areas of impeded drainage. The Preliminary Ecological Appraisal (PEA) Report[26] states "*Two permanently shallow ponds are located in the northern part of the area at the base of the bunds. Both supported vegetation that indicated the area holds water for much of the year, although seasonal drying (or a reduction in extent) in the summer months cannot be ruled out*"

4.4.7 A small area of high risk is located along the drain to between the OCGT Power Station Site and the Existing VPI CHP Power Station Site. The Risk of Flooding from Surface Water map (Annex 2 Environment Agency Consultation) shows surface water enters the OCGT Power Station Site from overtopping of the drain, most likely via a low spot along

[24] Ancholme, Scunthorpe and Messingham Internal Drainage Boards, Member of the Shire Group – *Report on Storm Damage*

and Flooding the Followed June 2007 (JBA Consulting)

[25] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

[26] AECOM (2017) Preliminary Ecological Appraisal (PEA) Report October 2017

the bank; however flooding of the OCGT Power Station Site is restricted to the area local to the drain.

4.4.8 Based on the information above the Site is assessed as being at very low to low risk of flooding from surface water sources.

4.4.9 The Proposed Development will increase the impermeable area and therefore increase the rate of surface water runoff from the Site. In order to mitigate against possible flooding from this source, a conceptual drainage strategy for surface water management at the Site has been prepared and is presented in Annex 5 Conceptual Drainage Strategy.

4.5 Artificial Waterbodies

4.5.1 Artificial flood sources include raised channels, such as canals, or storage features such as ponds and reservoirs.

4.5.2 The Flood and Water Management Act updated the Reservoirs Act and targeted a reduction in the capacity at which reservoirs should be regulated from 25,000m³ to 10,000m³. This reduction is, at the time of writing, yet to be confirmed meaning the requirements of the Reservoirs Act 1975 should still be adhered to.

4.5.3 The EA's Long-term Flood Risk mapping[27] shows that the Site is not located in an area at risk of flooding from a reservoir in the event of a structural failure or breach.

4.5.4 There are no canals located in close proximity to the Site.

4.6 Flooding from Groundwater

4.6.1 Groundwater flooding can occur when groundwater levels exceed ground surface levels as a result of periods of sustained high rainfall. 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) where the water table is more likely to be at shallow depth.

Geology

4.6.2 The British Geological Survey (BGS) 1:50,000 solid and drift geology map indicates that the Site is underlain by Devensian aged glacial till, overlying Upper Cretaceous aged chalk of the Burnham Chalk Formation.

Superficial Geology

4.6.3 The Groundsure® Geo Insight report[28] indicates that superficial drift deposits on the site are likely to comprise glacial deposits, comprising glacial till and glacial sands and

[27] https://flood-warning-information.service.gov.uk/long-term-flood-risk

[28] The GroundSure® Reports summarise the environmental information available in the public domain

gravels. There is a small pocket of tidal flat deposits consisting of clays and silts located in the north east of the Site.

4.6.4 The 2006 Soil Mechanics Interpretative Report[29] describes the glacial deposits as comprising "*slightly sandy, slightly gravelly clay. The sand and gravel component comprises subangular to subrounded chalk, occasionally sandstone and shell fragments*."

4.6.5 The VPI Immingham Energy Park Phase 2 Geotechnical & Geo-environmental Interpretative Report (included with this ES as Appendix 11D) indicates that the site is underlain by the Burnham Chalk Formation of the Upper Cretaceous period. The BGS Lexicon describes the Burnham Chalk Formation as "*White, thinly-bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams*". The upper 10m to 20m of the bedrock is frequently described as "*soft chalk*", overlying "*hard chalk and flints*", indicating that the upper part of the Chalk is extensively weathered.

Hydrogeology

4.6.6 The EA Aquifer Maps[30] indicate that:

- The superficial glacial deposits are classified as a 'Secondary Aquifer (undifferentiated)', defined either as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers', or 'lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, tin permeable horizons and weathering'; and
- The bedrock, Burnham Chalk Formation, is classified as a Principal Aquifer, defined as 'highly permeable formations usually with a known or probable presence of significant fracturing'. They may be highly productive and able to support large abstractions for public supply and other purposes.

Groundwater Levels

4.6.1 Groundwater strikes were recorded at a range of depths (1m to 28.6m bgl) throughout the site during the ground investigation[31]. The majority of the strikes occurred in the Glacial Till with a few strikes recorded in the Glacial Sands and Gravels and in the Chalk. In many cases, the groundwater was under sub-artesian pressures and semi-confined by less permeable clay layers. Upon release of these pressures, the recorded water strike level rose quite rapidly.

4.6.2 Following the ground investigation, several visits to Site were made to monitor groundwater levels. Recorded groundwater levels ranged from 0.96m bgl to 3.97m bgl.

[29] Soil Mechanics (ref. A6032): Interpretive Report on Ground Investigation for Total Oil Limited, April 2006

[30] http://apps.environment-agency.gov.uk/wiyby/117020.aspx

[31] Socotec (2018) VPI Immingham Factual Report on Ground Investigation Report No A8015-18

4.6.3 The 2006 Soil Mechanics ground investigation[32] showed water to be encountered within the more granular glacial horizons within the nearby BH5 at 4.3m bgl with sub-artesian conditions resulting in a water level rise to 3.9m after 20 minutes.

4.6.4 Additionally, during the 2009-2010 Highways England ground investigation[33], groundwater was encountered within the thicker granular glacial deposits, and in thin granular horizons within the glacial till, between depths of 2.4m and 15m bgl (-4.7 to -11.9m AOD). Again sub-artesian groundwater conditions were noted in several locations where groundwater was encountered, with borehole water level rises of up to 8.3m.

4.6.5 The Grimsby and Ancholme Catchment Flood Management Plan[34] (CFMP) states that 'land from Barrow upon Humber to Cleethorpes, including Grimsby and the Humber trade zone, is susceptible to flood risk if groundwater levels are high in the underlying rock'.

4.6.6 The NLC SFRA notes that groundwater levels can rise following heavy rain leading to ponding if the water cannot get away, as occurred in July 2007. However, there are no historical records that suggest the Site was affected by this flood event.

4.6.7 Information in the NLC PFRA notes that unless an area identified as 'susceptible to groundwater flooding' is also identified as 'at risk from surface water flooding', it is unlikely that this location would actually experience groundwater flooding to any appreciable depth and therefore it is also unlikely that the consequences of such flooding would be significant. Based on the mapping showing susceptibility to groundwater flooding the Site is located in an area with an equal or greater than 25% but less than 50% susceptibility to groundwater flood emergence.

4.6.8 The Proposed Development will not affect the groundwater profile across the local area and flow routes will be maintained. If, during the construction phase, groundwater is encountered the appropriate mitigation measures will be temporarily employed (dewatering/ pumping etc.) to prevent the risk of flooding to excavations etc.

4.6.9 Based on the above data the risk from groundwater flooding is considered to be low.

4.7 Flooding from Drainage Infrastructure

4.7.1 Flooding from drains, sewers and surface waters are normally interconnected. Insufficient or reduced drainage capacity within the sewer network can result in drainage capacity being exceeded causing extensive surface water flooding. Likewise increased volumes of surface water can overload sewers and drains, causing the drainage network to backup and surcharge causing surface water flooding.

[32] Soil Mechanics (2006) Interpretive Report on Ground Investigation for Total Oil Limited (ref. A6032), April 2006

[33] Highways Agency (2010) Geotechnical Data Management System Report (No 25153), A160 Improvements Ground Investigation Report, August 2010

[34] Environment Agency (2009) *Grimsby and Ancholme Catchment Flood Management Plan*

4.7.2 The existing access road (Access Site) to the car parks to the north of the OCGT Power Station Site comprises an area of hardstanding that is positively drained. Surface water from this area is discharged to and stored in the local land drain located directly adjacent to the north of the car parks. There is currently no drainage infrastructure within the OCGT Power Station Site boundary.

4.7.3 The PFRA details recorded local flood events as defined by NLC and Anglian Water. The Anglian Water DG5 database (provided to inform the PFRA) shows combinations of internal and external flooding to properties in the NLC area (no dates are given) but the database indicates that the area in proximity to the Proposed Development has not been flooded.

4.7.4 On the basis of the above, the Site is considered to be at low risk of flooding from drainage infrastructure.

4.7.5 Post development, surface water and foul water drainage infrastructure will be present within the Site. The conceptual drainage strategy for the Site is presented in Annex 5 Conceptual Drainage Strategy.

5.0 CLIMATE CHANGE

5.1 Context

5.1.1 The NPPF and EN-1 require site specific FRAs accompanying planning applications to assess the risk of all sources of flooding to and from the development and to demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

5.2 EA Climate Change Guidance Assessment

5.2.1 The EA published updated climate change guidance in relation to flood risk assessments in February 2016[35]. The guidance indicates that climate change is likely to increase river flows, sea levels, rainfall intensity, wave height and wind speed to the year 2115 (See below).

Sea Level Allowance

5.2.2 Within the EA published updated climate change guidance there is a single regional allowance for each epoch or time frame for sea level rise as shown in Table 12A-7.

Table 12A-7. Sea Level Allowance

Area of England	1990 to 2025	2026 to 2055	2056 to 2085	2086 to 2115
East, East Midlands, London, South East	4 mm per year (140 mm total increase)	8.5 mm per year (255 mm total increase)	12 mm per year (360 mm total increase)	15 mm per year (450 mm total increase)

Offshore Wind Speed and Extreme Wave Height Allowance

5.2.3 Wave heights may change because of increased water depths resulting from climate change. The frequency, duration and severity of storms could also change. Table 12A-8 shows the single allowance for each epoch for offshore wind speed and wave height. A 10% sensitivity should be applied to the allowance to understand the range of impact.

Table 12A-8. Offshore Wind Speed and Extreme Wave Height Allowance

	1990 to 2050	2051 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%

[35] Environment Agency (2016). Flood Risk Assessment: Climate Change Allowances. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

	1990 to 2050	2051 to 2115
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

Peak River Flow Allowances by River Basin District

5.2.4 The peak river flow allowances show the anticipated changes to peak flow by river basin district. The range of climate change allowances is based on percentiles. A percentile is a measure used in statistics to describe the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flows fall below it and half fall above it:

- The central allowance is based on the 50th percentile;
- The higher central is based on the 70th percentile; and
- The upper end is based on the 90th percentile.

5.2.5 The EA Climate Change Guidance[38] states: "If the central allowance is 30%, scientific evidence suggests that it is just as likely that the increase in peak river flow will be more than 30% as less than 30%".

5.2.6 At the higher central allowance, 70% of the possible scenarios fall below this value. So, if the higher allowance is 40%, then current scientific evidence suggests that there is a 70% chance that peak flows will increase by less than this value, but there remains a 30% chance that peak flows will increase by more.

5.2.7 The Proposed Development lies within the Humber River Basin District. Table 12A-9 shows the climate change peak river flow allowances for the Humber River Basin District.

Table 12A-9. Peak river flow allowances based on flood risk vulnerability classification and flood zone

Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Upper end	20%	30%	50%
Higher central	15%	20%	30%
Central	10%	15%	20%

Peak River Flow Allowances for Different Assessments

5.2.8 For FRAs, the "Flood Risk Vulnerability Classification" must be used to categorise the development in order to determine its compatibility with the flood zone. The Proposed Development at the Site is classified as 'Essential Infrastructure'.

5.2.9 The vulnerability classification and flood zone designation should be used to decide which peak river flow allowances (allowance category) to use based on the lifetime of the development. Table 12A-10 shows the peak river flow for the different flood risk vulnerability classifications for each zone.

Table 12A-10. Peak river flow allowances based on flood risk vulnerability classification and flood zone

Flood Zone 2
• Essential infrastructure – use the higher central and upper end to assess a range of allowances • Highly vulnerable – use the higher central and upper end to assess a range of allowances • More vulnerable – use the central and higher central to assess a range of allowances • Less vulnerable – use the central allowance • Water-compatible – use none of the allowances
Flood Zone 3a
• Essential infrastructure – use the upper end allowance • Highly vulnerable – development should not be permitted • More vulnerable – use the higher central and upper end to assess a range of allowances • Less vulnerable – use the central and higher central to assess a range of allowances • Water-compatible – use the central allowance
Flood Zone 3b
• Essential infrastructure – use the upper end allowance • Highly vulnerable – development should not be permitted • More vulnerable – development should not be permitted • Less vulnerable – development should not be permitted • Water-compatible – use the central allowance If (exceptionally) development is considered appropriate when not in accordance with flood zone vulnerability categories, then it would be appropriate to use the upper end allowance.

Peak River Flow Allowances for the Proposed Development

5.2.10 As outlined in Section 4.2, the lifetime of the development is assumed to be 40 years from commencement of operation in 2022 (2062), however; for the purpose of this assessment it has been assumed that the lifetime of the development is 100 years, providing a worst case scenario. The allowance to be applied for climate change in peak river flow over the lifetime of the development is as shown in Table 12A-11.

Table 12A-11. Peak river flow allowances for the Proposed Development

VPI B OCGT	
River Basin District	Humber
Flood Zone	3a

VPI B OCGT	
Flood risk vulnerability classification	Essential Infrastructure
Lifetime of development	100 years
Climate change allowance to be assessed	Upper end allowance 50%

Peak Rainfall Intensity Allowance

5.2.11 Increased rainfall affects river levels and land and urban drainage systems. Table 5-6 shows anticipated changes in extreme rainfall intensity in small and urban catchments. For FRAs and SFRAs, both the central and upper end allowances need to be assessed to understand the range of impact.

5.2.12 The lifetime of the development (up to 100 years) determines that the highest epoch needs to be evaluated. As shown in Table 12A-12, an increase in peak rainfall of between 20 – 40% needs to be assessed.

Table 12A-12. Peak Rainfall Allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2069	Total potential change anticipated for 2070 to 2115
Upper end	10%	20%	40%
Central	5%	10%	20%

5.3 Climate Change based on UKCP18

Sea Level Allowance

5.3.1 Still water return period water levels for tidal gauges around the UK are provided within UKCP18 based on 5%, 50% and 95% probabilities for the low, medium and high emissions scenarios.

5.3.2 Still tidal water levels for the tidal gauge at Immingham for each scenario are presented in Table 12A-13 below.

Table 12A-13. UKCP18 Predictions for 0.5% AEP Still Tidal Water Levels for the Immingham Tidal Gauge.

Emissions Scenario	Probability (%)	Still Tidal 0.5% AEP Water Level (mAOD)		
		2060*	2100	2120**
Low	5	5.154	5.254	5.293
	50	5.249	5.414	5.489
	95	5.382	5.673	5.831

Emissions Scenario	Probability (%)	Still Tidal 0.5% AEP Water Level (mAOD)		
		2060*	2100	2120**
Medium	5	5.17	5.31	5.379
	50	5.271	5.497	5.607
	95	5.418	5.785	5.986
High	5	5.212	5.46	5.593
	50	5.329	5.701	5.911
	95	5.482	6.061	6.401

* UKCP18 Data Year closest to the assumed operational life of development – 40 years from commencement of commercial operation in 2022

** UKCP18 Data Year closest to the assumed operational life of the power station (assumed to be 40 years from commencement of commercial operation), but will be assessed for climate change based on an operational life of 100 years as a worst case scenario).

5.3.3 .When the 95% probability high emissions scenario (taken to represent the worst case climate change scenario) still tidal water level is compared against that estimated using the EA climate change guidance (presented in Table 4.1), the UKCP18 data, still water levels are approximately 0.31m lower for the year 2060 (year based on the assumed lifetime of the development) and 0.05m higher for the year 2120 (based on an operational lifetime of 100 years).

Extreme Wave Height Allowance

5.3.4 In addition, the UKCP18 states that the annual maximum significant wave height is projected to change by up to +/- 1m or 20% by the end of the 21st century. When compared to the EA Climate Change Guidance (Table 5.2) this is a 10% increase on the previous allowance. This is likely to increase the risk of overtopping of the tidal flood defences over the lifetime of the development (assuming the height of the flood defences is not maintained for climate change).

Peak River Flow and Rainfall Intensity Allowances

5.3.5 Based on the data set out in the UKCP18 report, it is considered that the climate change allowances for increases in peak rainfall intensity and peak river flows remain similar to those in the current EA Climate Change Guidance (Table 5.3 and Table 5.6) over the lifetime of the development.

5.4 Impacts of Climate Change

Tidal Flooding

5.4.1 The 2011 NLC SFRA states: "'*The incidence of coastal flooding is also likely to increase, partly because the increased storminess will increase the frequency of waves and surges but also because sea levels are expected to rise. Government guidance currently suggests that sea levels off the East Coast could rise by up to 1m over the next 100 years'*.

5.4.2 The impact of climate change on peak still tidal water levels and shows climate change is projected to increase water levels in the Humber Estuary. Based on the regional allowances, as set-out in Table 5-1 above, the total allowance for the impact of climate change on still tidal water levels at North Killingholme has been calculated as:

- 0.37 m for a climate change horizon of 2062; and
- 0.93 m for a climate change horizon of 2115.

5.4.3 The predicted increases in water levels were calculated using an incremental rate of sea level rise from the date the Northern Area Tidal Model Analysis water levels published in 2014.

5.4.4 The allowance for climate change has been added to the 0.5% AEP event maximum still water level value, 5.42 m AOD, to consider the maximum increase in still water level over the lifetime of the development and beyond. Therefore the maximum still water level with climate change for the 2062 scenario is 5.79 m AOD and the maximum still water level for the 2115 scenario is 6.35 m AOD.

5.4.5 The UKCP18 worst case climate change scenario predicts a still tidal water level of approximately 6.40m AOD at Immingham (See Section 5.3), 0.05m higher than that estimated using the EA Climate Change Guidance for the 0.5% AEP flood event in the year 2120 (the nearest time frame to the year 2115 provided in UKCP18).

5.4.6 The height of the flood defences, approximately 6.44m AOD, in proximity to the Site are above the estimated 0.5% (1 in 200) AEP 2115 still tidal water levels but these levels do not include an allowance for wave height. When wave height is taken into account, the defences would not be sufficient to defend the land behind them from these higher return period events in the future. On this basis, the flood risk at the Site due to the overtopping of the tidal flood defences will increase with climate change (assuming the height of the flood defences are not maintained).

5.4.7 The residual flood risk to the Proposed Development due to the breaching of the tidal flood defences is not likely to increase due to climate change (the probability of a breach occurring will remain as the current scenario and is dependent on the condition of the flood defences). However, if a breach event did occur climate change would result in an increase in the depth of floodwater across the Site (refer to Section 4.2).

5.4.8 Section 2 above outlines how climate change will increase the risk of flooding at the Site due to overtopping of the flood defences. In the HFRMS, outlining the flood risk management plan for the Humber Estuary for the next 25 years and beyond, the Proposed Development is located in Flood Area 24 Immingham to Grimsby. The proposed management approach in this area is to continue to protect the area and improve the defences that protect existing development.

5.4.9 The Grimsby and Ancholme CFMP indicates that the Site area falls within Sub-Area 4 Immingham, Grimsby and Buck Beck where the preferred policy option for future flood risk management is Policy Option 4: '*Areas of low, moderate or high flood risk where the Environment Agency are already managing the flood risk effectively but where the Environment Agency may need to take further action to keep pace with climate change*'.

5.4.10 It is considered that the existing defences will be maintained to an appropriate standard to keep providing protection to the area and therefore the risk of flooding to the Site will not increase above the existing scenario.

Fluvial Flooding

5.4.11 There is no data available for the watercourses in close proximity to the Site that demonstrate the potential effects of climate change, however, Table 5-3 indicates fluvial peak flows may increase by up to 50%.

5.4.12 The Site is classed as at low risk of flooding from fluvial sources. As the watercourses in close proximity to the Proposed Development are part of a wider drainage system, managed by NELIDB, with capacity for a 0.1% AEP event it is unlikely that the changes to the magnitude of fluvial flooding will present a significant hazard to the Proposed Development.

Surface Water (Overland Flow)

5.4.13 Due to climate change rainfall intensity and magnitude of storm events are expected to increase over the lifetime of the development. As a result of the Proposed Development the impermeable area of the Site is expected to increase significantly. As a result of increasing rainfall intensities and an increase in impermeable surface area, surface water runoff rates at the Site will also be expected to increase.

5.4.14 Climate change must be taken into account when considering surface water runoff generated by development sites. This is usually represented by increasing the peak rainfall intensities (Table 5-6). An increase in rainfall intensity will result in an increase in runoff rates and volumes from the development, exacerbated by increased amounts of impermeable surface associated within the proposed development.

5.4.15 Additional surface water drainage will be required to ensure that the increase in impermeable surface area compared to the existing site does not increase the risk of flooding from surface water both on the Site and to the surrounding area. Therefore design of the drainage infrastructure will need to take this into account in accordance with the NPPF and NLC policies.

5.4.16 The outline drainage strategy detailing how surface water runoff will be managed on-site post development is provided in Section 6 and mitigation measures are outlined in Section 7.

Groundwater Flooding

5.4.17 The predicted increase in the wetness of winters and the intensity of storm events could impact groundwater level fluctuations across the Site, and possibly increase the level of the water table over the lifetime of the development. As the likelihood of groundwater emergence under the climate change scenario is likely to increase, the potential for groundwater flooding to impact infrastructure is also likely to increase.

5.4.18 The Site is currently considered to be at low risk of groundwater flooding. The Proposed Development is planned to increase the impermeable area, hence there is expected to be a limited chance of groundwater emergence that would cause flooding to the Proposed

Development. Therefore the potential for groundwater flooding, under climate change, remains a low risk.

Flooding from Drainage Infrastructure

5.4.19 It is difficult to predict precisely the impact of climate change on flooding from drainage infrastructure. However, with the projected increases in rainfall intensity, a greater amount of surface water runoff may enter the drain and sewer systems during storm events.

5.4.20 In order to account for this increase, new drainage and sewer systems will be designed to accommodate flows under climate change scenarios, with SuDS methods used where possible. As such the risk of flooding from drains and sewers is expected to remain low under climate change scenarios.

6.0 SURFACE WATER MANAGEMENT

6.1 Policy Requirements

6.1.1 There are a number of national and local policy requirements which need consideration in the design of any drainage strategy to ensure that the Proposed Development will be sustainable and can, if possible, contribute to a decreased flood risk elsewhere.

National Planning Policy Framework and EN-1

6.1.2 NPPF and EN-1 require that new development should not increase flood risk both on the Site and in the area surrounding it. This effectively means that surface water runoff should not exceed the peak volumes already generated on the site and that betterment should be provided where possible.

North Lincolnshire Council SuDS Guidance

6.1.3 North Lincolnshire Council (NLC) has created a SuDS guidance document[36] which stipulates the expectations of NLC for designers and developers in regards to the use of SuDS. This guidance document has been produced based on best practice guidelines from the Construction Industry Research and Information Association (CIRIA) SuDS manual.

6.1.4 The document details the requirements for SuDS, appropriate design processes and discusses various types of SuDS. Specific NLC requirements for drainage projects are also detailed with a checklist given for the required steps to be taken for the adoption of SuDS.

Building Standards Regulations 2000 Part H

6.1.5 The Building Standards Regulations 2000 Part H[37] requires that surface water runoff be preferentially discharged first to soakaways, then to surface watercourses and finally to sewers.

6.2 Existing Surface Water Drainage

Existing Surface Water Runoff

6.2.1 The OCGT Power Station Site currently comprises undeveloped land covering an area of approximately 2.6 ha.

6.2.2 Standing water has been observed on Site and this is believed to be due to minor undrained low points caused by the surface undulations. It is understood that the Site will

[36] North Lincolnshire Council (2017) SuDS and Flood Risk Guidance Document Rev I April 2017

[37] Office of the Deputy Prime Minister (2002) The Building Regulations 2000, Drainage and Water Disposal (Approved Document H)

be re-graded as part of the development therefore reducing the likelihood of standing water.

6.2.3 Land drains are present to the north-east and south-east boundaries of the Site.

6.2.4 Both NLC and NELIDB have stated that surface water runoff generated on the Site should be restricted to the existing greenfield runoff rate (See Annex 3 and Annex 4). The greenfield runoff rate for the Site is as shown in Table 12A-14 based on the HR Wallingford online calculator based on co-ordinates (OSNGR) 516495, 417675.

Table 12A-14: Greenfield Runoff Rates

Return Period	Runoff Rate (l/s)
QBAR*	10.81
1 in 1 year	9.4
1 in 30 years	26.48
1 in 100 years	38.48

Note* the mean annual flood flow from a rural catchment (approximately 2.3 year return period).

6.3 Proposed Surface Water Management

6.3.1 The Proposed Development will increase the total area of impermeable surfaces on the Site. It has been assumed that post-development the majority of the Site (90%) will be impermeable. Following the development works the surface water runoff rate will increase and this increase in runoff will need to be attenuated prior to discharge to meet the required greenfield runoff rate of 10.81 l/s.

6.3.2 The drainage system which is to be installed as part of the Proposed Development will ensure that flooding on site is mitigated to an acceptable level during the design event and any flooding is directed to non-critical areas. It is also required to prevent surface water flows originating within the Site from causing or exacerbating flooding to surrounding areas.

Surface Water Attenuation

6.3.3 Surface water attenuation systems will be required to limit the discharge to the existing greenfield runoff rate. This may take the form of one or more of the sustainable drainage options discussed below in Table 12A-16 or alternative solutions may be preferred. Detailing the composition of the attenuation system is outside of the scope of this report; however an estimate of the required storage volume has been made.

6.3.4 The MicroDrainage Source Control quick storage estimation tool has been used to calculate these storage volumes, presented in Table 12A-15. FSR rainfall estimated hydrographs were used to undertake this analysis. A conservative assumption of zero infiltration has been made, in the absence of permeability data for the Site.

Table 12A-15: Required Attenuation Volume

Rainfall Event	Min Storage (m³)	Max Storage (m³)
1% AEP + 40% Climate Change	1635	2207

6.3.5 Detailed attenuation calculations will be undertaken as part of the drainage design as the development project is progressed and attenuation solutions will be specified at this stage.

Sustainable Drainage Systems

6.3.6 In line with EA advisory recommendations, CIRIA SuDS manual best practice guidelines and local planning policy, sustainable drainage systems should be used as a preferential option. A summary of sustainable drainage systems is given in Table 6-3, this is not an exhaustive list and other options will also be considered. The SuDS management train (an integrated sequence of measures employed in a SuDS scheme which, taken together, control volumes of run off and reduce pollution before discharge) will be taken into account during detailed drainage design with an aim of capturing surface water as close to the source as possible.

Table 12A-Error! No text of specified style in document.**16: Sustainable Drainage Systems**

Technique	Description	Restrictions of use
Storage Pond	Storage ponds can be used to attenuate overland runoff and slowly release it into a watercourse or sewer. These systems do not offer water quality benefits unless additional water quality measures are added such as filters or sedimentation volume.	Storage ponds may require substantial earthworks and thus incur high costs during the construction phase. Additionally, large ponds which store water above ground level may be classified as reservoirs which are subject to a range of legislative requirements. Land take requirements for storage ponds are likely to be substantial.
Permeable Paving	Permeable paving allows rainwater to infiltrate through a hard-standing surface to underlying soil or drainage infrastructure. From which it may infiltrate or be directed to a local watercourse or sewer.	Permeable pavements may be restricted by the presence of basements or groundwater levels as well as high imposed loads.
Rainwater Harvesting	Rainwater from roofs and hard surfaces can be stored and used for non-potable purposes. This can provide a reduction of surface water runoff through control at source as well as reducing the demand on the water supply system. In the case of the proposed development harvested rainwater could be used to supplement cooling water supplies.	Rainwater harvesting is dependent on a consistent supply of rainwater which cannot be ensured. As such it will be used as a supplement to conventional water supply only.
Below Ground Attenuation	Below ground storage tanks will attenuate surface water flows in much the same way as surface water ponds, although with reduced land take. Storage tanks will typically require a hydro brake to ensure steady and controlled	Upfront costs are likely to be high for buried storage tanks. The maintenance regime may be onerous or involve heightened health and safety risks due to

Technique	Description	Restrictions of use
	discharge.	enclosed spaces.

Infiltration

6.3.7 Based on available geological information it is considered unlikely that infiltration based drainage solutions will be viable. An assessment to confirm this will be undertaken during detailed drainage design if an infiltration based drainage system is progressed.

Discharge

6.3.8 As discharge via infiltration is likely to be unviable it is proposed that all drainage be discharged to the land drain to the south-east of the Site due to favourable Site topography and development layout.

6.3.9 Should the southern drainage ditch be unviable as a discharge point then discharge to other nearby watercourses will be considered. If necessary the Site may be split into multiple catchments which can outfall to different drainage ditches. Discharge consent must be attained for each watercourse that is to be used as an outfall location.

6.3.10 There are no known local sewers which could be used as discharge points. The nearest local sewer is located beneath Chase Hill Road, approximately 2 km away from the Site. Discharge to sewers will only be considered if all local watercourses are unviable as outfalls.

Pollution Prevention and Control

6.3.11 As the Proposed Development will be an active industrial site, pollution controls will be required to prevent accidental discharge of pollutants such as hydrocarbons with surface water. Pollution prevention must be considered throughout the design phases and will be undertaken as detailed below:

- The design of oil interceptors shall be undertaken based on manufacturer supplied information. Based on the Site use and proposed receiving water body, these are envisaged to be Class 1 Full Retention systems. Provision shall be made where appropriate to prevent silt and debris from entering the drainage system in accordance with Building Regulations 2010;
- Foul flows and effluent arising from the Proposed Development operation will be kept separate from the surface drainage network. Measures will be taken to ensure accidental flows such as fuel/ chemical spillages and fire control do not enter the surface water network. Such measures may include isolation points such as penstocks, or source control measures such as booms or absorbent systems;
- Areas which are expected to be sources of frequent pollutant spills will be isolated through the use of bunds to an appropriate level or other physical barriers to prevent spills from impacting the rest of the Site;
- During construction, the Contractor will adhere to EA pollution prevention guidelines, to reduce the risk of pollution in the event of flooding on Site; and

- The use of sediment removal techniques, particularly SuDS with passive sediment removal benefits will be utilised as part of the drainage design.

7.0 MITIGATION OF RESIDUAL FLOOD RISKS AND OFF-SITE IMPACTS

7.1 Introduction

7.1.1 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.

7.1.2 The EA recommended a series of flood mitigation measures to reduce this risk to occupiers and equipment within the Site. VPI Immingham Ltd do not intend on building their own new flood defences but wish to build their 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.

7.1.3 This Section therefore provides recommendations in accordance with the guidance provided in the NPPF, SFRA and by the EA on how VPI Immingham Ltd 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;
- design capacity exceedance.

7.2 Flood Resistance and Resilience Measures

7.2.1 The following flood resilience and resistance mitigation measures were considered to ensure the operation of the 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.

7.2.2 The NLC SFRA 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 design internal finished floor levels are elevated above the modelled breach event peak flood level.

7.2.3 CIRIA Report C688 'Flood Resilience and Resistance for Critical Infrastructure'[38], 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".

7.2.4 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 0.3m and 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.

[38] CIRIA. (2010). Report C688 'Flood Resilience and Resistance for Critical Infrastructure. Available at: https://www.ciria.org/Resources/Free_publications/Flood_resilience.aspx

7.2.5 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[39] 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.

7.2.6 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. No flood volume compensation is therefore required.

7.2.7 The predicted peak flood level for the Site during a 0.1% AEP (1 in 1000 chance) flood event including climate change up to 2115 is estimated by AECOM to be 6.7 mAOD. 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.

7.2.8 Relevant pieces of critical equipment include:

- Electrical equipment, switchboards and control panels;
- Transformers;
- Auxiliary generator; and
- Closed loop fin-fan cooling system.

7.2.9 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.

[39] CIRIA. (2006). Designing for exceedance in urban drainage - good practice. Available at: https://www.ciria.org/Resources/Free_publications/Designing_exceedance_drainage.aspx

7.3 Flood Emergency Response Plan

7.3.1 The Proposed Development would be on standby and needs to be available at all times. It is most likely to run during periods of low electricity supply or high demand on the transmission network, or when required to provide technical services to support the National Grid. This is expected to be weighted towards the winter period, for a few hours at a time. When operational the Proposed Development, will be continually manned over the timescale of operation. The Site is at a high residual risk of flooding and therefore a system will be put in place to safeguard the workers at the Site in the event of defence failure.

7.3.2 It is proposed 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.

7.3.3 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.

7.3.4 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 safe place of 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.

7.4 Flood Warnings and Alerts

7.4.1 The EA operates a Flood Warning Service[40] 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.

7.4.2 EA Flood Alert codes are assigned to areas.

[40] Environment Agency. 2018 Flood Warning Service- Flood warnings for England. Available at: https://flood-warning-information.service.gov.uk/warnings

7.4.3 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.

7.4.4 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.

7.4.5 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.

7.4.6 For any proposed commercial or industrial developments within a designated floodplain (as in the case of the Site), 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.

7.4.7 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.

7.5 Emergency Access and Egress to/from the Site

7.5.1 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.

7.5.2 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'[41], 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

[41] Defra and Environment Agency. (October 2005). 'Framework and Guidance for Assessing and Managing Flood Risk for New Development'. FD2320 R&D Technical Report 2.

- 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.

7.5.3 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 (see Section **Error! Reference source not found.**) has illustrated that the Site and immediate surrounding area is located in an area of 'significant to extreme' 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

7.5.4 Safe places of 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.

7.5.5 An area within the main buildings for the Proposed Development 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 0.1% AEP flood level, estimated by AECOM to be around 6.70 mAOD.

7.6 Drainage System Failure, Capacity Exceedance and Maintenance

7.6.1 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.

7.6.2 In order to reduce the risks, maintenance of the system will be incorporated in general site management and will remain the responsibility of VPI Immingham Ltd. 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.

7.6.3 CIRIA C635 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).

8.0 SUMMARY AND CONCLUSIONS

8.1 Flood Risk Summary

Tidal Sources

8.1.1 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.

8.1.2 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.

8.1.3 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.

Fluvial Sources

8.1.4 The Site is located in the vicinity of a number of watercourses managed by the NELIDB. The IDB and the SFRA indicate that flood risk to the study area from these watercourse drainage catchments is low. The drainage catchment has sufficient capacity within its drainage channels to contain the 1% and 0.1% AEP flood events and therefore the site is considered to be at low risk of fluvial flooding;

Surface Water Runoff

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

Groundwater

8.1.6 The risk of groundwater flooding within the Site is considered to be 'low'';

Artificial Sources

8.1.7 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.

8.2 Management of Surface Water Runoff from the Site

8.2.1 In order to comply with the requirements of the local, regional and national planning policy, the surface water runoff from the Site will be restricted to approximately 10.81 l/s (greenfield runoff rate).

8.2.2 To meet this requirement the Site requires an attenuation volume of between approximately 1635 m3 and 2207 m^3. This volume will accommodate surface water runoff for a 1% AEP storm event with a 40% allowance for climate change.

8.2.3 It is likely, due to the use of the Site and ground/groundwater conditions that surface water attenuation will be provided by underground tanks or above ground ponds and/or oversized pipes. Additional SuDS measures suitable for the facility will be assessed at the detailed drainage design stage.

8.3 Residual Risk Mitigation Measures

8.3.1 Based on the flood level information provided by the EA and climate change estimations undertaken by AECOM, the predicted peak flood level for at the Site during a 0.1% AEP (1 in 1000 chance) flood event is estimated to be around 6.7 mAOD.

8.3.2 It is therefore recommended that any internal floor level providing a safe place of refuge for the occupiers of the Proposed Development area within the Site would need to be elevated above a level of 6.7 mAOD.

8.3.3 VPI Immingham Ltd does not intend to raise any existing ground levels within the Site, but elevate all critical equipment assets and provide a safe place of refuge above a level of 6.7 mAOD.

8.3.4 A number of additional mitigation strategies will be considered during the design process for the proposed development to ensure the operation of 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.

ANNEX 1 FIGURES

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

Order Limits

Purpose of Issue
ENVIRONMENTAL STATEMENT

Client
VPI IMMINGHAM B LTD

Project Title
THE VPI IMMINGHAM OCGT PROJECT

Drawing Title
SITE LOCATION
FIGURE 12A.1

Drawn	Checked	Approved	Date
JW	DH	MS	05/04/2019

AECOM Internal Project No.	Scale @ A3	Inset Map
60547702	1:15,000	/ 1:200,000

AECOM
Midpoint
Alencon Link, Basingstoke
Hampshire, RG21 7PP
Telephone (01256) 310200
Fax (01256) 310201
www.aecom.com

DCO Document Ref: **6.4.26**

Rev

File Name:K:\5004 - Information Systems\60547702 Immingham Gas Pipeline\02_Maps\Power Plant Site\OCGT Full ES 2019\Figure 1.1 Site Location.mxd

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- Order Limits
- Works No. 1 - OCGT Power Station
- Works No. 2 - Access
- Works No. 3 - Temporary Construction Laydown
- Works No. 4 - Gas Connection
- Works No. 5 - Electrical Connection
- Works No. 6 - Utilities and Services Connections

Purpose of Issue
ENVIRONMENTAL STATEMENT

Client
VPI IMMINGHAM B LTD

Project Title
THE VPI IMMINGHAM OCGT PROJECT

Drawing Title
PARTS OF THE SITE
FIGURE 12A.2

Drawn	Checked	Approved	Date
JW	DH	MS	05/04/2019

AECOM Internal Project No.	Scale @ A3
60547702	1:3,000

AECOM
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DCO Document Ref:
6.4.26

Rev

File Name:K:\5004 - Information Systems\60547702 Immingham Gas Pipeline\02_Maps\Power Plant Site\OCGT Full ES 2019\Figure 3.2 Parts of the Site.mxd

Local Land Drain Adjacent to Site

Watercourse 9

Water Storage Lagoon

Settling Lagoons

Watercourse 9A

Rosper Road Pools

Humber Lower

Burkinshaw's Covert
Station House
Depot
Path
L Ho
Outfall
Jetty
GVC
Pipe Line
Travelling Crane
Conveyor
Conveyors
Works
Hazel Dene
Spro
Coal Terminal
Ore Terminal
Warehouse
Pipe Lines
Chy
Fl Sk
F Sta
Mast
Warehouses
Masts
Wate Towe
STATION ROAD
ROSPER ROAD
MARSH LANE
HUMBER ROAD
WEST HAVEN WAY
A160
A1173
Track
Drain
LC
Mean High Water
6m
4m
3m
2m
7m

100 0 100 200 300 400 500 m

N

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

Order Limits

Purpose of Issue
ENVIRONMENTAL STATEMENT

Client
VPI IMMINGHAM B LTD

Project Title
THE VPI IMMINGHAM OCGT PROJECT

Drawing Title
SURFACE WATER FEATURES WITHIN THE STUDY AREA FIGURE 12A.3

Drawn	Checked	Approved	Date
TD	DH	MS	05/04/2019

AECOM Internal Project No. 60547702
Scale @ A3 1:7,500

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DCO Document Ref: **6.4.26**
Rev

File Name:K:\5004 - Information Systems\60547702 Immingham Gas Pipeline\02_Maps\Power Plant Site\OCGT Full ES 2019\Figure 12.1 Surface Water Features within the Study Area.mxd

ANNEX 2 ENVIRONMENT AGENCY CONSULTATION

Joanne Somerton
joanne.somerton@aecom.com

Our ref: CCN/2018/73227

Date: 12 February 2018

Dear Jo

Provision of Flood Risk Information for a site in South Killingholme, 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 there are many kilometres of raised flood defences. To meet the requirements of the National Planning Policy Framework, these defences are removed in their entirety to produce the Flood Map for Planning (Rivers and Sea). The map therefore shows the full extent of areas that would be at risk of flooding if no defences existed and water could 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 flooding 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.

Tidal Flood Risk Information

Tidal Defence Information

The tidal defences protecting this site consist of concrete floodwalls which are supplemented by saltmarsh to maintain foreshore levels.

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, Thrapston, 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 Robert Eames using the details below.

Yours sincerely,

[redacted]

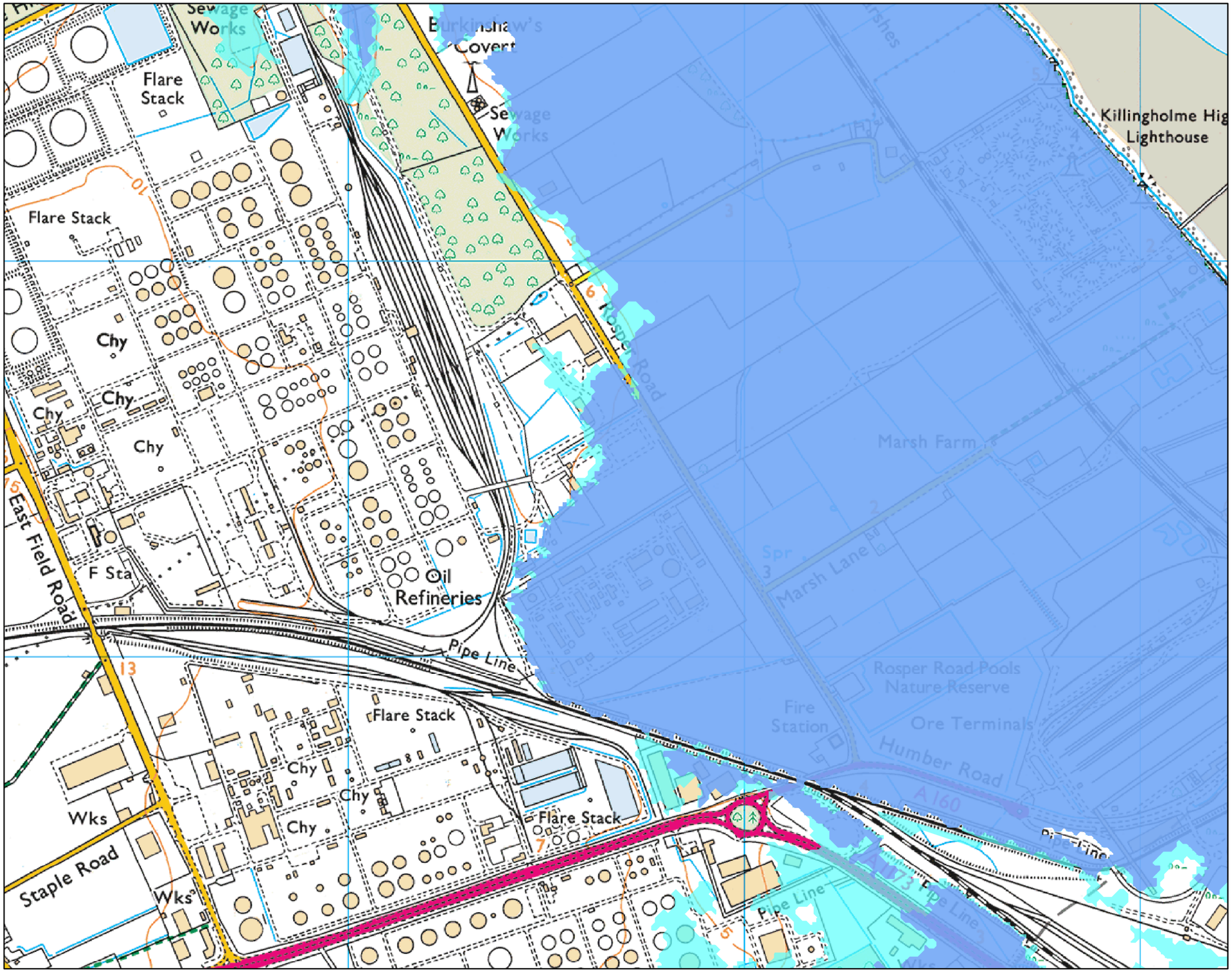
FOR Claire Rose
Partnerships and Strategic Overview Team Leader - South Humber and East Coast

Direct dial 0208 474 9436
Direct e-mail PSO_Coastal@environment-agency.gov.uk

Enc.
Flood Map
Historic Flood Extent Map
Estimated Tide Levels
Tidal Breach Locations Map
Hazard Mapping – Breaching (4 maps)
Hazard Mapping – Overtopping (4 maps)

Awarded to Lincolnshire & Northamptonshire Area

Flood Map centred on TA 16677 17430 - created February 2018 [Ref: CCN-2018-73227]



Environment Agency

Scale 1:10,000

N W E S

- Main River
- 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.

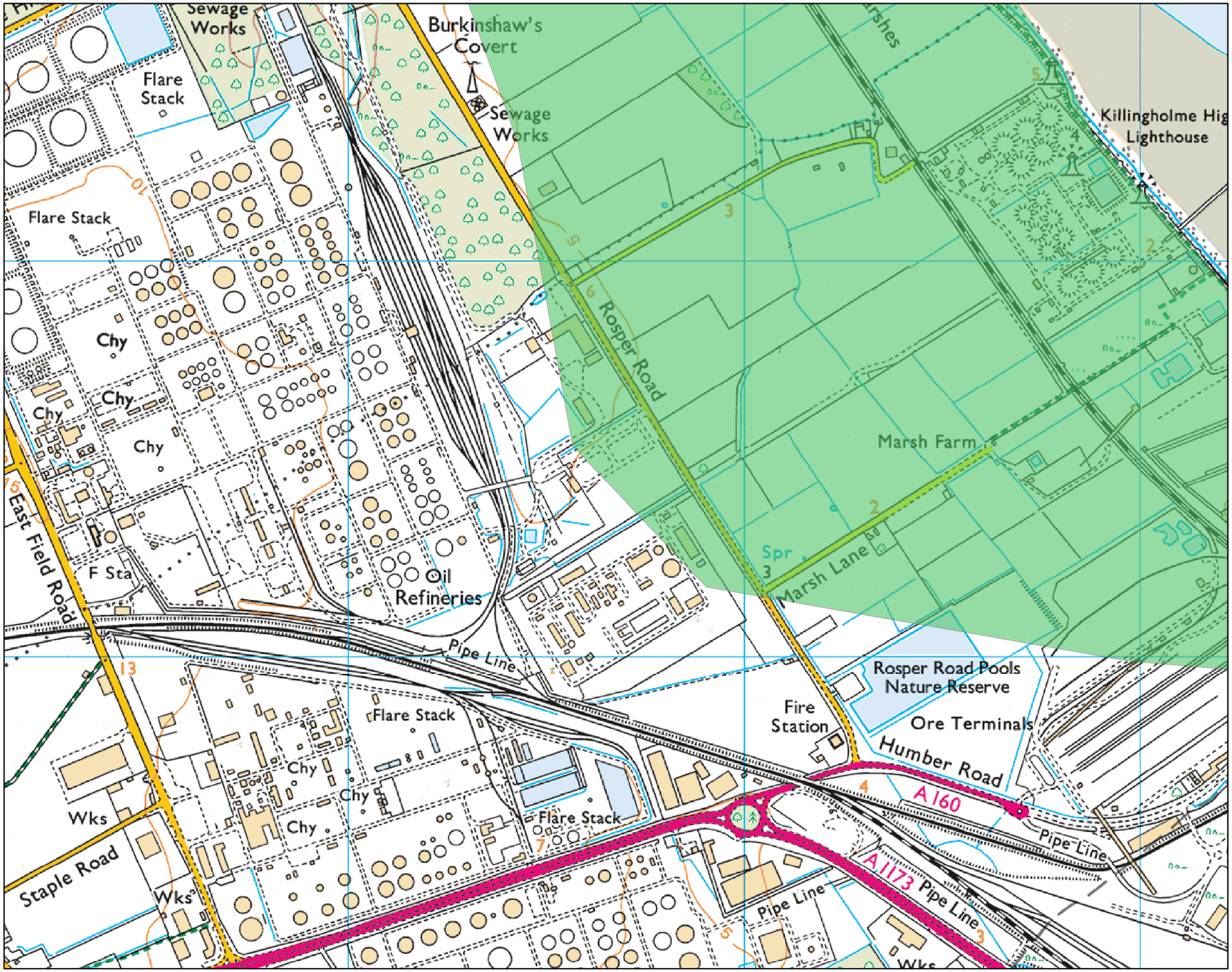
Light blue shows the extent of the Extreme Flood Outline, which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater.

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 16677 17430 - created February 2018 [Ref: CCN-2018-73227]



Environment Agency

Scale 1:10,000

N W E S

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

Tidal Level Location Map
Lincolnshire & Northamptonshire Area

Environment Agency

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.

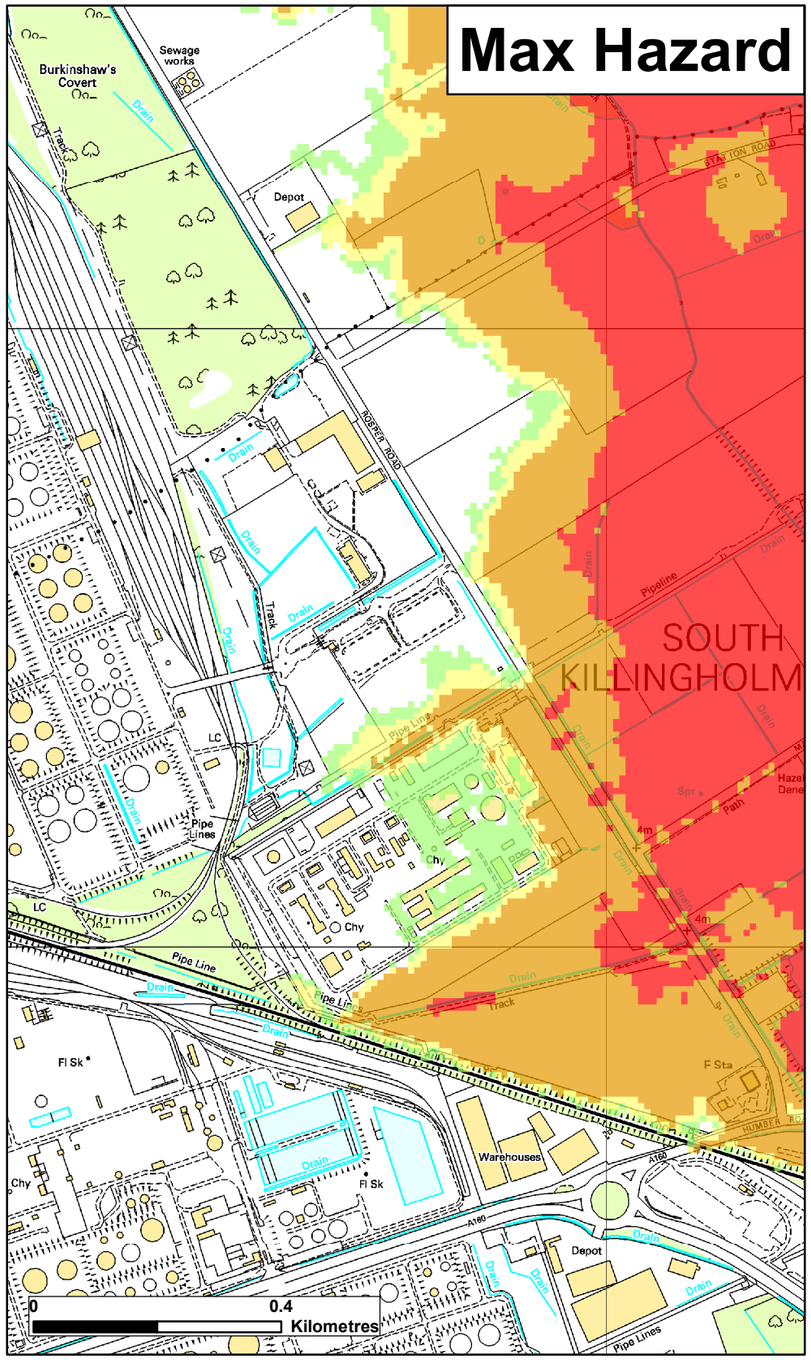
General Enquiries No: 03708 506 506.
Weekday daytime calls cost 5p plus up to 6ppm from BT Weekend Unlimited. Mobile and other providers charges may vary

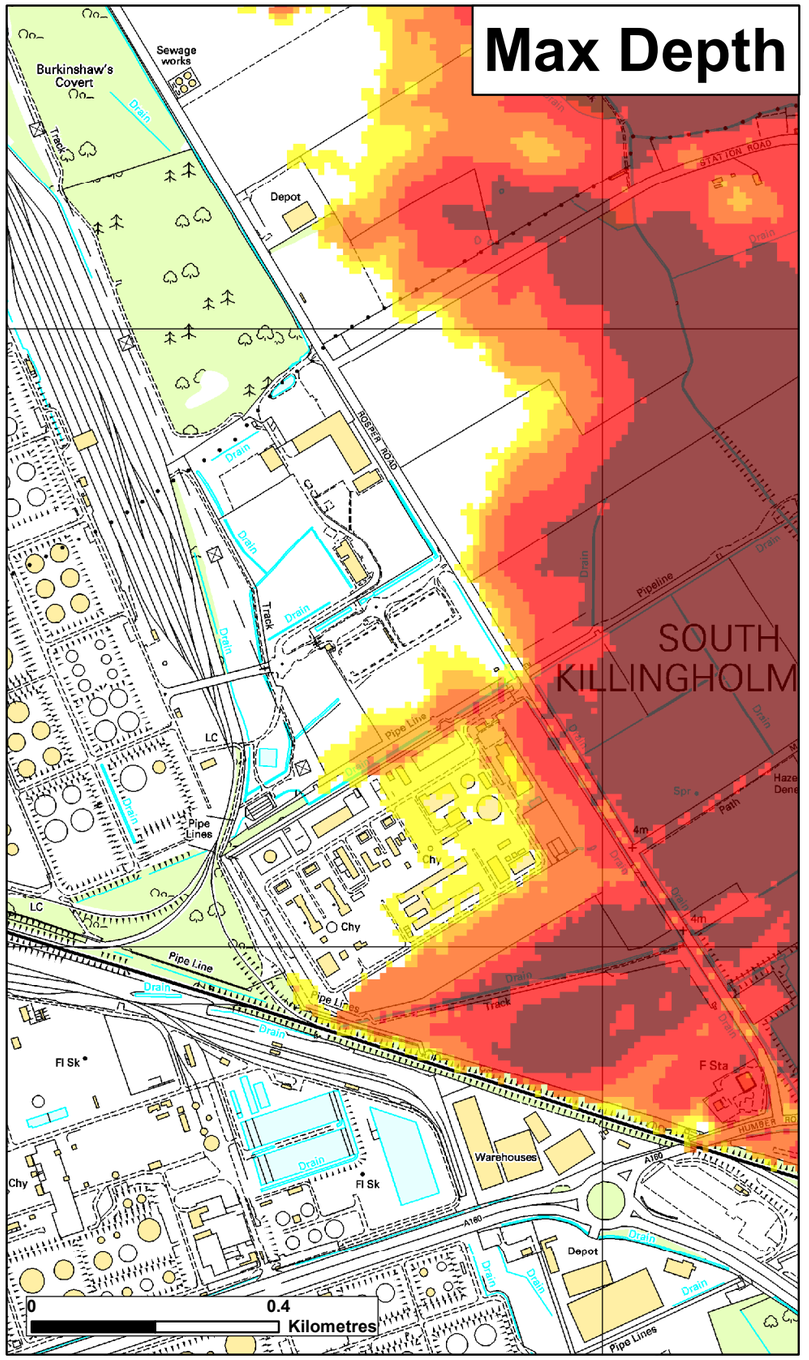
Environment Agency

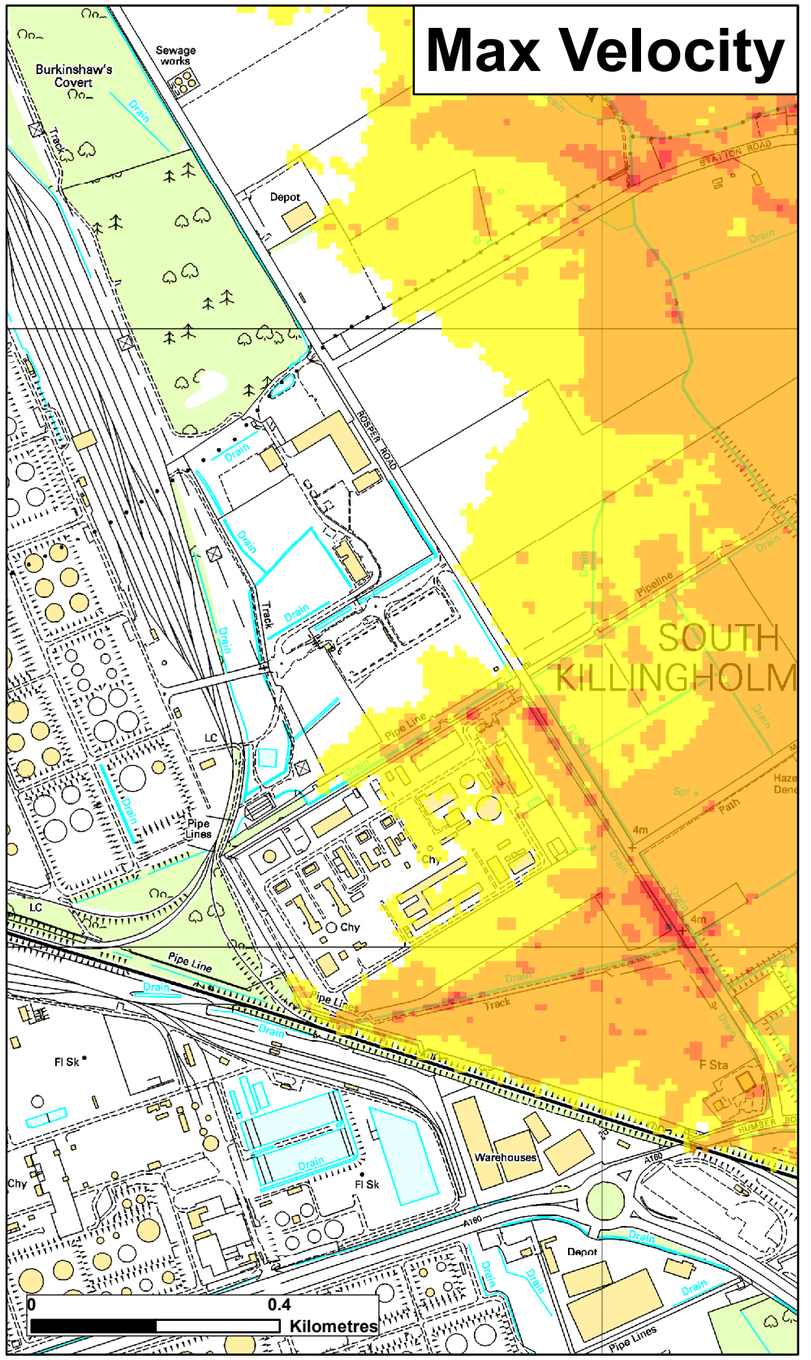
Produced by the Partnership and Strategic Overview Team, Lincoln
General Enquiries No: 03708 506 506

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	February 2018	Scenario year	2006	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-73227

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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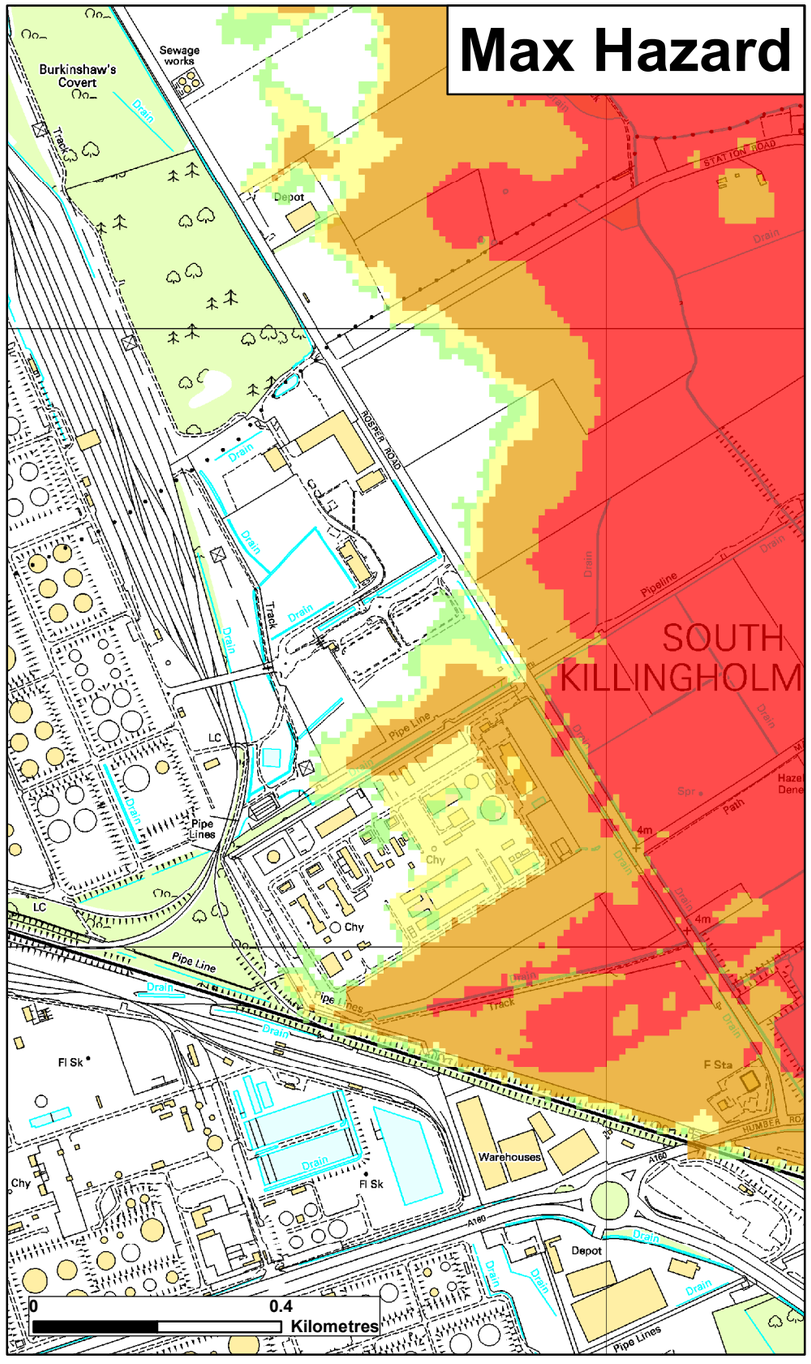
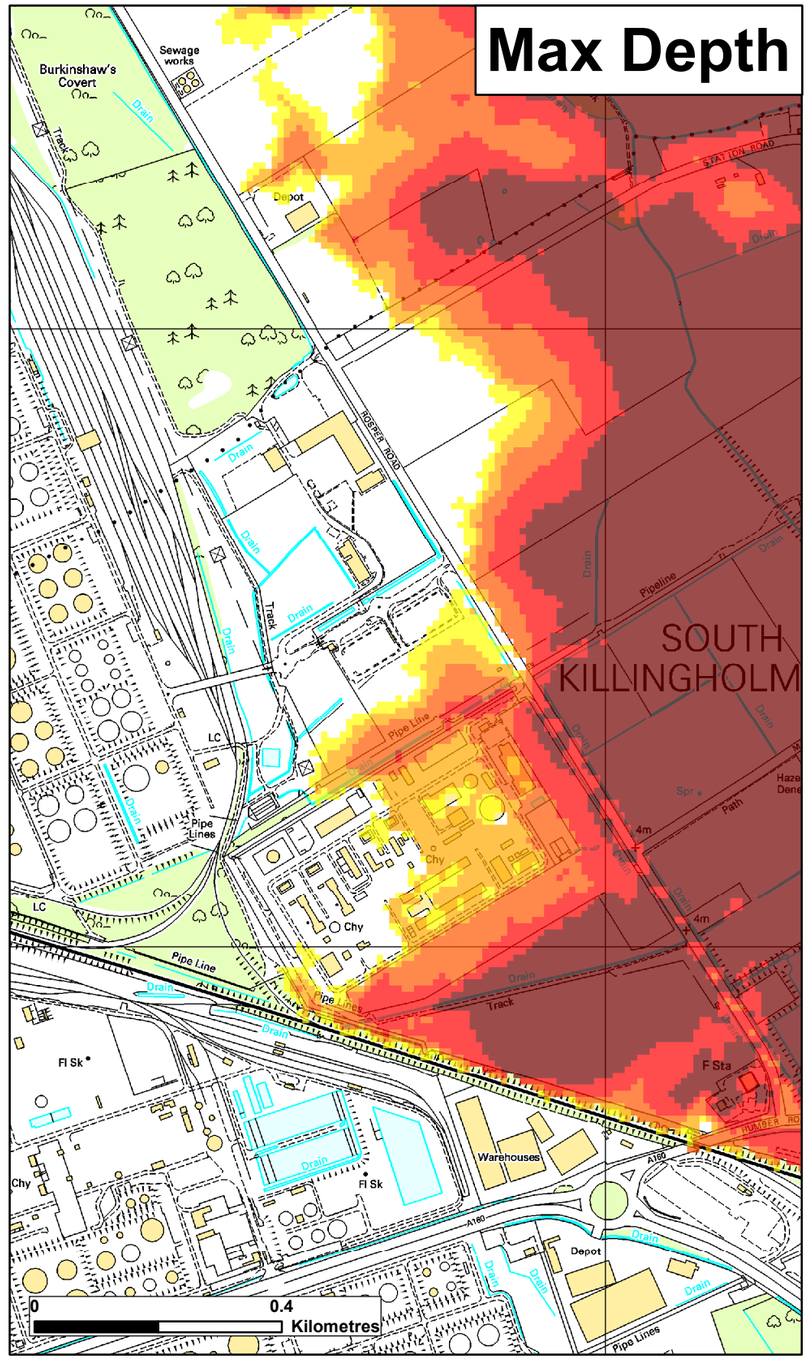
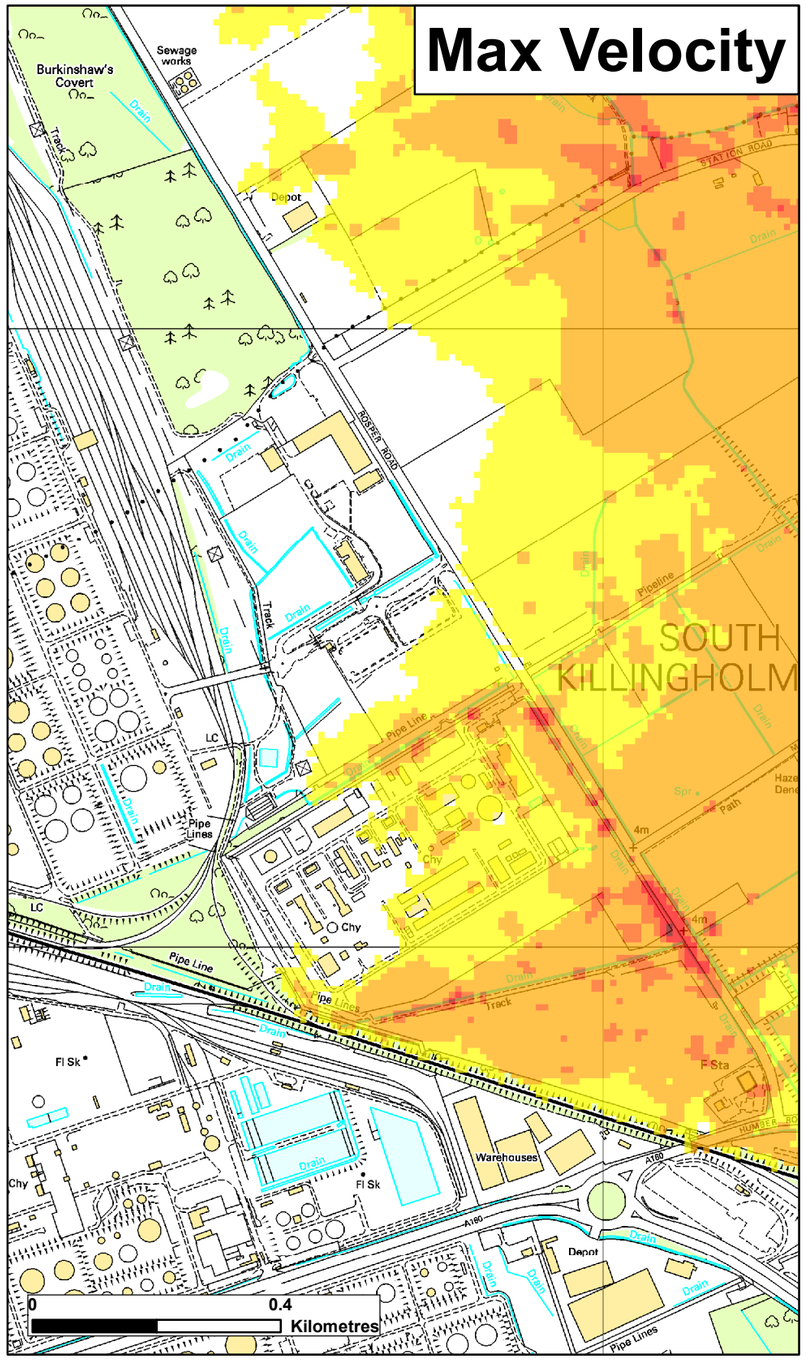
Environment Agency

Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 16677 17430







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- 1.5 - 2.5
- 2.5 +

Date Printed	February 2018	Scenario year	2006	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-73227

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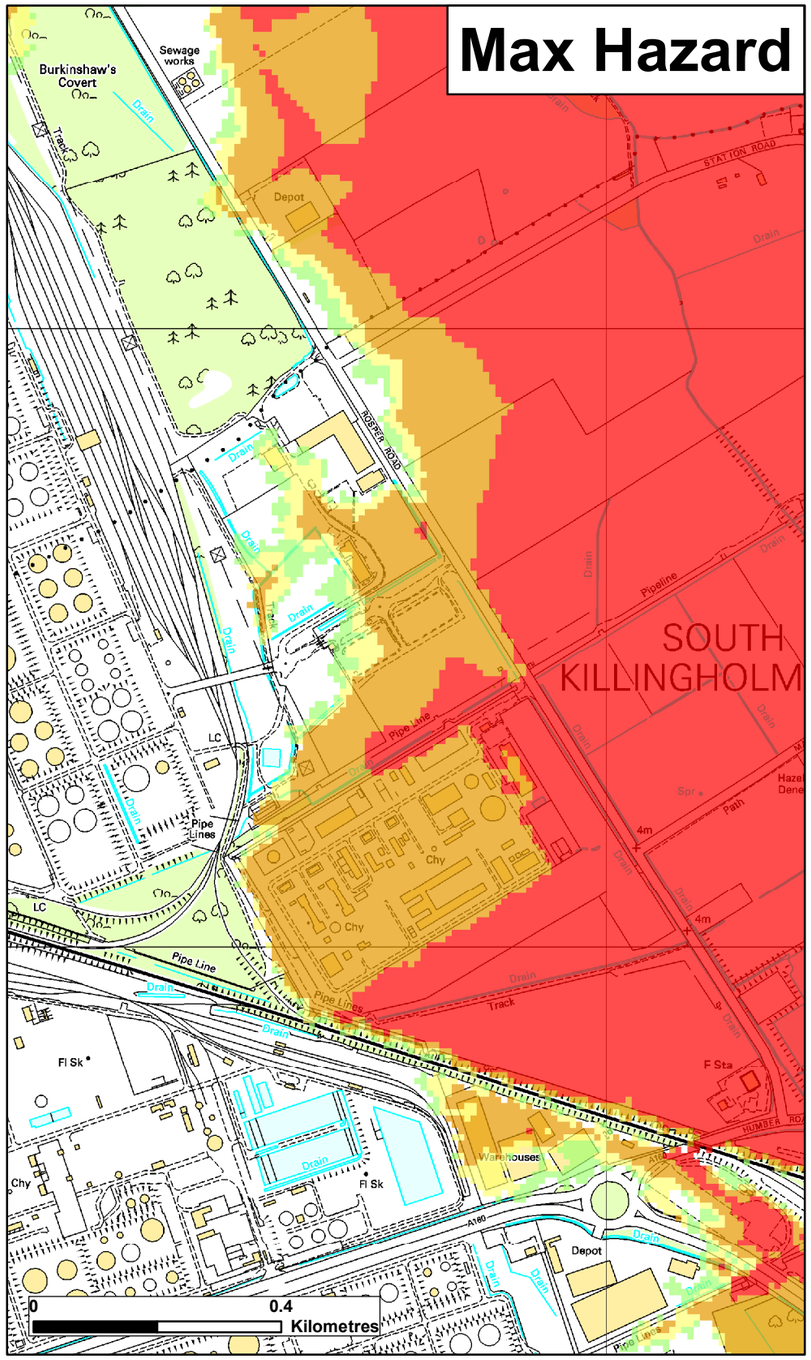
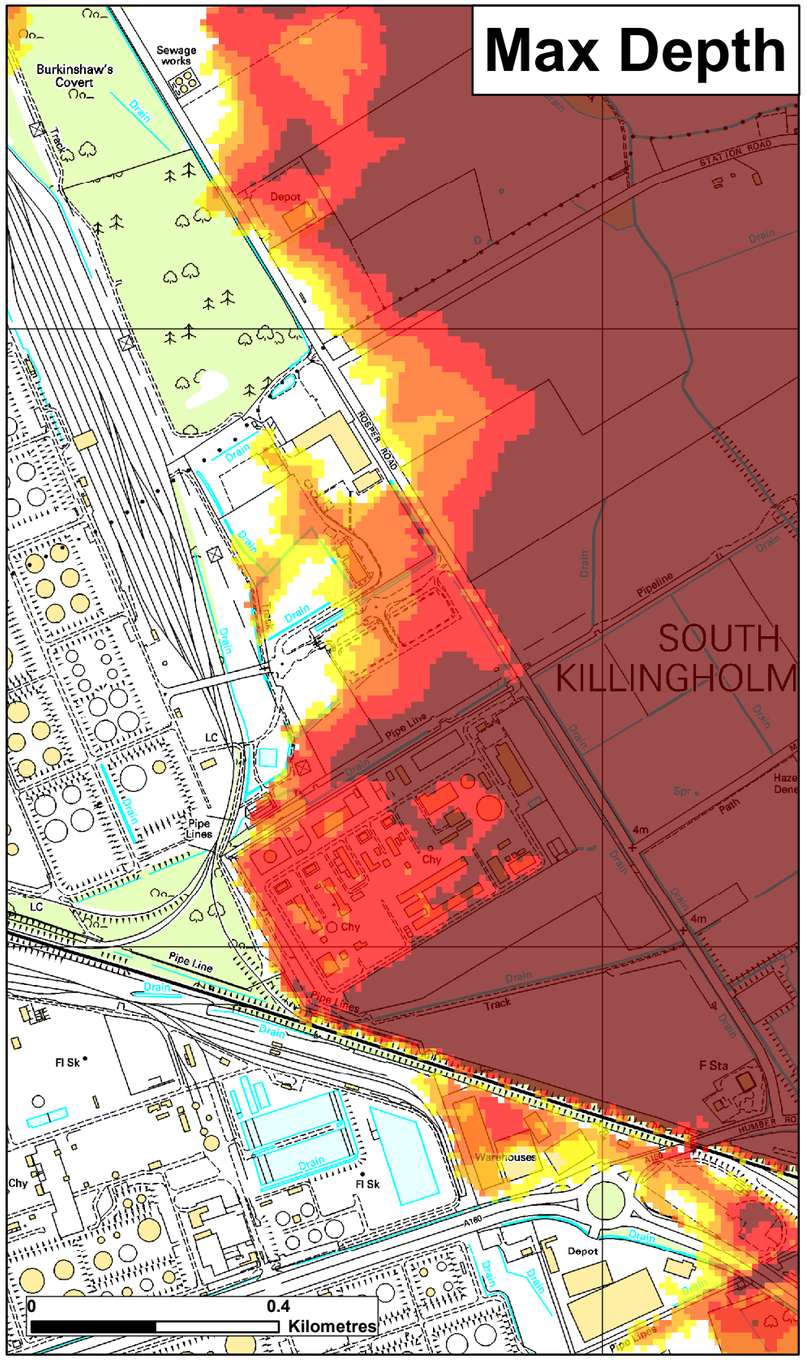
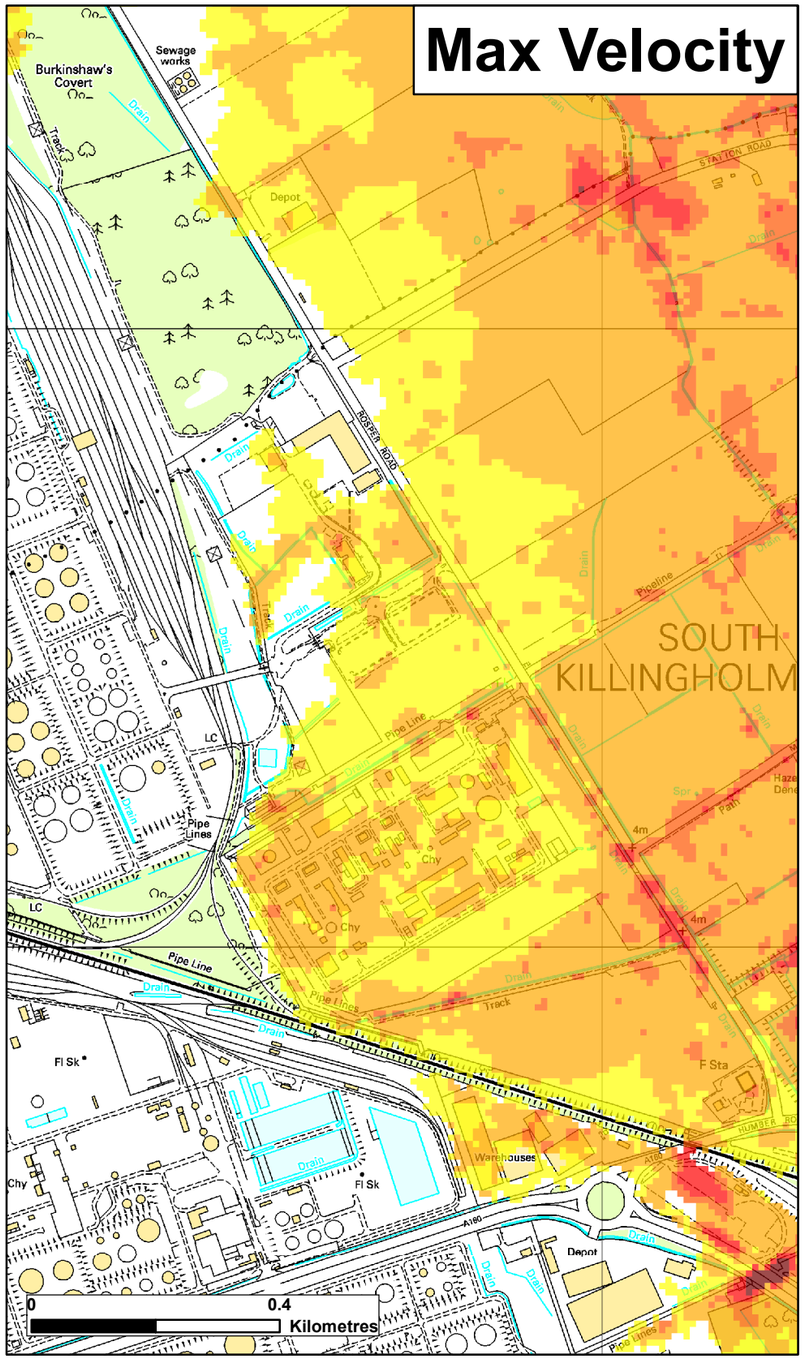
Environment Agency

Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 16677 17430







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Date Printed	February 2018	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-73227

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.

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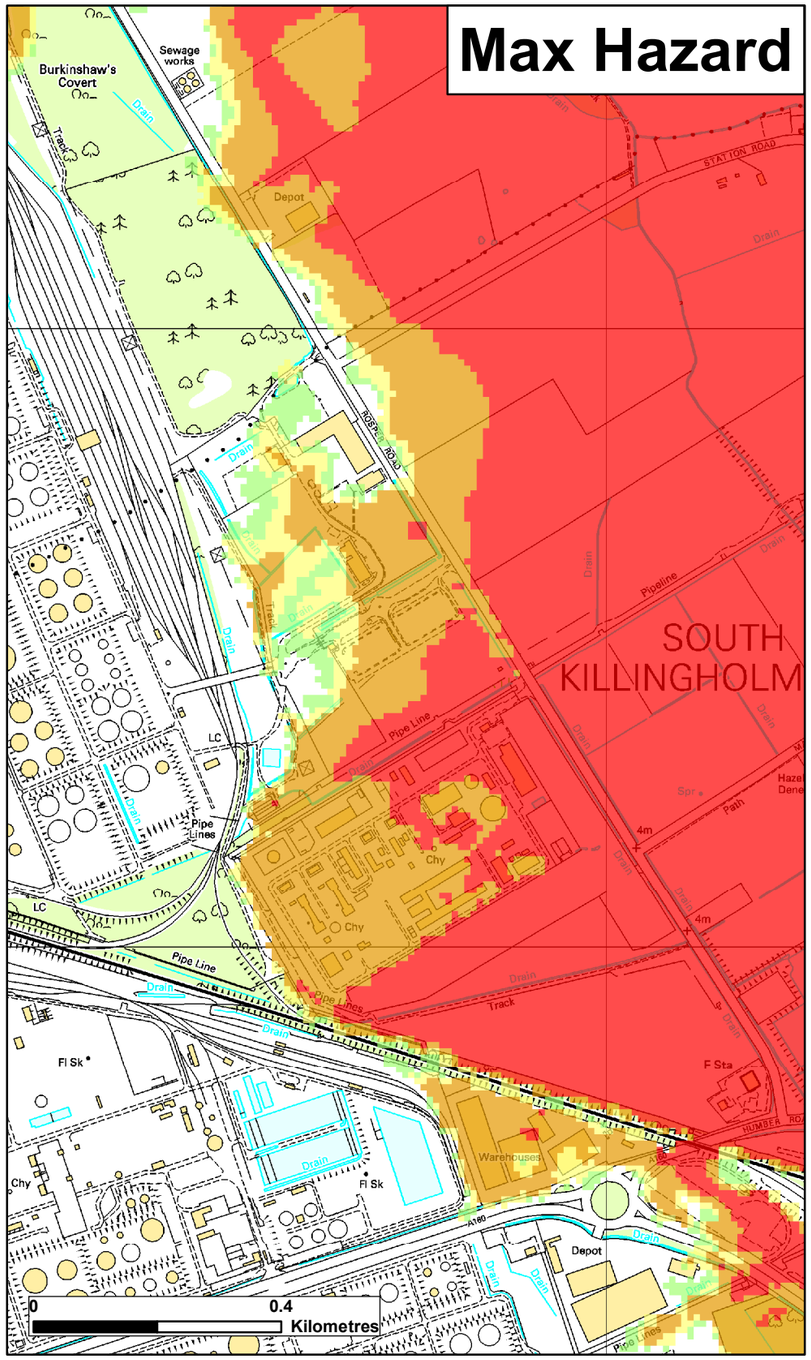
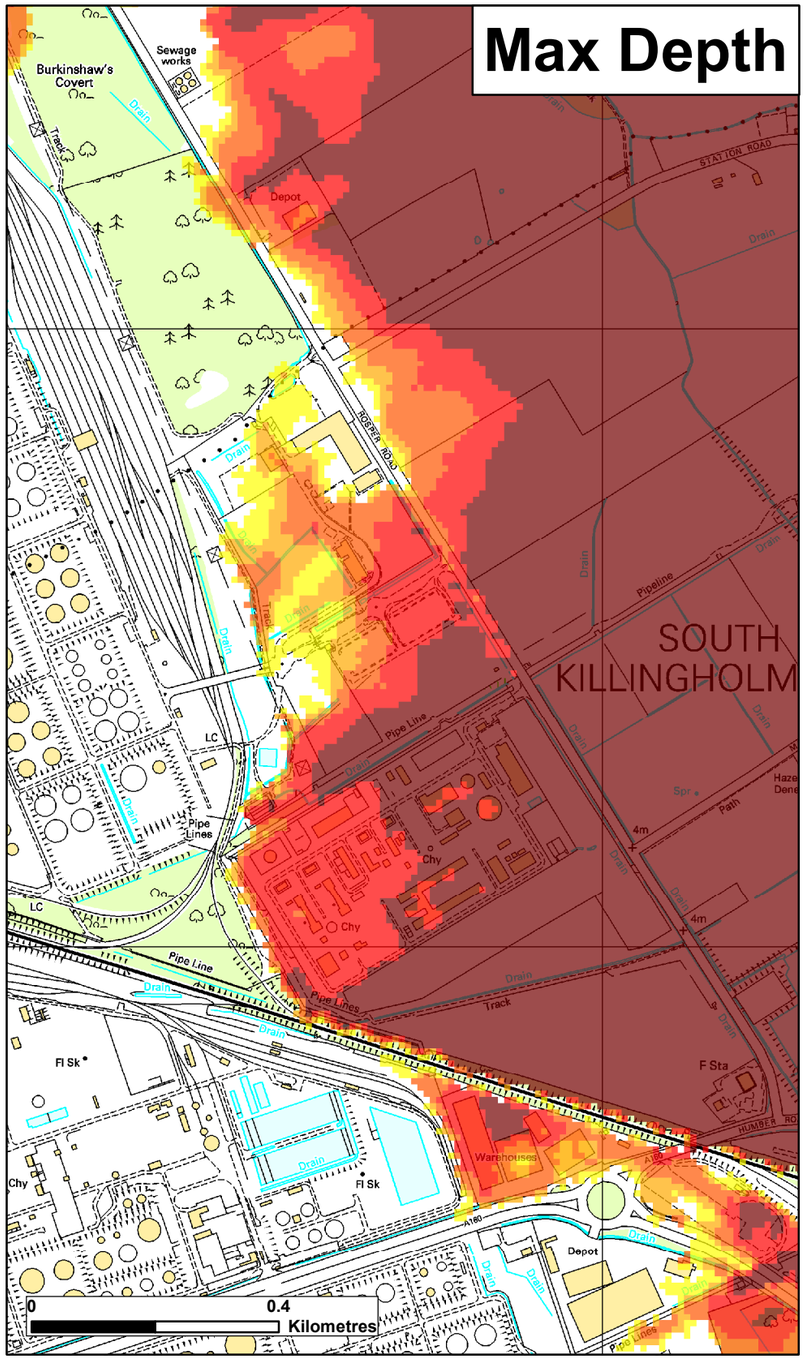
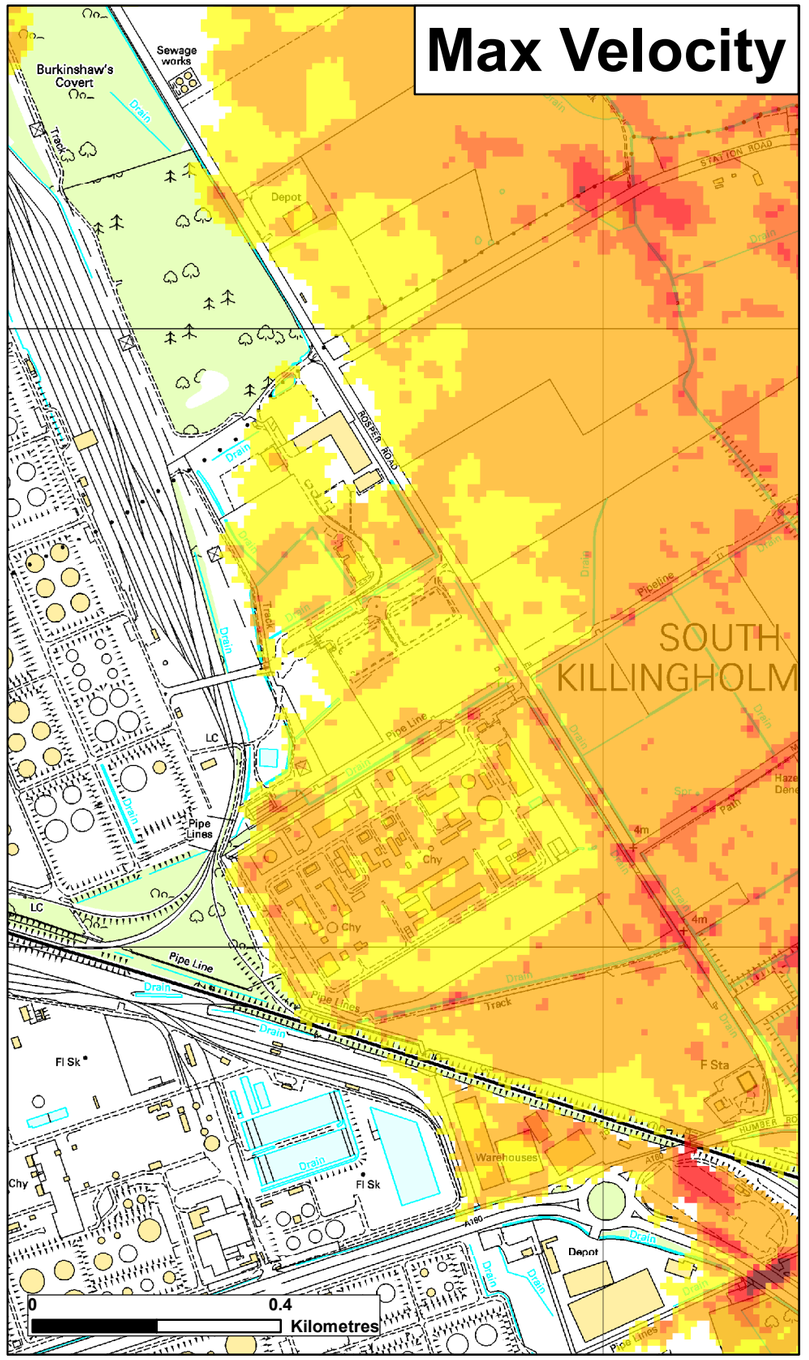
Environment Agency

Lincolnshire and Northamptonshire Breach Hazard mapping

Map Centred on TA 16677 17430







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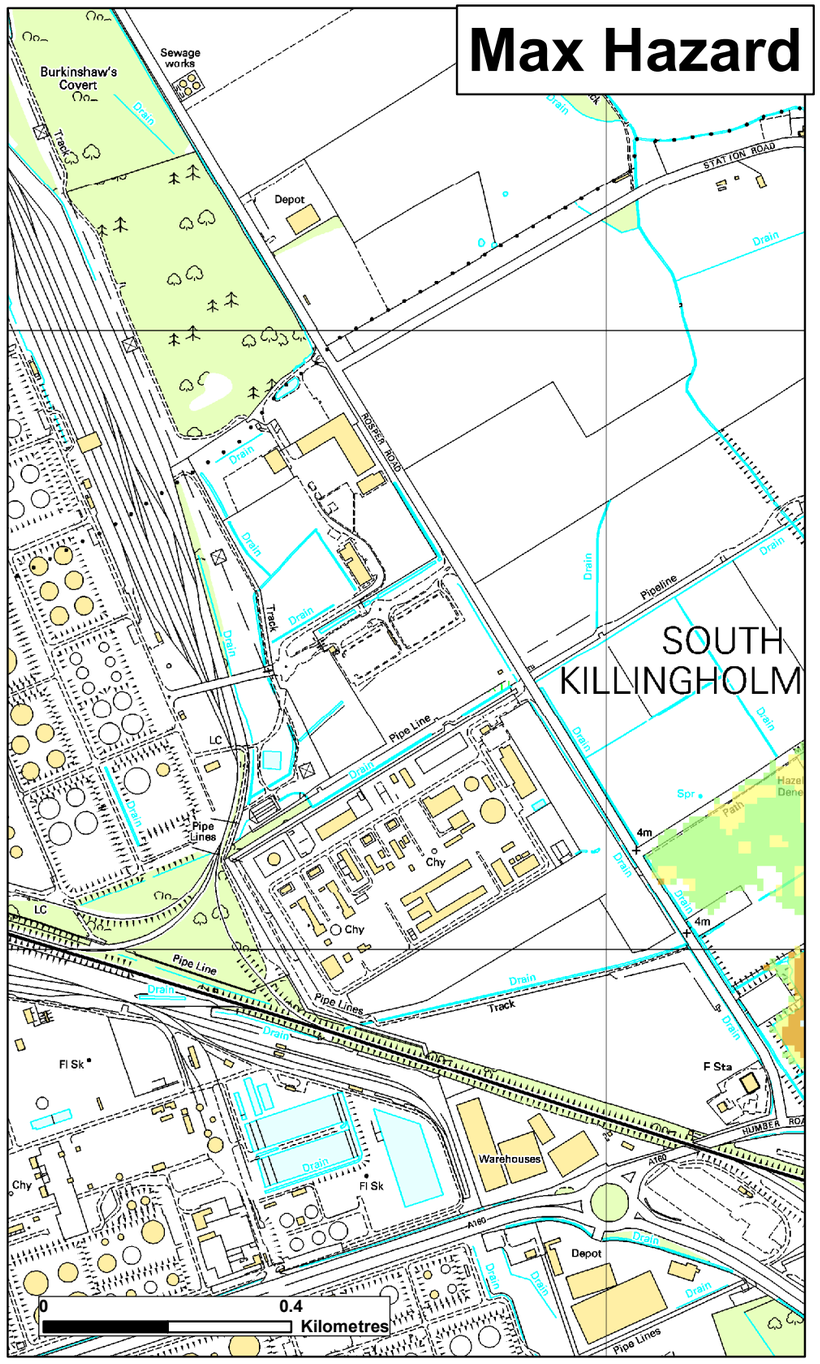

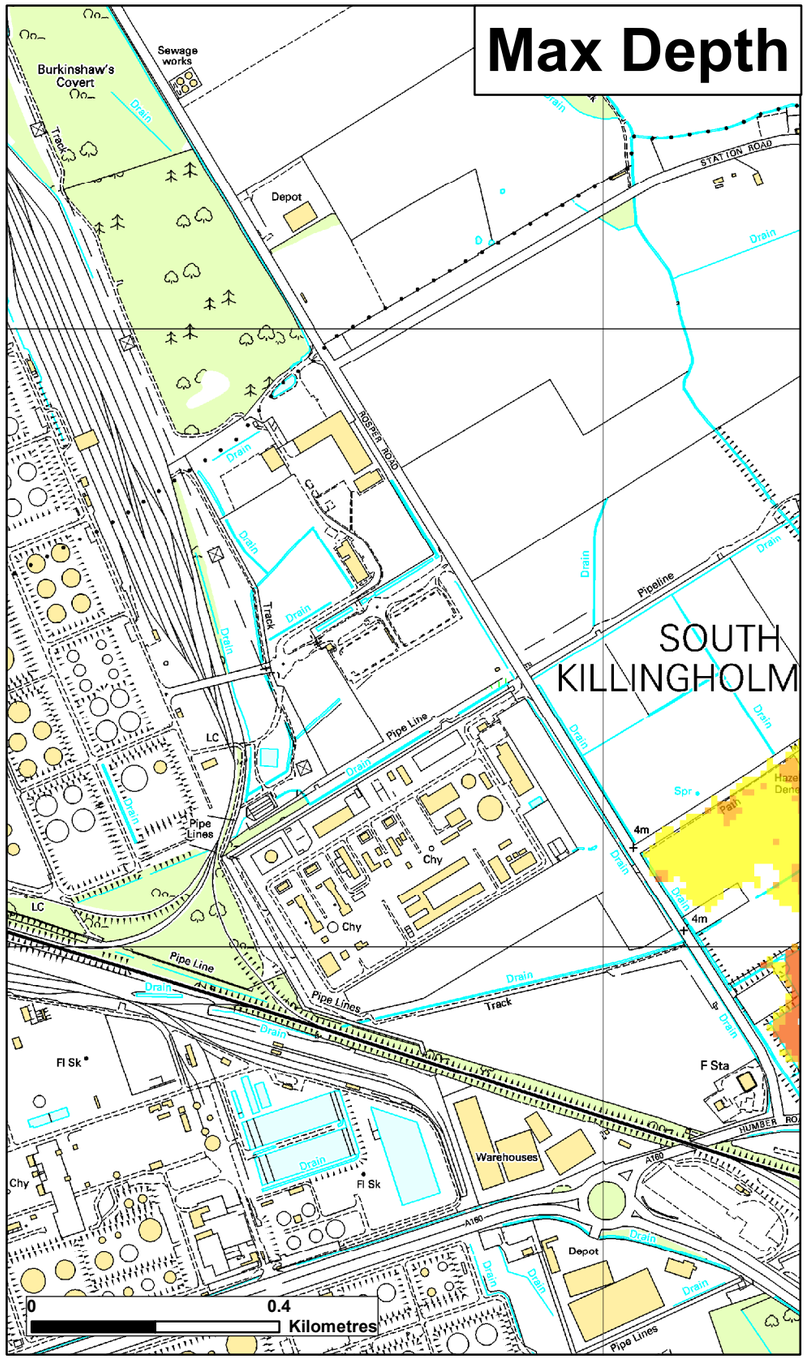

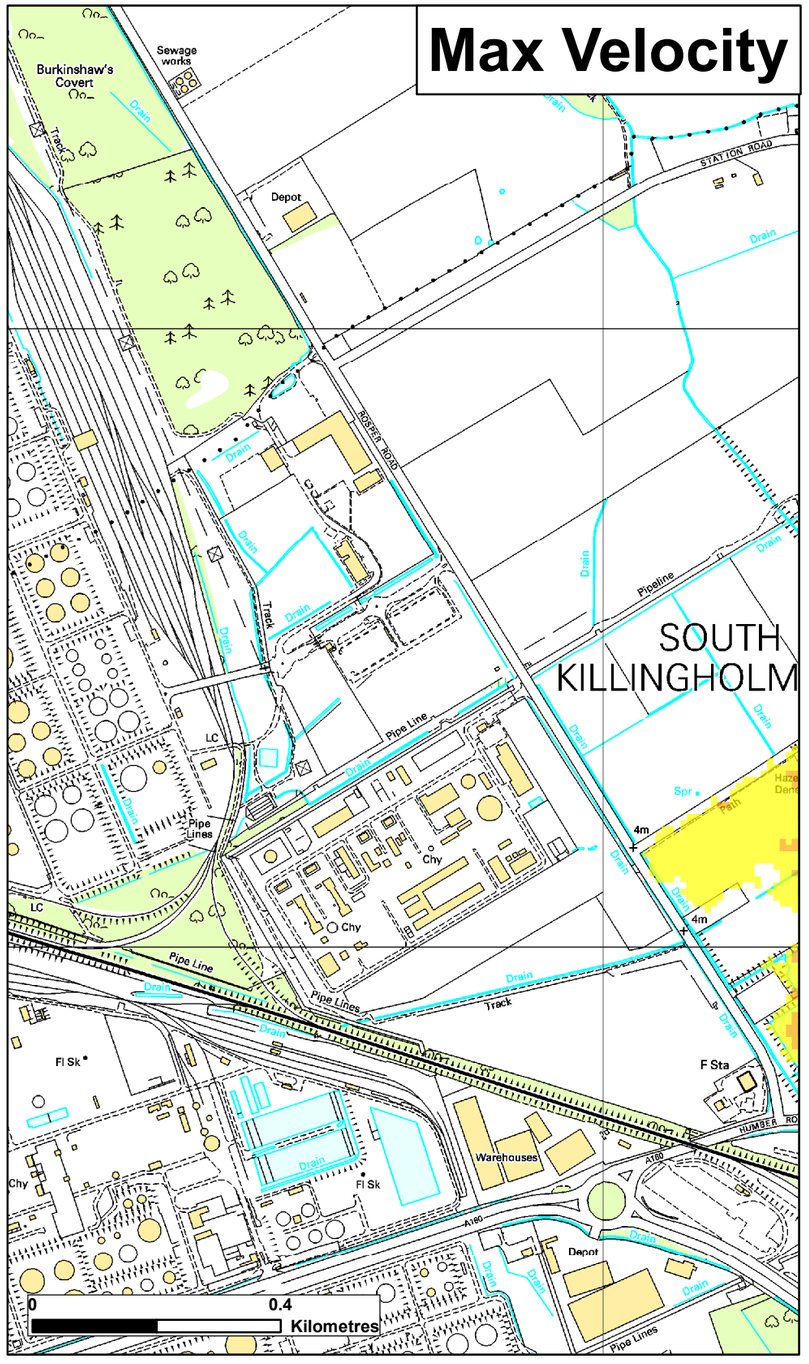

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Date Printed	February 2018	Scenario year	2006	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-73227

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.

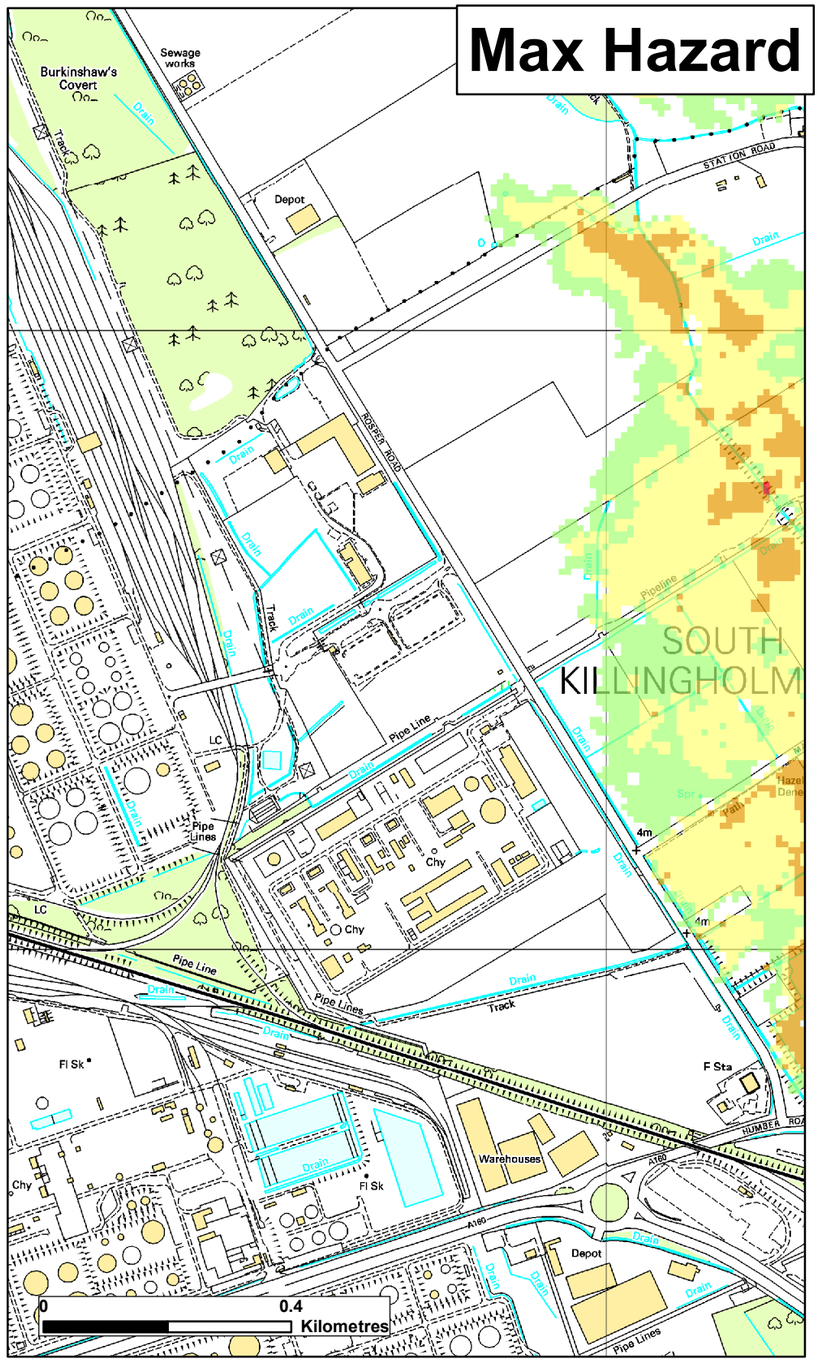
These maps do not replace the flood zone maps used in the National Planning Policy Framework (NPPF)

Environment Agency

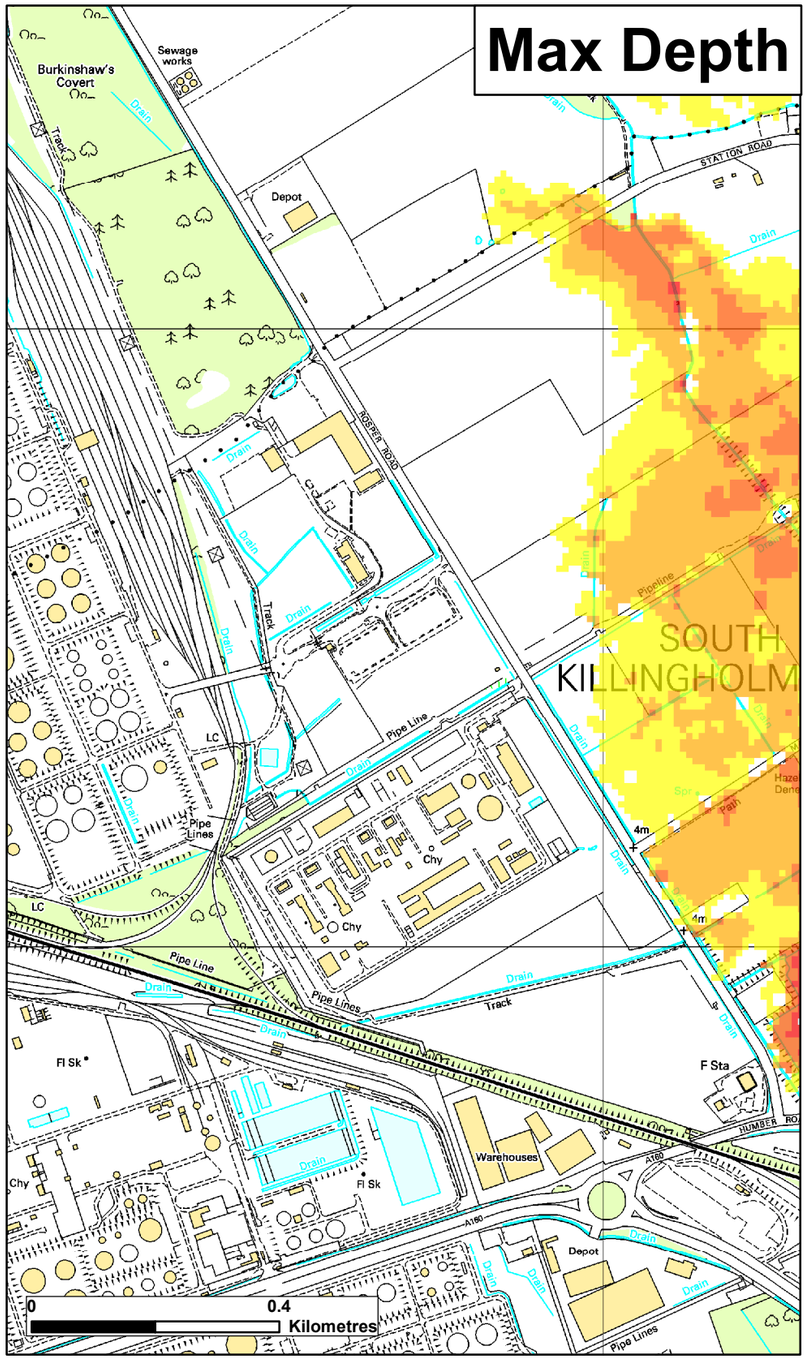
Lincolnshire and Northamptonshire Overtopping Hazard Mapping

Map Centred on TA 16677 17430

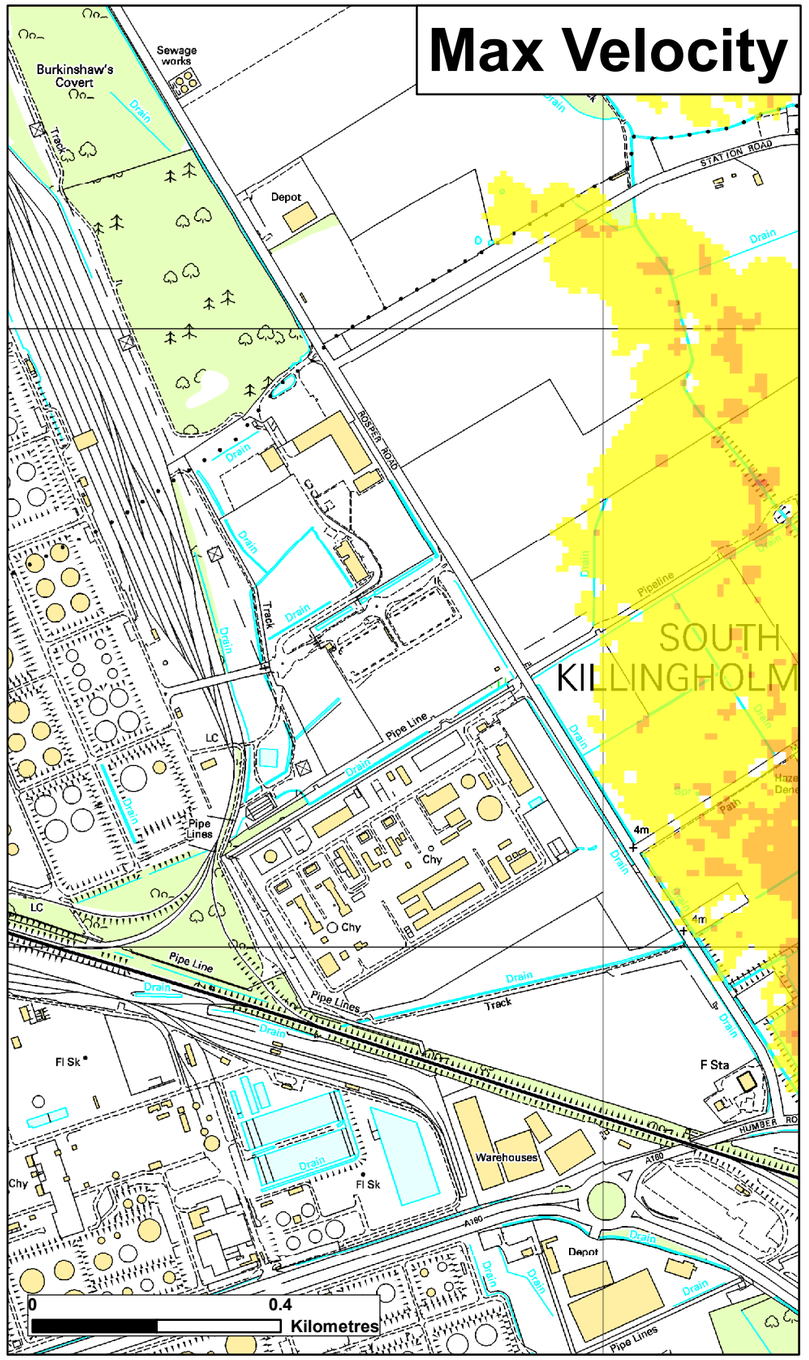
Max Hazard



Max Depth



Max Velocity



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Date Printed	February 2018	Scenario year	2006	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-73227

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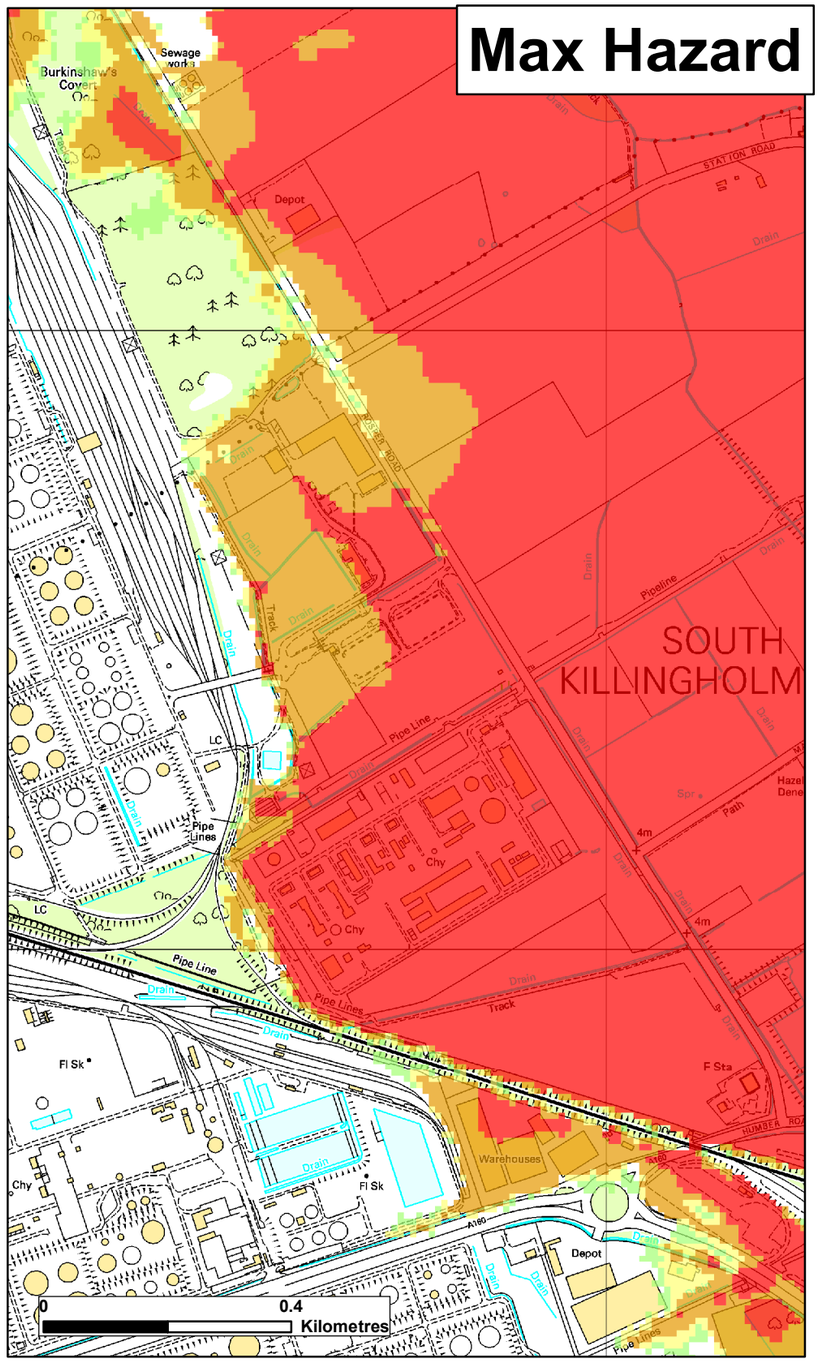

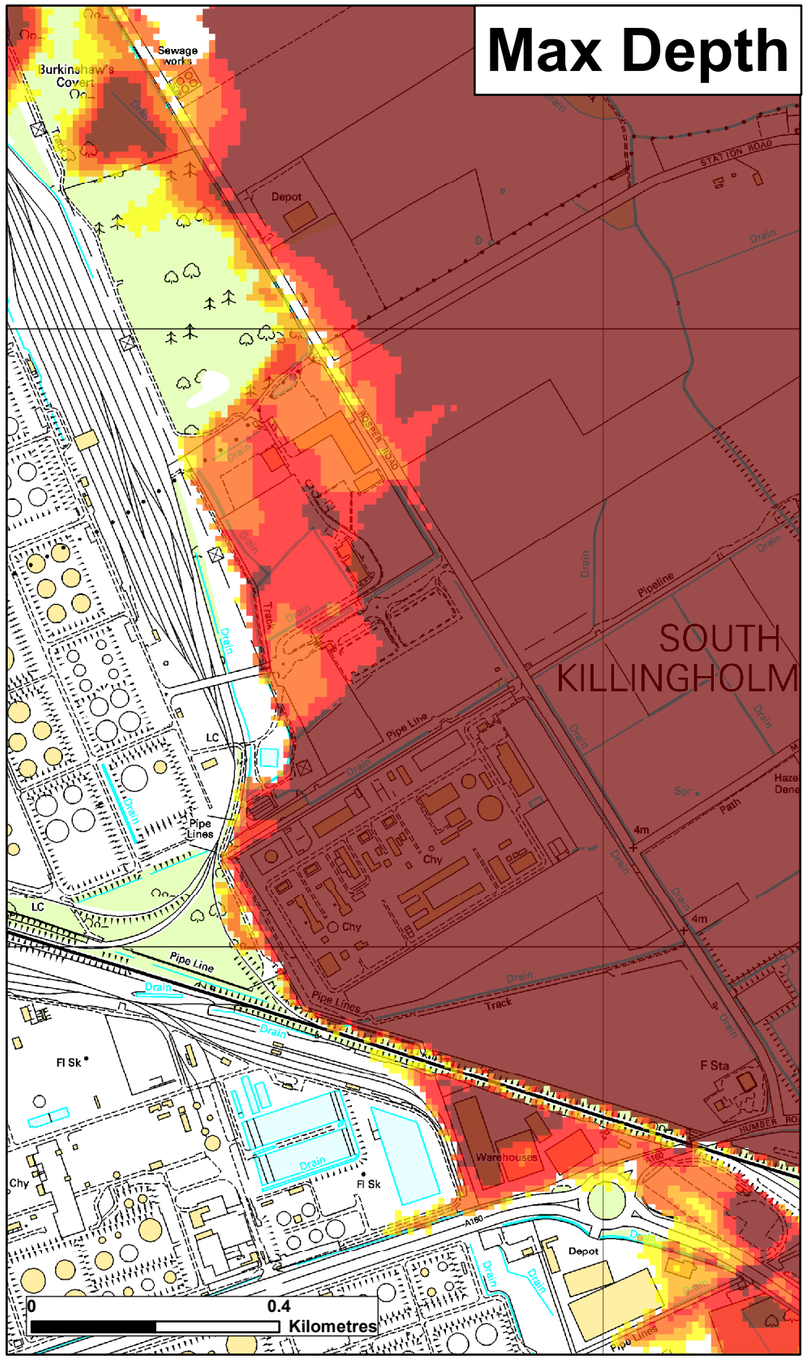

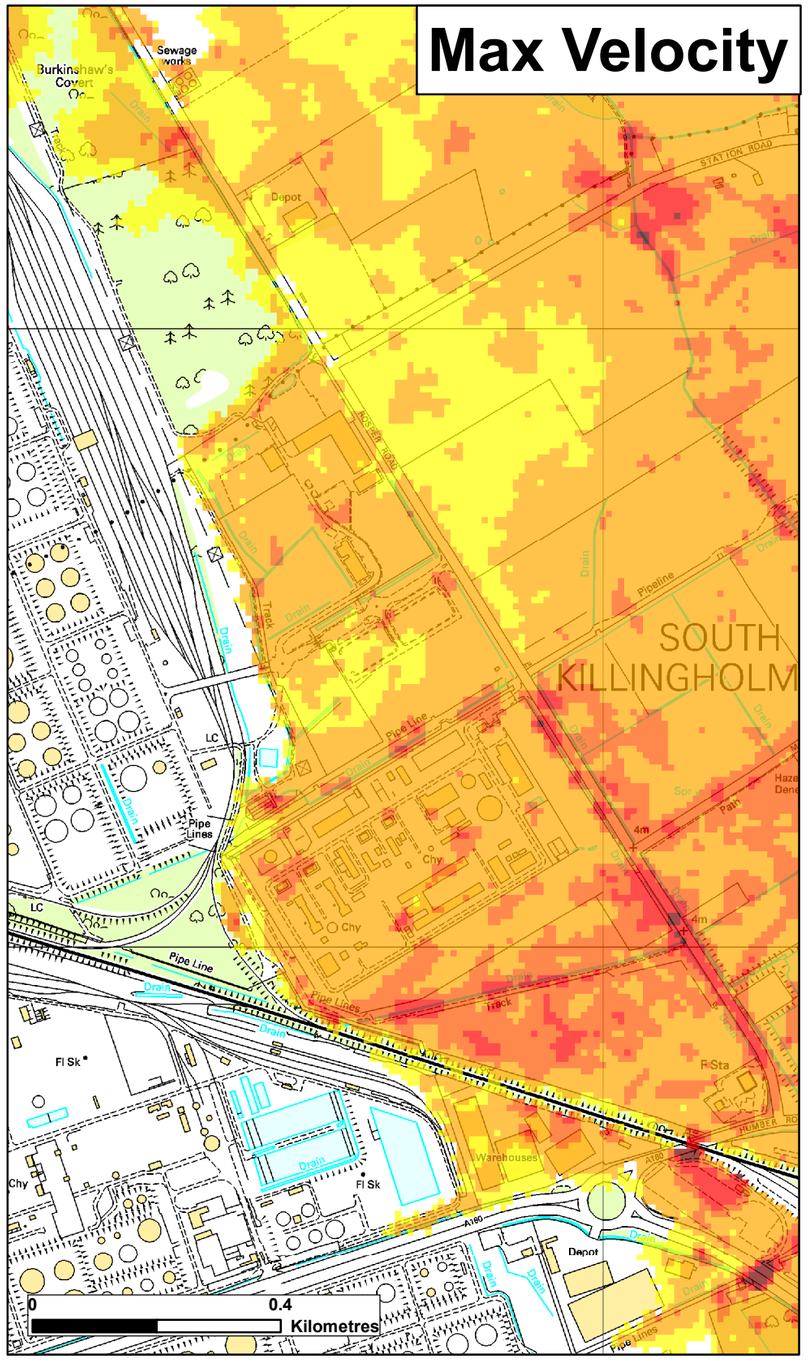

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Date Printed	February 2018	Scenario year	2115	Scenario Annual Chance	0.5% (1 in 200)	CCN Number	CCN-2018-73227

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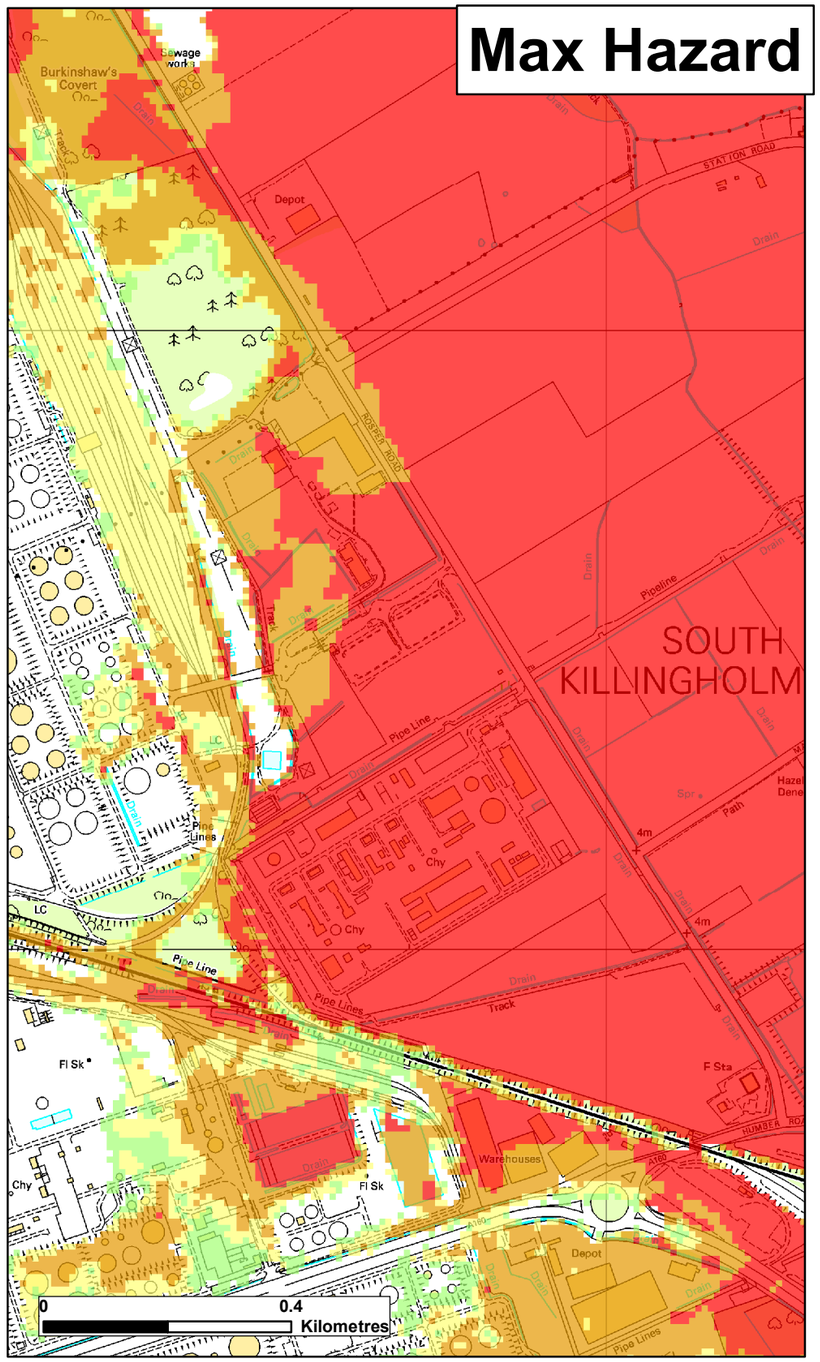
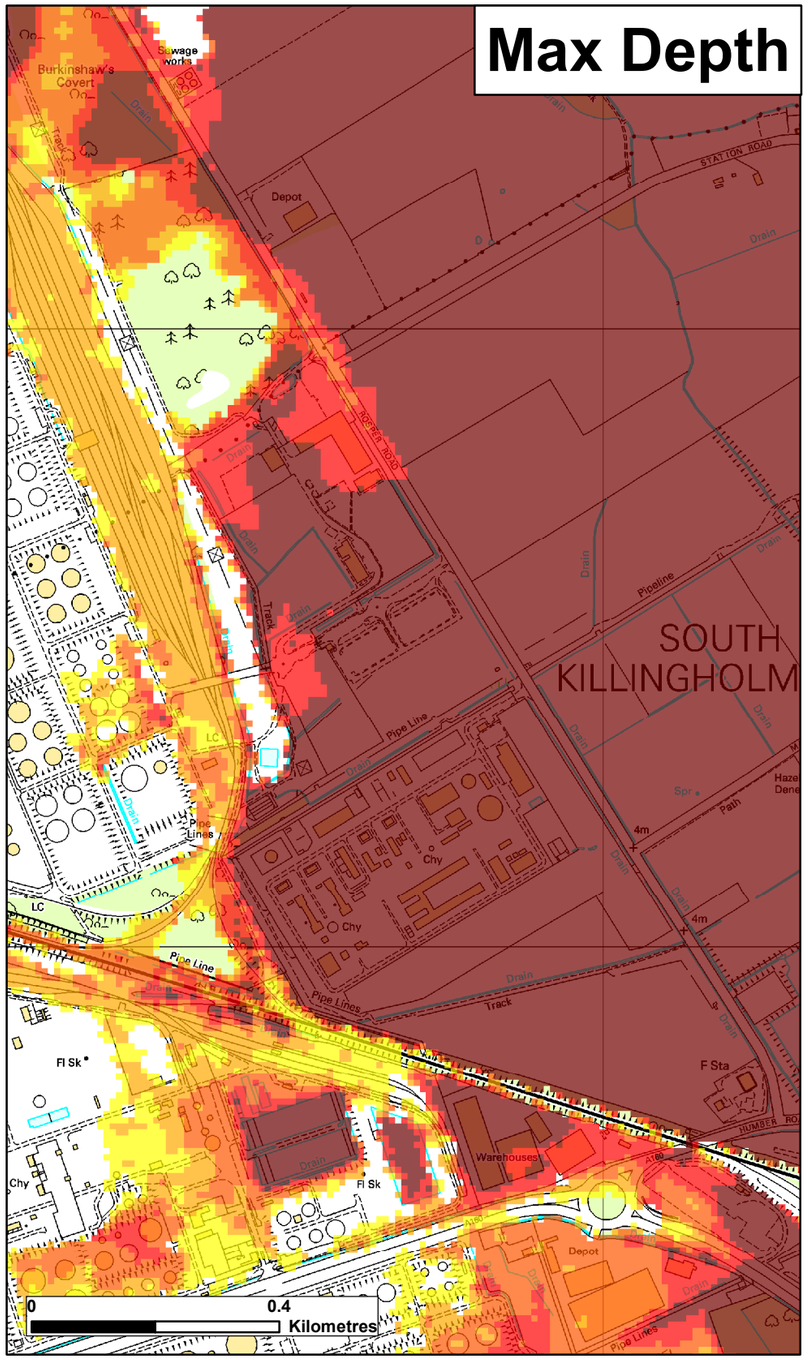
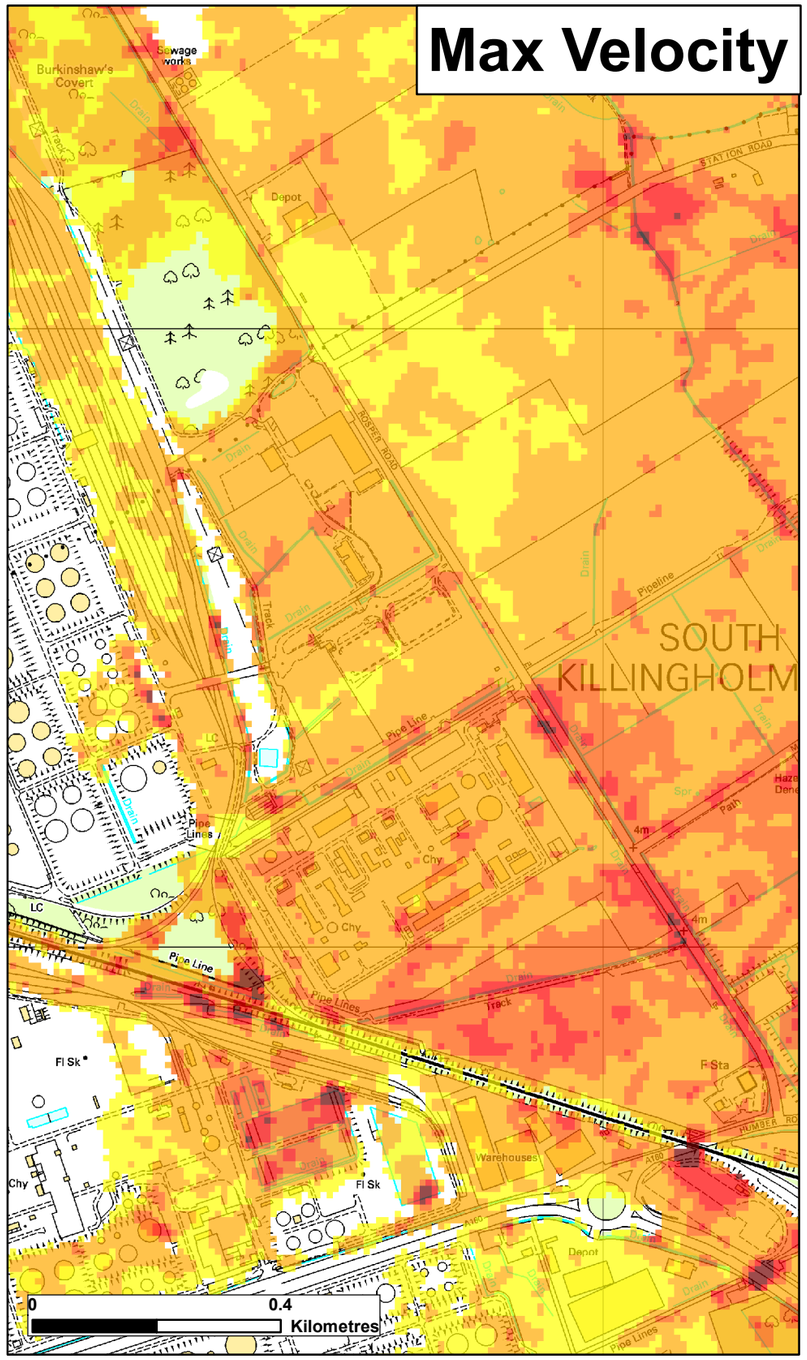
Map Centred on TA 16677 17430







Max Hazard
(Flood Risk to People : FD2320)

- Less than 0.75 (Low Hazard)
- Between 0.75 and 1.25 (Danger for Some)
- Between 1.25 and 2.0 (Danger for Most)
- Greater than 2.0 (Danger for All)

Max Depth (m)

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

Max Velocity (m/s)

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

Date Printed	February 2018	Scenario year	2115	Scenario Annual Chance	0.1% (1 in 1000)	CCN Number	CCN-2018-73227

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)

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

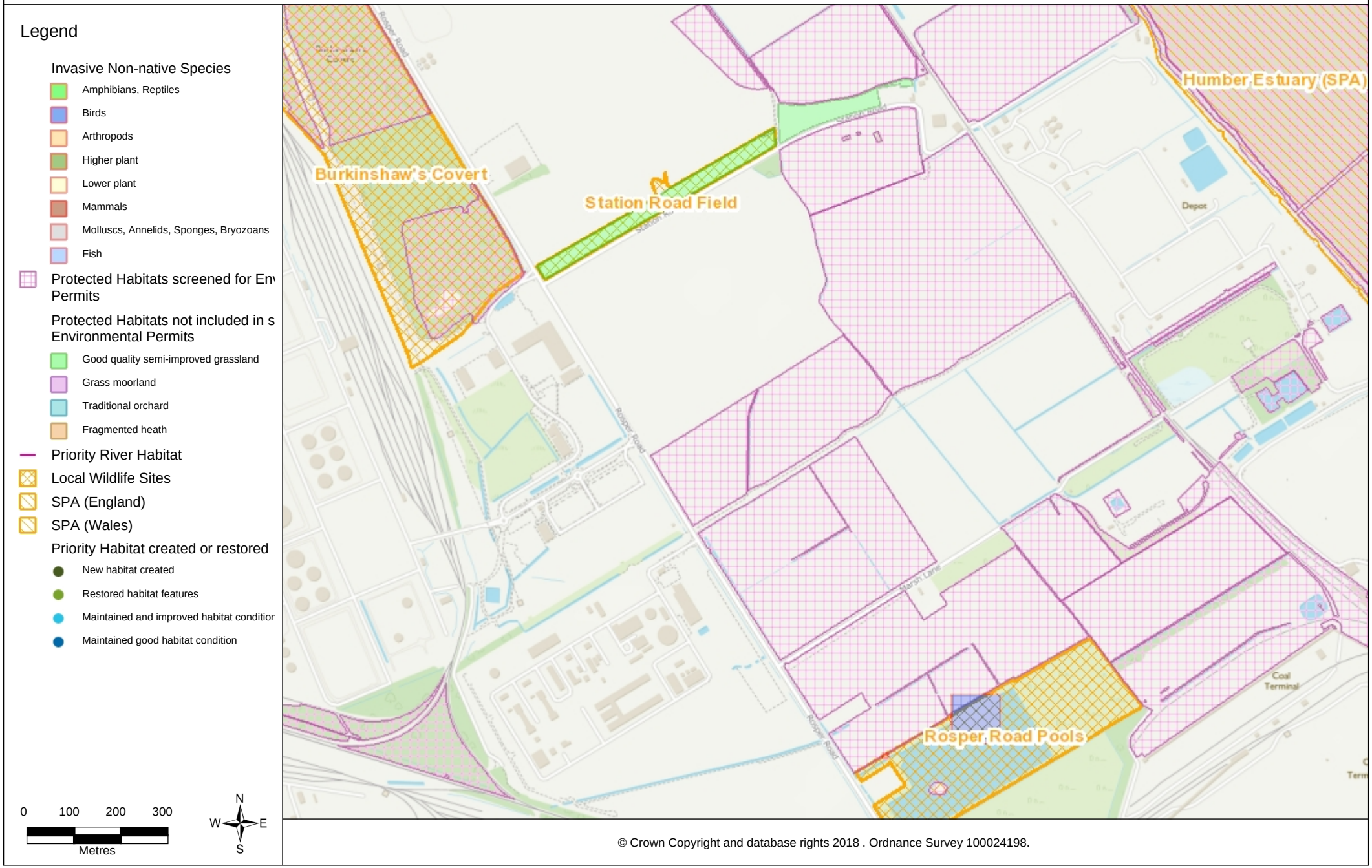
Environment Agency

Lincolnshire and Northamptonshire Overtopping Hazard Mapping

Map Centred on TA 16677 17430

Designations centred on 516677, 417430 created Jan 2018 CCN/2018/73227

Environment Agency

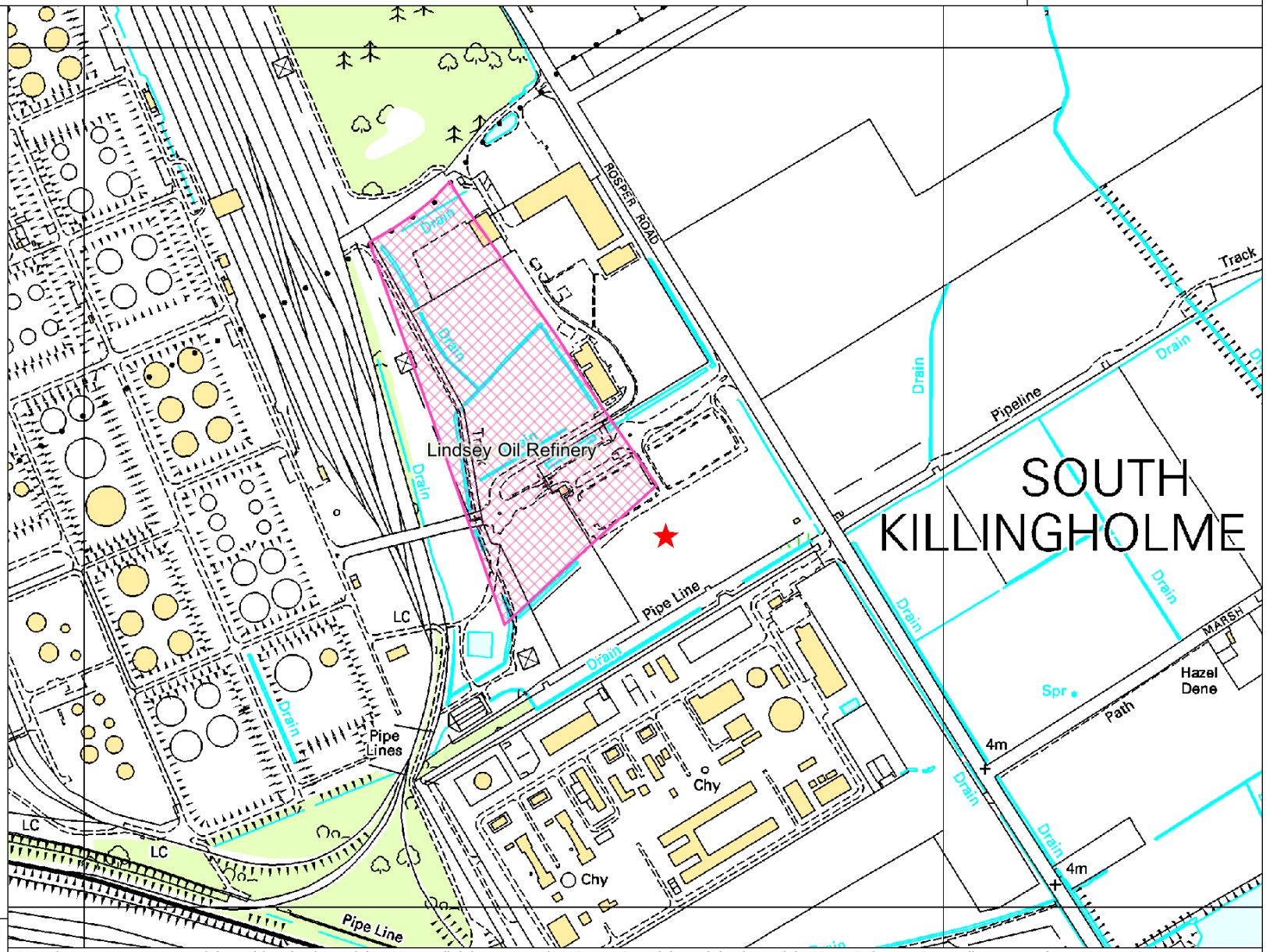


VPI Immingham - ARCOM enquiry

Environment Agency

Legend

- Authorised Landfill Sites
- Historic Landfill Sites



0 65 130 195 m.

N W E S

ANNEX 3 NORTH LINCOLNSHIRE COUNCIL CONSULTATION

Strategic Flood Risk Assessment
Map 25
Compartment 1T3 Immingham and North Killinholme Breach Hazard

KEY

- Council Boundary
- Pumping Stations
- Historic Flood Complaints
- Main River Watercourse
- Significant Ordinary Watercourse
- Flood Defences
- Sub Compartment Boundary
- Breach Location
- Outside Study Area

Degree of Flood Hazard from Level 2 Assessment

- Negligible (Hazard Rating = 0)
- Low (Hazard Rating = 0 - 0.75)
- Moderate (Hazard Rating = 0.75 - 1.25)
- Severe (Hazard Rating = 1.25 - 2)
- Extreme (Hazard Rating >2)
- Undefined (No Level 2 Assessment)
- Covered by Breach Hazard Map 24

N

1:20000

Sub Compartment - 3

Sub Compartment - 2

Sub Compartment - 1

North Lincolnshire

North East Lincolnshire

0 1 2 kilometres

Somerton, Joanne

From:	Barrie Onions <Barrie.Onions@northlincs.gov.uk>
Sent:	25 January 2018 10:38
To:	Somerton, Joanne
Cc:	Billy Green; Rod Chapman; Sam Cross; Craig Fotheringham
Subject:	Fw: Data consultation Request - VPI Immingham: Flood Risk Information
Attachments:	VPI Immingham Data Request NLC.pdf

Hi Joanne

You should be aware that flood guidance in the form of a SFRA and Development and Food Guidance can be found on our web site. The SFRA is in the policy section and the other guidance is under the planning application submission guidance. I can confirm that as you state the site lies in EA Flood Zone 3a (and combined SFRA Flood Zone 2/3a). Should you require any SFRA maps please let me know.

Your many questions relate to drainage issues so I have passed your request onto the Council's Drainage Team to answer.

The Drainage Team will answer direct to you or pass onto me to send to you.

Kind Regards

Barrie

Barrie Onions
Senior Planning Officer
Spatial Planning
Planning & Regeneration
Places Directorate
North Lincolnshire Council
Tele - 01724 297571
Email - barrie.onions@northlincs.gov.uk

From: Spatial Planning
Sent: 22 January 2018 10:01
To: Barrie Onions
Subject: Fw: Data consultation Request - VPI Immingham: Flood Risk Information

Barrie,

You will probably be able to answer some of the questions raised in this info request. I'm not sure who else it has been circulated to as it seems just to be sent to Spatial Planning.

Regards
Craig

Spatial Planning Team

Economy & Growth
Business Development
North Lincolnshire Council
Civic Centre
Ashby Road
Scunthorpe
DN16 1AB

Tel: 01724 297
E-mail: spatial.planning@northlincs.gov.uk

From: Somerton, Joanne <joanne.somerton@aecom.com>
Sent: 19 January 2018 16:24
To: Spatial Planning
Cc: Lowe, Richard; Sangster, Malcolm
Subject: Data consultation Request - VPI Immingham: Flood Risk Information

Dear Sirs

Please find attached a data consultation request for information to inform a flood risk assessment for a proposed development on a site located at South Killingholme. A site location plan is included to the rear of the attached correspondence.

If you require further information please do not hesitate to contact me.

Kind Regards

Jo Somerton

Joanne Somerton (MSc, BSc)
Principal Flood Risk Specialist, Water & Flood Management, UK & I
D +44-01132045028
M +44-07917503650
joanne.somerton@aecom.com

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T +44-01133916800
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Somerton, Joanne

From:	Billy Green <Billy.Green@northlincs.gov.uk> on behalf of LLFAdrainageteam <LLFAdrainageteam@northlincs.gov.uk>
Sent:	08 February 2018 11:51
To:	Somerton, Joanne
Cc:	Guy Hird; Richard Wright; Barrie Onions
Subject:	Fw: Data consultation Request - VPI Immingham: Flood Risk Information
Attachments:	VPI Immingham Data Request NLC.pdf; NLC SuDS Guidance Published document.pptx

Hi Joanne

With reference to your recent request for information I reply as follows: -

1) Surface Water or Groundwater Flooding in area - We are not aware of any within the vicinity of the development.

2) Historical Flooding of Watercourses within the area - We are not aware of any within the vicinity of the development. The site lies within an Internal Drainage Board may be able to assist (copied into this email) Ref: 9A Drain

3) Information on Sewer Surcharging - We are not aware of any within the vicinity of the development (Anglian Water need to be contacted with respect to this).

4) Surface Water & SuDS compliance Please refer to our Local SuDS and Flood Risk Guidance Document. The need to comply with the 1 in 100 year plus CC flood event and consideration/implementation of the various SuDS methods relevant to the size of development. The existing site V's the proposed site discharge rates and is the site brownfield or greenfield?

5) Mitigation measures - restriction from the site at greenfield run off rate.

The Environment Agency would need to be consulted with respect to fluvial flood risk and finished floor levels etc

Please contact me if you require further information.

Kind Regards,

North Lincolnshire Council Flood Risk Team
Lead Local Flood Authority

Community Services
Places Directorate
8-9 Billet Lane
Scunthorpe
DN15 9YH
Tel: 01724 297522

Note: For all future correspondance via email, please reply to LLFAdrainageteam@northlincs.gov.uk

---

From: Billy Green
Sent: 07 February 2018 16:03
To: LLFAdrainageteam
Subject: Fw: Data consultation Request - VPI Immingham: Flood Risk Information

Regards

Billy Green
Drainage Projects Manager
Flood Risk Team
Transport, Highways & Environment
Highway & Community Services
North Lincolnshire Council

Highways and Neighbourhood Services Depot
8/9 Billet Lane
Scunthorpe
DN15 9YH

Tel: 01724 297522

From: Somerton, Joanne <joanne.somerton@aecom.com>
Sent: 07 February 2018 12:02
To: Billy Green
Subject: RE: Data consultation Request - VPI Immingham: Flood Risk Information

Billy

Please find attached the consultation request sent to Barrie attached.

Kind Regards

Jo Somerton

Joanne Somerton
Principal Flood Risk Specialist, Water and Flood Management, UK & I
D +44-0113-2045028
M +44-079170503650
joanne.somerton@aecom.com

From: Billy Green [mailto:Billy.Green@northlincs.gov.uk]
Sent: 06 February 2018 16:42
To: Somerton, Joanne; Barrie Onions
Cc: Rod Chapman; Sam Cross; Craig Fotheringham; LLFAdrainageteam
Subject: Re: Data consultation Request - VPI Immingham: Flood Risk Information

Hi Barrie / Joanne

Can you please attached the data consultation request and email it to LLFA Dainage Team email...
Regards

Billy Green
Drainage Projects Manager
Flood Risk Team
Transport, Highways & Environment
Highway & Community Services
North Lincolnshire Council

Highways and Neighbourhood Services Depot
8/9 Billet Lane
Scunthorpe
DN15 9YH

Tel: 01724 297522

From: Somerton, Joanne <joanne.somerton@aecom.com>
Sent: 06 February 2018 16:30
To: Barrie Onions
Cc: Billy Green; Rod Chapman; Sam Cross; Craig Fotheringham
Subject: RE: Data consultation Request - VPI Immingham: Flood Risk Information

Dear All

I am writing to follow up on the data consultation request sent on 19th January with regards the above site (see email train below).

I have received a response from Barrie with regards flood risk information, however, I am still waiting for a response from the Council's Drainage Team.

Please can you advise as to when to expect a response?

Kind Regards

Jo Somerton

Joanne Somerton
Principal Flood Risk Specialist, Water and Flood Management, UK & I
D +44-0113-2045028
M +44-079170503650
joanne.somerton@aecom.com

From: Barrie Onions [mailto:Barrie.Onions@northlincs.gov.uk]
Sent: 25 January 2018 10:38
To: Somerton, Joanne
Cc: Billy Green; Rod Chapman; Sam Cross; Craig Fotheringham
Subject: Fw: Data consultation Request - VPI Immingham: Flood Risk Information

Hi Joanne

You should be aware that flood guidance in the form of a SFRA and Development and Food Guidance can be found on our web site. The SFRA is in the policy section and the other guidance is under the planning

application submission guidance. I can confirm that as you state the site lies in EA Flood Zone 3a (and combined SFRA Flood Zone 2/3a). Should you require any SFRA maps please let me know.

Your many questions relate to drainage issues so I have passed your request onto the Council's Drainage Team to answer.

The Drainage Team will answer direct to you or pass onto me to send to you.

Kind Regards

Barrie

Barrie Onions
Senior Planning Officer
Spatial Planning
Planning & Regeneration
Places Directorate
North Lincolnshire Council
Tele - 01724 297571
Email - barrie.onions@northlincs.gov.uk

From: Spatial Planning
Sent: 22 January 2018 10:01
To: Barrie Onions
Subject: Fw: Data consultation Request - VPI Immingham: Flood Risk Information

Barrie,

You will probably be able to answer some of the questions raised in this info request. I'm not sure who else it has been circulated to as it seems just to be sent to Spatial Planning.

Regards
Craig

Spatial Planning Team
Economy & Growth
Business Development
North Lincolnshire Council
Civic Centre
Ashby Road
Scunthorpe
DN16 1AB

Tel: 01724 297
E-mail: spatial.planning@northlincs.gov.uk

From: Somerton, Joanne <joanne.somerton@aecom.com>
Sent: 19 January 2018 16:24
To: Spatial Planning

Cc: Lowe, Richard; Sangster, Malcolm
Subject: Data consultation Request - VPI Immingham: Flood Risk Information

Dear Sirs

Please find attached a data consultation request for information to inform a flood risk assessment for a proposed development on a site located at South Killingholme. A site location plan is included to the rear of the attached correspondence.

If you require further information please do not hesitate to contact me.

Kind Regards

Jo Somerton

Joanne Somerton (MSc, BSc)
Principal Flood Risk Specialist, Water & Flood Management, UK & I
D +44-01132045028
M +44-07917503650
joanne.somerton@aecom.com

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aecom.com

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Please think before you print- North Lincolnshire Council greening the workplace.
This e-mail expresses the opinion of the author and is not necessarily the view of the Council. Please be aware that anything included in an e-mail may have to be disclosed under the Freedom of Information Act and cannot be regarded as confidential. This communication is intended for the addressee(s) only. Please notify the sender if received in error. All Email is monitored and recorded.
Please think before you print- North Lincolnshire Council greening the workplace.

ANNEX 4 NORTH EAST LINDSEY IDB CONSULTATION


Legend
EA Main River
NEL Watercourses
North_East_Lindsey_IDB_Boundary
10A
10
10B
9A
9
8G
8D
8
The Lookout
Station House
Hazel Dene
A160
Contains OS data © Crown Copyright and database right 2017

Somerton, Joanne

From:	Guy Hird <Guy.Hird@witham3idb.gov.uk>
Sent:	19 February 2018 16:25
To:	Somerton, Joanne
Cc:	Billy Green; Darren Scott
Subject:	FW: North East Lindsey IDB: Data Consultation Request - VPI Immingham, South Killingholme
Attachments:	VPI Immingham Data Request NELIDB.pdf; NELDB map.pdf
Follow Up Flag:	Follow up
Flag Status:	Flagged

ND-3864-2018-PLN

Jo

North East Lindsey IDB: Data Consultation Request - VPI Immingham, South Killingholme

My comments in response to your questions are in red. I have attached a map the Board maintain watercourses near the site 9 is South Killingholme Drain and 9A is South Killingholme Drain Branch 1.

- Identify which drains/ watercourses fall under the jurisdiction of the North East Lindsey IDB; see attached map.
- Confirm if any of the drains/ watercourses are regulated by pumping; none, the watercourse that serves the site has a gravity discharge to the Humber.
- Provision of a catchment map for the North East Lindsey IDB drains/ watercourses; see attached map.
- Whether any of the drains/ watercourses have defences/ embankments; the watercourses do not have banks.
- Any known flooding issues (historical flood levels, extents data, flood maps); no information, you should contact the EA for their data.
- Easements required relating to drains/ watercourses maintained by North East Lindsey IDB; the Board byelaw distance is 7m.
- Indication of acceptable discharge rates of surface water to the drains; and agree with North Lincolnshire Council.
- Any other information that is relevant or should be considered in the FRA (predicted climate change impacts
etc.).

AECOM also require the following information:

- Details of surface water and/ or groundwater abstractions in the area local to the Site; no information, this is not something the Board deals with.
- Details of any pollutant incidents. no information, this is not something the Board deals with.

Regards

Guy Hird
Engineering Services Officer

Witham First District Internal Drainage Board
Witham Third District Internal Drainage Board
Upper Witham Internal Drainage Board
North East Lindsey Drainage Board
J1 The Point,
Weaver Road,

LINCOLN,
LN6 3QN.
01522 697123

From: Somerton, Joanne [mailto:joanne.somerton@aecom.com]
Sent: 18 January 2018 5:02 PM
To: Enquiries <Enquiries@witham3idb.gov.uk>
Cc: Lowe, Richard <richard.lowe@aecom.com>; Sangster, Malcolm <Malcolm.Sangster@aecom.com>
Subject: North East Lindsey IDB: Data Consultation Request - VPI Immingham, South Killingholme

Dear Sirs

Please find attached a data consultation request for flood risk information to inform a Flood Risk Assessment for a proposed gas fired power station at a site in South Killingholme. A location map is included in the data consultation request.

If you require further information please do not hesitate to contact me.

Kind Regards

Jo Somerton

Joanne Somerton (MSc, BSc)
Principal Flood Risk Specialist, Water & Flood Management, UK & I
D +44-01132045028
M +44-07917503650
joanne.somerton@aecom.com

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aecom.com

ANNEX 5 CONCEPTUAL DRAINAGE STRATEGY

1. Introduction

The proposal is for the creation of an Open Cycle Gas Turbine (OCGT) facility off Rosper Road, at South Killingholme, Immingham. The Proposed Development will replace land which is currently undeveloped, and therefore will increase surface water runoff through an increase in impermeable area.

The Site is approximately 2.6 hectares (Ha), and is currently undeveloped brownfield land. Land drains currently exist on the north-east and south-east boundaries of the Site. The Site will be re-graded as part of the Proposed Development.

This report is based on the indicative plant layout plans, provided at the time of writing. It has been assumed that these plans are representative of the final development of the Site. The conceptual surface water drainage strategy should be reviewed when further design details are available, however, the broad principles are provided here. An indicative site layout is included as Figure 1.

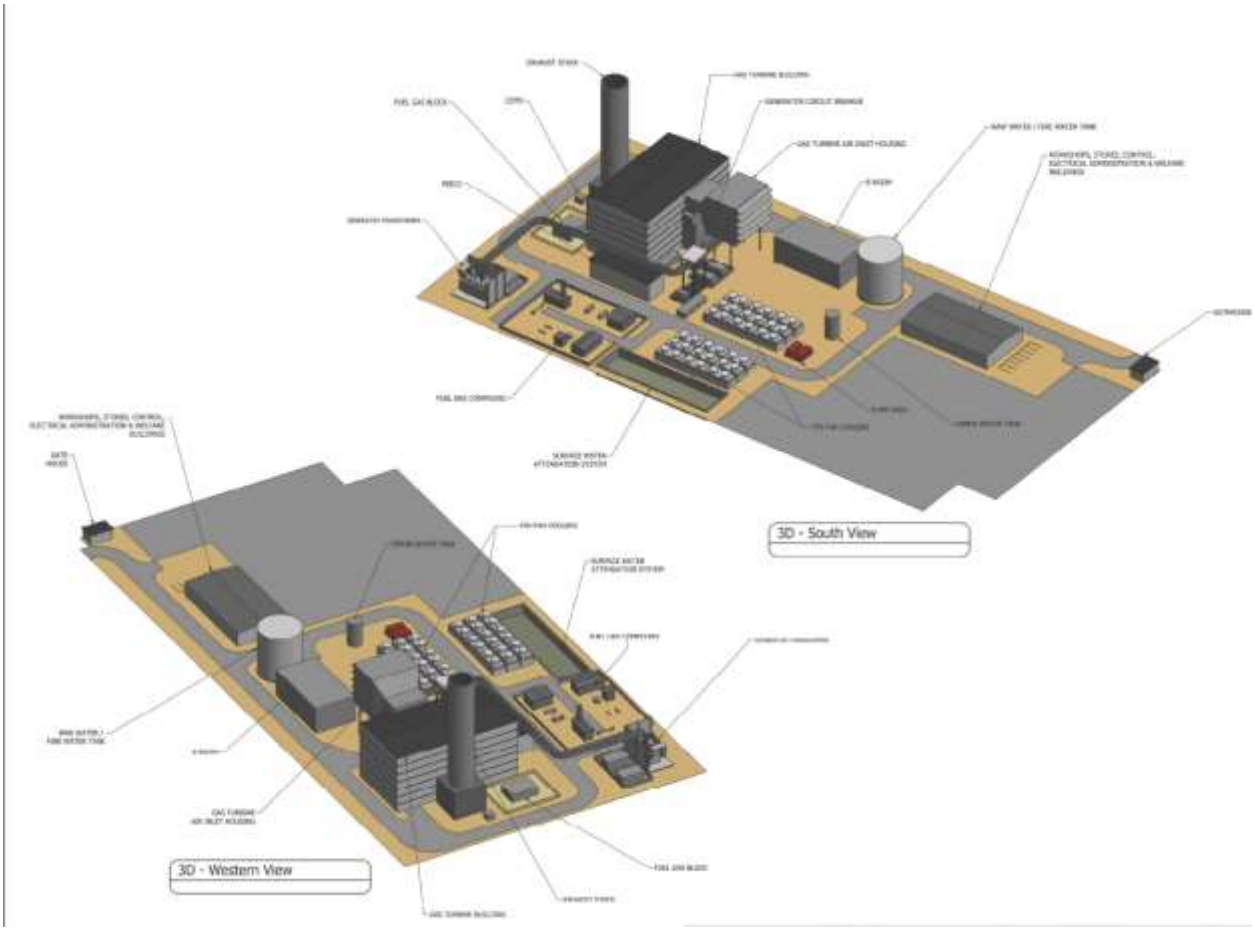

Figure 1. Indicative Plant Layout

2. Policy Requirements

2.1 National Planning Policy Framework

The revised National Planning Policy Framework[1] (NPPF) requires that the Proposed Development should not increase flood risk both on the Site and in the area surrounding it. Surface water runoff should therefore not exceed the volumes already generated by the existing Site and betterment should be provided where possible.

2.2 Environment Agency

The EA advisory comments set out the following recommendations:

- **Runoff Rates** – Peak discharge rates from a site will not increase as a result of a proposed development, up to a 1% Annual Exceedance Probability (AEP) storm event including climate change. The Environment Agency expects all applicants to strive to achieve greenfield runoff rates to reduce the impact of the development on the surface water drainage infrastructure, unless it is demonstrated that this is not practicable;

- **Storage Volumes** - Storage volume for all storm events up to a 1% AEP, including an allowance for climate change, can be provided on site. The site will not flood from surface water during events up to a 1% AEP, including an allowance for climate change, or surface water flooding will be safely contained on site up to this event, ensuring that surface water runoff will not increase flood risk to the development or third parties;

- **Sustainable Drainage System (SuDS) Techniques** - SuDS such as green roofs, ponds, swales and permeable pavements should be used. The SuDS hierarchy should be followed; and

- **Residual Risk** - The residual risk of flooding can be managed and contained safely on site should any drainage features fail or during an extreme storm event. The location, depth and flow routes of any over ground flooding should be clearly shown on a plan.

2.3 North Lincolnshire Council SuDS Guidance

North Lincolnshire Council (NLC) has created a SuDS guidance document[2] which stipulates the expectations of NLC for designers and developers in regards to the use of SuDS. This guidance document has been produced based on best practice guidelines from the CIRIA SuDS Manual[3].

The document details the requirements for SuDS, appropriate design processes and discusses various types of SuDS. Specific NLC requirements for drainage projects are also detailed with a checklist given for the required steps to be taken for the adoption of SuDS.

[1] Revised National Planning Policy Framework, Published 24th July 2018. Available at: https://www.gov.uk/government/collections/revised-national-planning-policy-framework
[2] North Lincolnshire Council (2017) SuDS and Flood Risk Guidance Document Rev I April 2017
[3] CIRIA (2015) The SuDS Manual C753

2.4 Building Standards Regulations

The Building Standards Regulations 2000 Part H[4] requires that surface water runoff be preferentially discharged first to soakaways, then to surface watercourses and finally to sewers.

2.5 Surface Water Management

Existing Surface Water Runoff

The revised NPPF requires that new developments should not increase flood risk on the site or in the surrounding area. Therefore surface water runoff rates leaving the site should not exceed the existing undeveloped runoff rate.

The greenfield runoff rate for the Site has been calculated based on the IoH124 runoff calculation method from the HR Wallingford online calculator based on co-ordinates (OSNGR) 516495, 417675.

The Site area of 2.6 Ha has been used within these calculations. Table 1 summarises the greenfield runoff rates for a range of return period rainfall events.

Table 1: Greenfield Runoff Rates

Return Period	Runoff Rate (l/s)
QBAR	10.81
1 in 1 year	9.4
1 in 30 years	26.48
1 in 100 years	38.48

Proposed Surface Water Runoff Rates

The Proposed Development will increase the runoff rate, due to the increase in impermeable areas. These anticipated surface water runoff rates, assuming no attenuation, have been calculated using the rational method:

$$Q = 2.78 \times CIA$$

Where Q = runoff rate (l/s)

C = runoff coefficient (0.9 used to represent hard standing)

I = Rainfall intensity (mm/hr)

A = Site Area (Ha)

As the majority of the Site is hard standing, an assumed runoff coefficient of 0.9 has been used for the calculations. Post development runoff rates for the Site for a range of return periods and storm durations are presented in Table 2.

[4] Office of the Deputy Prime Minister (2002) The Building Regulations 2000, Drainage and Water Disposal (Approved Document H)

Table 2. Post development runoff rates (no attenuation)

Return Period	Total Site (2.6 Ha) Runoff (l/s)								
	15 mins	30 mins	1hr	2hr	3 hr	5 hr	12 hr	24 hr	48 hr
2 (50%)	172	113	71	50	40	29	16	10	6
5 (20%)	303	197	123	79	60	41	21	13	7
10 (10%)	396	258	162	100	74	50	25	15	8
30 (3.3%)	541	357	225	134	97	65	32	18	10
50 (2%)	611	405	255	150	109	72	35	20	11
100 (1%)	706	472	299	172	124	82	40	23	13
100 + 20% CC	847	566	359	206	149	98	48	28	16
100 + 40% CC	944	661	419	241	174	115	56	32	19

Surface Water Attenuation

In order to prevent increases in flood risk downstream, in accordance with the NPPF, EA, NLC and North East Lindsey IDB requirements, surface water discharge from the Proposed Development should be restricted to the greenfield runoff rate. Surface water attenuation will therefore be required, as included in the Site layout, to ensure greenfield runoff rates (Table 1) are not exceeded.

Storage volume calculations have been undertaken for the critical storm duration of the design return period storm event based on an allowable discharge of 10.81 l/s, equal to the Q-bar greenfield runoff rate. The storage volume estimate has been made using the quick storage estimate tool within the Micro drainage 2016.1 Source Control Program; results are shown in Table 3. FSR rainfall estimated hydrographs were used to undertake this analysis. A conservative assumption of zero infiltration has been made, in the absence of permeability data for the Site.

Table 3. Storage Volumes

Rainfall Event	Min Storage (m^3)	Max Storage (m^3)
1% AEP + 40% Climate Change	1635	2207

These volumes are estimates, and detailed surface water modelling would be required as part of a detailed design phase to better assess storage volumes.

This surface water attenuation has been proposed at the southern extent of the Proposed Development. As discharge via infiltration is likely to be unviable, it is proposed that all surface water be discharged to the land drain to the south-east of the Site. Discharge should be at the greenfield runoff rate. This will be subject to confirmation that sufficient capacity is available and receiving discharging consent from North East Lindsey IDB. Confirmation

should also be sought that the discharge rate is sufficient to prevent an increased risk of siltation within the drain and allow for continued operation without the need for increased maintenance.

Surface water is to be collected on site and conveyed to the storage area (comprising a storage pond or underground attenuation tank etc.) via the use of drainage ditches/swales where possible.

2.6 Sustainable Drainage Systems

In line with EA advisory recommendations, CIRIA SuDS manual best practice guidelines and local planning policy sustainable drainage systems should be used as a preferential option. A summary of sustainable drainage systems is given in Table 4, this is not an exhaustive list and other options will also be considered. The SuDS management train will be taken into account during detailed drainage design with an aim of capturing surface water as close to the source as possible.

Table 4. Sustainable Drainage Systems

Technique	Description	Restrictions of use
Storage Pond	Storage ponds can be used to attenuate overland runoff and slowly release it into a watercourse or sewer. These systems do not offer water quality benefits unless additional water quality measures are added such as filters or sedimentation volume.	Storage ponds may require substantial earthworks and thus incur high costs during the construction phase. Additionally, large ponds which store water above ground level may be classified as reservoirs which are subject to a range of legislative requirements. Land take requirements for storage ponds are likely to be substantial.
Permeable Paving	Permeable paving allows rainwater to infiltrate through a hard-standing surface to underlying soil or drainage infrastructure. From which it may infiltrate or be directed to a local watercourse or sewer.	Permeable pavements may be restricted by the presence of basements or groundwater levels as well as high imposed loads.
Rainwater Harvesting	Rainwater from roofs and hard surfaces can be stored and used for non-potable purposes. This can provide a reduction of surface water runoff through control at source as well as reducing the demand on the water supply system. In the case of the Proposed Development harvested rainwater could be used to supplement cooling water supplies.	Rainwater harvesting is dependent on a consistent supply of rainwater which cannot be ensured. As such it will be used as a supplement to conventional water supply only.
Below Ground Attenuation	Below ground storage tanks will attenuate surface water flows in much the same way as surface water ponds, although with reduced land take. Storage tanks will typically require a hydro brake to ensure steady and controlled discharge.	Upfront costs are likely to be high for buried storage tanks. The maintenance regime may be onerous or involve heightened health and safety risks due to enclosed spaces.

2.7 Infiltration

Based on available geological information it is believed to be unlikely that infiltration based drainage solutions will be viable. An assessment to confirm this will be undertaken during detailed drainage design if an infiltration based drainage system is progressed.

2.8 Discharge

As discharge via infiltration is likely to be unviable it is proposed that all drainage be discharged to the land drain to the south-east of the Site due to favourable site topography and development layout.

Should the southern drainage ditch be unviable as a discharge point then discharge to other nearby watercourses will be considered. If necessary the Site may be split into multiple catchments which can outfall to different drainage ditches. Discharge consent must be attained for each watercourse that is to be used as an outfall location.

There are no known local sewers which could be used as discharge points. Discharge to sewers will only be considered if all local watercourses are unviable as outfalls.

2.9 Foul Drainage

A septic tank or bioreactor is likely to be used for treatment of sanitary or domestic wastewater from offices/ administration/ welfare facilities. Solids from the septic tank will be emptied as required and tankered off site to a waste treatment plant.

2.10 Interaction of the Surface Water and Foul Drainage Systems

Clean water from the septic tank or bioreactor will combine with other site clean water, including surface water, to drain off site via a local land drain.

Figure 2 outlines how the surface water and foul water systems will interact.

The supply from the potable water system is used in three ways:

- Potable Water Consumers – including domestic messing and cleaning facilities, showers and toilets etc. The anticipated usage will be <5m3/day. Foul water from these uses will be sent to the Bioreactor/ Septic Tank via the potable water drainage system. Clean water from the bioreactor/ septic tank will be discharged to the retention pond and ultimately to the local IDB drainage ditch as part of the restricted discharge from the Site. Foul water will be disposed of off site;

- Process Water Consumers – consisting of closed loop coolers and heat exchangers, such as the fin-fan oil coolers, radiators and transformer oil coolers. Being closed loop these systems are not drained but may however need topping up. Any drainage from these systems would be ad-hoc/ infrequent occurring only in the event of a major plant or equipment shutdown (likely to be every 5-10 years). Process water would pass through an oil separator with any oil removed disposed of off site. Clean water from these processes will discharge to the external rainwater drains, discharging to the retention pond and ultimately, the local IDB drainage ditch as part of the restricted discharge from the Site;

- Fire Fighting Water Tank – Fire fighter water is emergency drainage from a fire fighting activity. Dependent on the location of the fire, the water may runoff to the Process Internal Drains or Process External/ Rainwater Drains.

Surface water generated on site will enter the Process Internal Drains or the Process External/ Rainwater Drains. Water from the Process Internal Drains (drains within buildings such as the transformer compounds or tank bunds) has the potential to be contaminated

with oil. Surface water from these drains combine with the process water drainage and pass through the Oil Separator.

Process External/ Rainwater Drains catch clean, uncontaminated surface water runoff from roads and building roofs and is discharged to the local IDB drain at the restricted runoff rate, via the retention pond.

2.11 Pollution Prevention and Control

As the Proposed Development will be an active industrial site, pollution controls will be required to prevent accidental discharge of pollutants such as hydrocarbons with surface water. Pollution prevention must be considered throughout the design phases and will be undertaken as detailed below:

- The design of oil interceptors shall be undertaken based on manufacturer supplied information. Based on the Site use and proposed receiving water body, these will be Class 1 Full Retention systems. Provision shall be made where appropriate to prevent silt and debris from entering the drainage system in accordance with Building Regulations 2010;
- Foul flows and effluent arising from the Proposed Development operation will be kept separate from the surface drainage network. Measures will be taken to ensure accidental flows such as fuel/ chemical spillages and fire control do not enter the surface water network. Such measures may include isolation points such as penstocks, or source control measures such as booms or absorbent systems;
- Areas which are expected to be sources of frequent pollutant spills will be isolated through the use of bunds to an appropriate level or other physical barriers to prevent spills from impacting the rest of the Site;
- During construction, the Contractor will adhere to EA pollution prevention guidelines, to reduce the risk of pollution in the event of flooding on Site; and
- The use of sediment removal techniques, particularly SuDS with passive sediment removal benefits will be utilised as part of the drainage design.

Annex 1 Figures

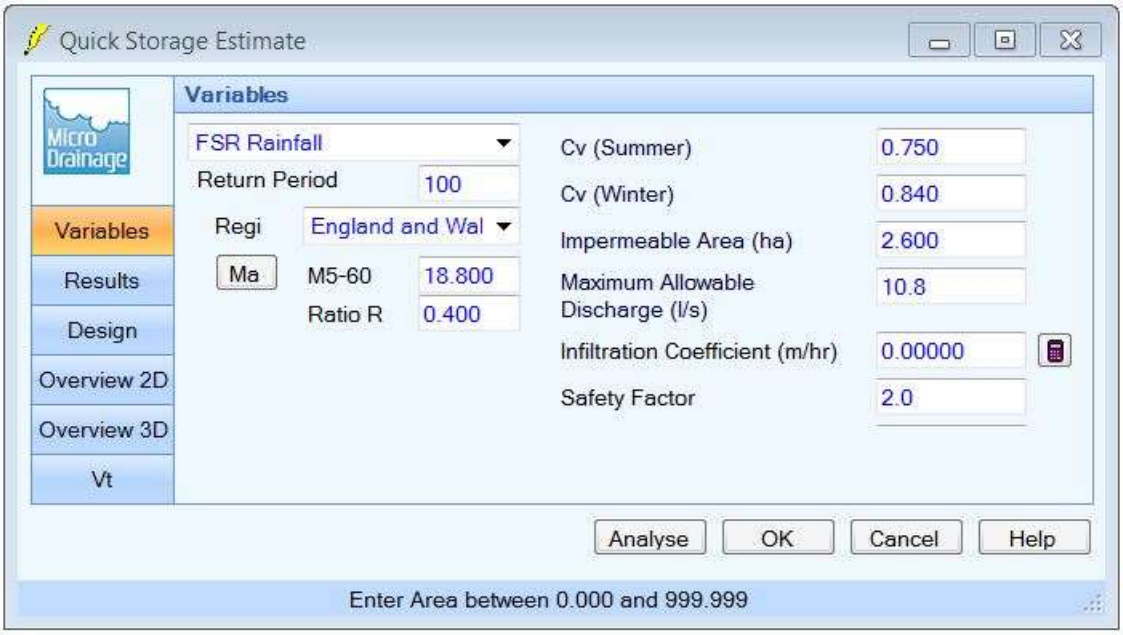

Figure A1 Microdrainage Source Control Quick Storage Estimate Input

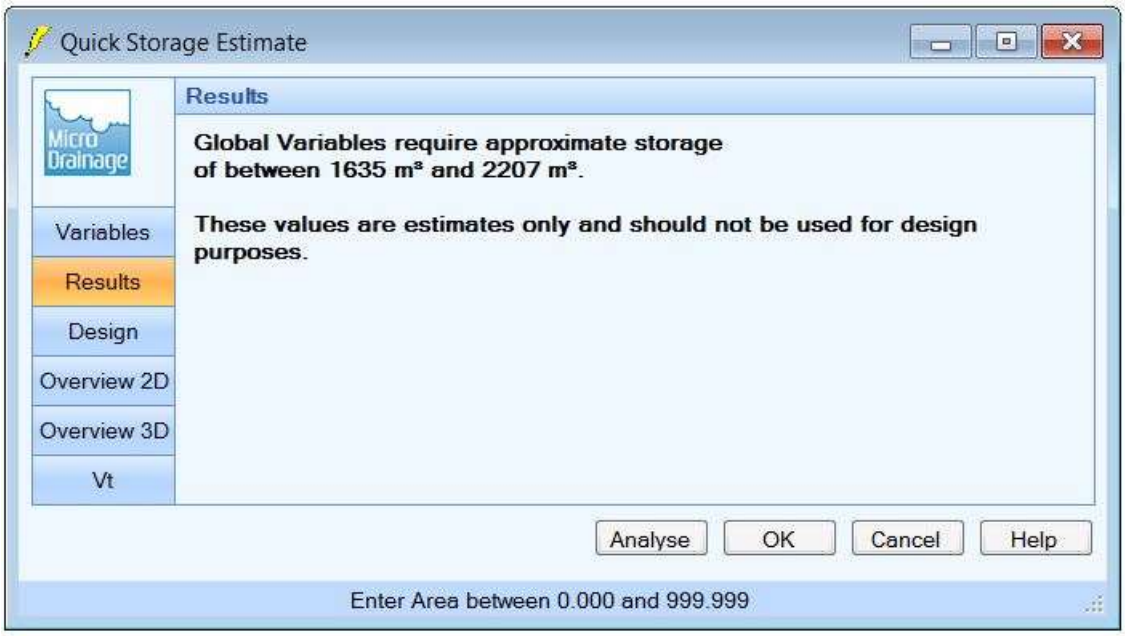

Figure A2. Microdrainage Source Control Quick Storage Estimate Output

VPI Immingham OCGT drainage plan