FIVE ESTUARIES OFFSHORE WIND FARM

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VOLUME 5, REPORT 3.1: FLOOD RISK ASSESSMENT – EXPORT CABLE CORRIDOR

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Volume 5, Report 3.1: Onshore Export Cable Corridor Flood Risk Assessment

Five Estuaries Offshore Wind Farm

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Revision Record

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Basis of Report

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Executive Summary

SLR Consulting Limited (SLR) has been appointed by GoBe Consultants on behalf of Five Estuaries Offshore Windfarm Ltd (the Applicant) to evaluate the potential flood risk to Five Estuaries Offshore Wind Farm (VE) proposed onshore export cable corridor (ECC). The ECC will be approximately 22km from landfall to the proposed National Grid connection point at the East Anglia Connection Node (EACN). The onshore ECC and a 2 km buffer around this infrastructure corridor and associated haul roads has been considered in this assessment.

1. Construction methods including trenchless construction techniques (such as horizontal directional drilling) will be used where required to prevent disruption to larger watercourses and Main Rivers. This method will also be used to place electricity cables under the existing sea defences to minimise potential impacts. Other construction methods, such as open trenching could be used for smaller watercourses (e.g. drainage ditches) which may temporarily cause disruption, however this is not expected to cause any permanent change to flood risk over the operational and decommissioning phases of the ECC.

2. With reference to the Environment Agency's (EA) Flood Map for Planning[1], most of the site is located across Flood Zone 1, however onshore ECC crosses a coastal area of Flood Zone 2 and 3 at landfall and the onshore ECC route also crosses Flood Zone 2 and 3 at Tendring Brook and on the upper reaches of Holland Brook where the onshore ECC crosses the Brook north of the A120 at Horsley Cross.

3. EA mapping also confirms the landfall section of the site which borders the coastline between Holland Haven and Frinton-on-Sea is afforded protection by coastal flood defences which comprise of a flood wall, groynes, embankments, engineered high ground and natural high ground. These defences provide a protection against tidal flooding for a 1 in 200 (0.5%) annual exceedance probability event.

4. The presence of coastal flood defences means that provided these defences remain effective, the risk of flooding at the site will be equivalent to areas designated as Flood Zone 1.

5. The landfall area of the onshore ECC is however inherently at risk of tidal flooding resulting from a breach of the defences (residual risk) although deemed to be low probability. The EA are responsible for maintaining the coastal flood defences and as such provide an effective deterrent against structural failure. In the low event of failure, breaching of the defences is not considered to affect the development due to established construction methods. There will however potentially be a risk to construction personnel and planning for potential tidal flood events will be managed through the contractor

1 Environment Agency Flood Map for Planning https://flood-map-for-planning.service.gov.uk/

subscribing to the EA's Floodline service and using this as a trigger for emergency flood response procedures.

6. EA surface water flooding mapping confirms that most of the onshore ECC is within a very low risk of flooding from this source, with the exception of localised flooding contained along ordinary watercourses across the onshore ECC route. This potential risk is not significant in relation to the construction methods to be used including trenchless crossing methods.

7. Due to the nature of the development and the majority land use along the onshore ECC route being rural, the risk to above ground infrastructure is not considered to be affected.

8. In conclusion, based on the information outlined within this Flood Risk Assessment, the perceived level of flood risk to and caused by the onshore ECC is low and the development would be safe, without significantly increasing flood risk elsewhere.

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Acronyms and Abbreviations

AOD	Above Ordnance Datum
APE	Annual Probability Event
BGS	British Geological Survey
CoCP	Code of Construction Practice
DCO	Development Consent Order
DEFRA	Department of Food and Rural Affairs
ECC	Export Cable Corridor
EA	Environment Agency
FRA	Flood Risk Assessment
HDD	Horizontal Directional Drilling
LLFA	Lead Local Flood Authority
MAGIC	Multi-Agency Geographic Information for the Countryside.
NGR	National Grid Reference
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
OnSS	Onshore Substation
OWF	Offshore Wind Farm
PDZ	Policy Development Zones
PPG	Planning Practise Guidance
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SPZ	Source Protection Zone
SSSI	Sites of Special Scientific Interest
SuDS	Sustainable Drainage Systems
VE	Five Estuaries
WTGs	wind turbine generators

1.0 Introduction

9. SLR Consulting Limited (SLR) has been appointed by GoBe Consultants on behalf of Five Estuaries Offshore Windfarm Ltd (the Applicant) to prepare a Flood Risk Assessment (FRA) for the proposed onshore export cable corridor (ECC) of the Five Estuaries Offshore Wind Farm (VE) development (the site).

1.1 Context and Site Location

10. VE is a proposed extension to the operational Galloper Offshore Wind Farm (OWF). The VE wind turbine generators (WTGs) will be situated across two array areas to the east of the operational Galloper OWF. The array areas will be located approximately 37 km off the coast of Suffolk, England. Subsea cables will connect the turbines to the offshore substation platforms and then export the power generated to shore where cables will run from the onshore landfall site to a new onshore substation, where the power will be uprated and transferred by cables to a new National Grid substation. This flood risk assessment will focus on this proposed onshore ECC. A separate FRA has been prepared to cover the proposed onshore substation (OnSS) Application document 5.3.2: OnSS FRA.

11. The onshore cable corridor will be approximately 22km but an installed cable length of up to 24.5 km from landfall to the proposed National Grid connection point at the East Anglia Connection Node (EACN) have been considered in the assessment to allow for micro-routing. The onshore ECC and a 2 km buffer around this infrastructure corridor and associated haul roads have been used as the study area in this assessment. The onshore ECC study area extends a short distance along the Essex coastline from Holland-on-Sea in the south-west to Frinton-on-Sea at its landfall, and approximately 20 km inland in a north-westerly direction, following the general direction of Holland Brook, towards Ardleigh and the River Stour. The site has been separated into seven sections within the search area which are as follows:

- Section 1 - Landfall to the East Coast Main Line spur (Sunshine Coast Line) railway;
- Section 2 -Land north of the Sunshine Coast Line railway to the B1033 at Thorpe Road;
- Section 3 - Land north of the B1033 at Thorpe Road to the B1035 at Thorpe Road/ Swan Road junction;
- Section 4 - Land north of the B1035 at Thorpe Road/ Swan Road junction to the A120 at Colchester Road. This section is divided into Section 4A (south of Tendring Brook) and 4B (north of Tendring Brook);
- Section 5 - Land north of the A120 Colchester Road to Bentley Road
- Section 6 - Land west of Bentley Road to Ardleigh Road; and
- Section 7 - land north of Ardleigh Road to the OnSS area.

12. A Site location plan is provided in Figure 1-1.

Figure 1-1 Site Location Plan

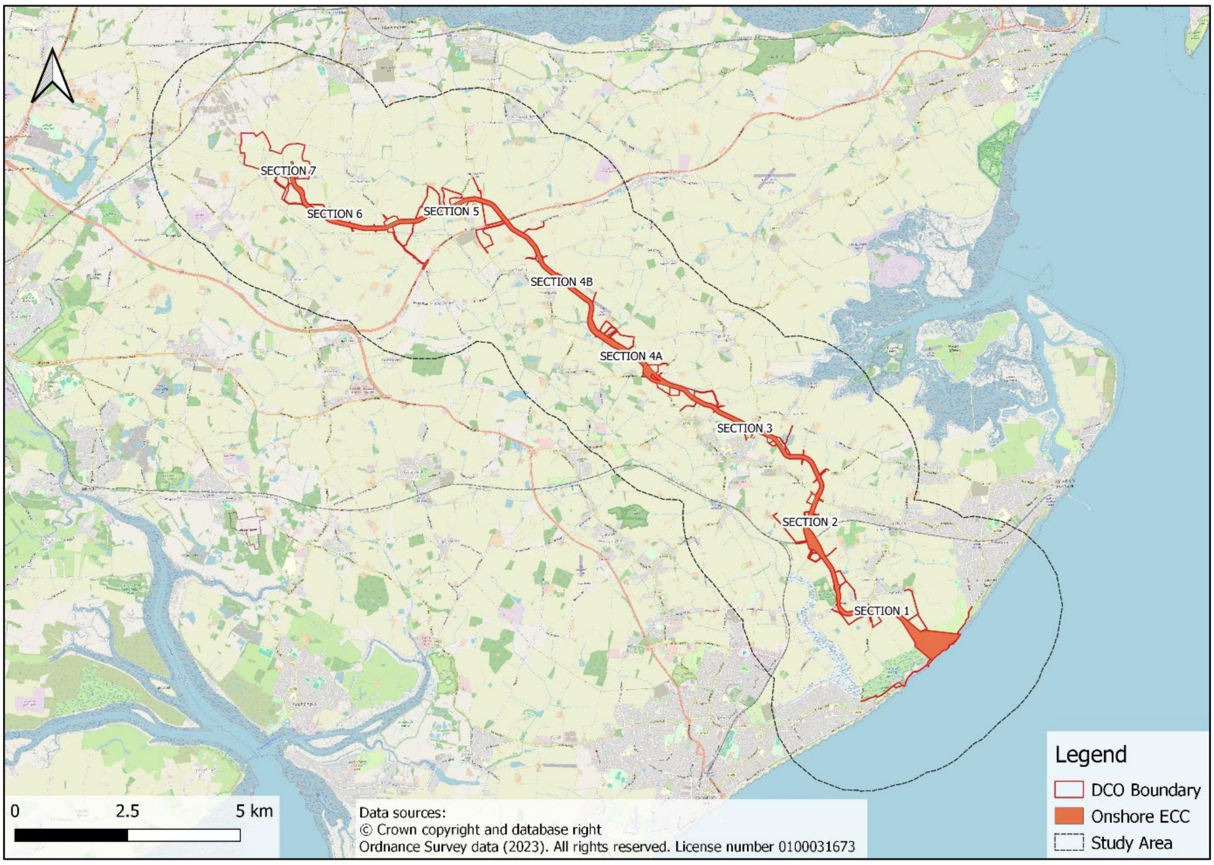


Figure 1-2 Site Layout with Aerial Background

1.2 Background and Aims

13. The aim of the FRA is to assist the VE development in relation to flood risk and outline the potential for the onshore ECC to be impacted by flooding, the impacts of the works associated with establishing the onshore ECC on flooding, and the proposed measures which could be incorporated to mitigate any identified risk. The report has been produced in accordance with the National Planning Policy Framework[2] (NPPF) and its associated Planning Practice Guidance[3] (PPG), in addition to National Policy Statement for Overarching Energy[4] (EN-1) taking due account of current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[5].

1.3 Data Sources Considered

14. In assessing the flood risk to the Site, the following sources have been reviewed:

2 National Planning Policy Framework: Communities and Local Government. (December 2023)

3 Planning Practice Guidance: Flood Risk and Coastal Change, Ministry of Housing, Communities and Local Government (Published March 2014, Updated August 2022)

4 Overarching National Policy Statement for Energy (EN-1), Department for Energy Security and Net Zero, January 2024, https://www.gov.uk/government/publications/overarching-national-policy-statement-for-energy-en-1

5 BS8533:2017, Assessing and managing flood risk in development: Code of Practice (December 2017)

- Five Estuaries Scoping Report;
- Five Estuaries Preliminary Environmental Information Report (PEIR) and associated consultee responses;
- Mapping published on the EA's website;
  - Risk of Flooding from Rivers and Sea;
  - Flood Map for Planning[6];
  - Long Term Flood Risk Information[7];
  - Risk of Flooding from Reservoirs; and
  - Risk of Flooding from Surface Water.
- British Geological Survey (BGS)[8] mapping for details of superficial and bedrock geology BGS Geology Viewer (BETA);
- Cranfield Soil and Agrifood Institute Soilscapes map viewer[9] for soil information;
- EA LiDAR data from the Department for Environment Food & Rural Affairs, https://environment.data.gov.uk/DefraDataDownload/?Mode=survey;
- Tendring District Council Strategic Flood Risk Assessment[10];
- Tendring District Council Strategic Flood Risk Assessment Addendum[11]; and
- Department Environment, Food and Rural Affairs (DEFRA)'s Multi-agency geographic information for the countryside (MAGIC)[12] website.

1.4 Climate Change

15. The NPPF requires that flood risk is considered over the lifetime of the development and therefore consideration needs to be given to the potential impacts of climate change.

16. In February 2016, the EA issued updated guidance on the impacts of climate change on flood risk in the UK to support NPPF. This was most recently updated in May 2022 and advice sets out that peak rainfall intensity, sea level, peak river flow; offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change. Consideration of the changes to these parameters should use the allowances outlined below based on the anticipated lifetime of the development.

6 Environment Agency Flood Risk for Planning, https://flood-map-for-planning.service.gov.uk/ [Accessed: October 2023]

7 Environment Agency Long Term Flood Risk, https://www.gov.uk/check-long-term-flood-risk [Accessed: October 2023]

8 British Geological Survey, Geoindex Onshore, https://geologyviewer.bgs.ac.uk/ [Accessed: October 2023]]

9 Soilscapes, Cranfield Soil and Agrifood Institute, Cranfield University, DEFRA, http://www.landis.org.uk/soilscapes/ [Accessed: October 2023]]

10 Strategic Flood Risk Assessment, JBA, March 2009

11 Strategic Flood Risk Assessment Addendum, Essex County Council Flood Services, September 2017

12 Magic Map Application, DEFRA, https://magic.defra.gov.uk/MagicMap.aspx [Accessed: October 2023]

17. Data has been received from the EA with respect to modelled peak water levels for coastal areas and for inland watercourses including Holland Brook and Kirby Brook. The data is sourced from the following models:

- Clacton Coastal Model 2018;
- Clacton and Holland 2020; and
- Kirby Brook, Essex, 2015.

18. The climate change allowance guidance acknowledges that there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, the document provides estimates of possible changes that reflect a range of different emission scenarios, over different epochs.

19. Allowances in relation to offshore wind speed and extreme wave height are relevant to sites situated on the open coast, which would include the area inland from landfall on the ECC route. The Clacton Coastal Model includes results from scenarios which include allowances for climate change, which will include storm surge.

1.4.1 Anticipated Lifetime of Development

20. The NPPF practice guidance classifies land uses into five categories. Utilities infrastructure such as these works is classified as "Essential Infrastructure". The onshore cable is to be designed for a 40-year design life, which fall within the 2080's epoch when considering climate change allowances for river flow and the 2070s epoch for peak rainfall intensity. Design of the ECC will need to consider assessment of the 1 in 100 (1%) Annual Probability Event (AEP) for fluvial flooding and the 1 in 200 (0.5%) AEP for tidal flood risk.

1.4.2 Peak River Flow

21. Guidance states that for "Essential Infrastructure" development located in Flood Zone 2 or 3a and 3b, the "higher central" allowance should be considered. For the Combined Essex Management Catchment in which the site is located, this equates to a 38% increase in peak flow by the 2080s, which corresponds to the proposed 40-year design life.

Table 1-1 Peak River Flow Allowances by River Basin

River Basin District	Allowance Category	2020s	2050s	2080s
Combined Essex Management Catchment Allowances	Central	7%	8%	25%
	Higher Central	13%	16%	38%
	Upper End	27%	37%	72%

1.4.3 Peak Rainfall Intensity

22. For peak rainfall intensity the PPG guidance states that flood risk assessments for "Essential Infrastructure" developments with a 40-year design life, the central allowance for the 2070's epoch for both the 3.3% AEP storm event and 1% AEP storm event should be used. As detailed in Table 2: Peak Rainfall Intensity Allowances, this equates to a 20% uplift on the 3.3% AEP event and 20% uplift for the 1% AEP event.

Table 1-2 Peak Rainfall Intensity Allowances

Management Catchment	Annual Exceedance Probability (%)	Allowance Category	Total potential change anticipated for the 2050s	Total potential change anticipated for the 2070s
Combined Essex Catchment Allowances	3.3	Central	20%	20%
		Upper End	35%	35%
	1	Central	20%	25%
		Upper End	45%	40%

2.0 Baseline Context

2.1 Local Hydrology

23. There are five EA Statutory Main Rivers[13] are present across or around the onshore ECC, as detailed in Table 2-1. Several ordinary watercourses also flow across the onshore ECC serving as tributaries to the Main Rivers.

24. The study area is drained principally by the Holland Brook catchment, starting as an ordinary watercourse near Little Bromley and draining in a south-easterly direction towards the coast. River flows are measured at Thorpe le Soken, approximately 5 km south-east of Tendring and approximately 7 km upstream of the coast, where a tidal influence is noted as being important due to the low river gradient. The Holland Brook catchment is noted as comprising London Clay with some Boulder Clay cover in the north-west, mixed permeability bedrock and superficial deposits. It is a rural, predominantly arable, catchment with some grassland.

25. The north-western/ western part of the study area also includes tributaries draining into the upper reaches of Tenpenny Brook which drains south out of the study area and into the River Colne estuary north of Brightlingsea. The northern part of the study area includes the upper reaches of ordinary watercourses that drain north towards the River Stour estuary near Manningtree. The lower eastern part of the study area includes the upper reaches of Beaumont Cut which drains east towards the coast at Hamford Water. The ECC Sections are displayed in Figure 1-1.

Table 2-1 Environment Agency Statutory Main Rivers

EA Statutory Main River	Location within the VE Onshore boundary Sections	Tributaries
Holland Brook	Section 1-6	Tendring Brook (also a Main River); Pickers Ditch, Weeley Brook, Little Bentley, Kirby Brook (also a Main River)
Kirby Brook	Section 1	(Tributary of Holland Brook)
Tendring Brook	Section 3	(Tributary of Holland Brook)
Beaumont Cut	Section 2 & 3	N/A
Tenpenny Brook	Section 6 &7	(Tributary of River Colne)

2.1.1 Holland Brook

26. Holland Brook is an EA designated Main River draining a catchment size of 54.9 km^2 which rises in Little Bromley and flows 16.5 km from northwest to south eastwards past

13 Main River Map, Environment Agency [Accessed: October 2023]

the towns of Tendring, Weeley and Little Clacton to its mouth at Holland-on-Sea. This river course flows along the western side of the onshore ECC (Figure 1-1).

27. Holland Brook receives inflows from the statutory Main River tributaries of Tendring Brook, Weeley Brook, Parker's Ditch and Kirby Brook. Holland Brook predominantly flows through rural, arable and grassland and intersects the Colchester to Walton-on-the-Naze railway line at Thorpe le Soken, and again in Great Holland along the Colchester to Clacton-on-Sea section of the line. The discharge point of this river is an outfall built within a sea defence system containing a tidal gate and sea wall at Holland Haven. The location of the outfall is NGR TM 219 172. The land behind the sea wall and outfall is lower lying and acts as a flood storage area at high tide when the tidal gate is in its closed position.

2.1.2 Kirby Brook

28. Kirby Brook is an EA designated Main River which drains an upstream catchment size of 6.56 km^2 which rises just south of Kirby Cross village and is a tributary of Holland Brook. Kirby Brook flows south-east up to the coastline just south of Frinton-on-Sea, where it then runs southwards parallel to the coastline to its confluence with Holland Brook at Holland-on-Sea. The river flows through a mix of land uses, from agricultural land at its source to the edge of Frinton-on-Sea's residential neighbourhood and the remainder of the course through SSSI sites bordering the coastline.

2.1.3 Tendring Brook

29. Tendring Brook is a designated EA Main River draining an upstream catchment size of 9.81 km^2 and a tributary of Holland Brook. Tendring Brook flows form the northeast of Tendring towards the south where it meets its confluence with Holland Brook near Hillhouse Lane. The river runs through rural agricultural land. The onshore ECC intersects Tendring Brook at Tendring.

2.1.4 Beaumont Cut

30. Beaumont Cut is a Main River draining an upstream catchment of size of 3.19 km^2, flowing eastwards into the 7.78 ha coastal embayment of Hamford Water National Nature Reserve (NNR). This reserve consists of marsh, mud flats and sands. The onshore ECC is not intersected by this river; however, it is within the 2 km buffer zone as it flows north of Golden Lane in Thorpe le Soken.

2.1.5 Tenpenny Brook

31. Tenpenny Brook is an EA designated Main River rising to the south of Great Bromley and flows south-westwards to discharge into the Colne Estuary, north of Brightlingsea. headwaters of the brook rise on land to the south of the OnSS to the south west of Sections 6 & 7 of the onshore ECC.

2.1.6 Ordinary Watercourses

32. The site contains several existing field drains, ditches and irrigation channels. Most of the surface water channels crossed are ordinary watercourses and form tributaries to the Main River watercourses detailed above.

2.2 Site Topography

33. Ground level data across the site has been obtained from 0.5 m resolution aerial photogrammetry (LiDAR) data using a Digital Surface Model (DSM) which includes the natural and built features on the surface.

34. Land within the study area extends inland from the Essex coastline across low lying topography towards higher ground in the north-west of the study area; maximum elevations tend to remain below 40 m Above Ordnance Datum (AOD).

2.3 Geological and Hydrogeological Features

2.3.1 Geology

35. The whole of the onshore ECC is underlain by Thames Group, Clay, Silt, Sand and Gravels of Palaeogene age. This lithology is characteristically impermeable, and the deposits are classified as unproductive aquifer. More generally, the study area is described as being located on marine-derived sedimentary bedrock, with a variety of coarse-to-fine-grained aeolian and fluvial superficial deposits. Superficial deposits vary across the site and are absent in several areas.

36. Where present, superficial deposits underlying the study area comprise mainly of Quaternary Diamicton Till in the north; and discrete deposits of Quaternary Sand and Gravel in Tendring and Great Holland in the south, Quaternary Undifferentiated River Terrace deposits are present along the Holland-on-Sea coastline, underlying the proposed access route for the ECC.

37. These superficial deposits are of low sensitivity, comprising of Secondary (A) and Secondary (B) Aquifers and Unproductive Strata.

38. Soilscapes data indicates that the onshore ECC covers four categories of soils which are as follows:

- Soilscape 8: “Slightly acid loamy and clayey soils with impeded drainage, with a loamy some clayey texture”. Drainage is noted as being slightly impeded, with arable and grassland landcover and drains to the stream network. This covers land to the south of Holland on-Sea including the coast northwards up to Clacton-on-Sea, most of Weeley town, and Tendring. Patches of this soil type are present in Great Holland and Little Clacton;
- Soilscape 18: “Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils, with loamy and clayey texture”. Drainage is noted as being impeded, with grassland and arable some woodland landcover; this drains to the stream

network. This covers northwards from the coast, encompassing Great Holland, Little Clacton and most of the floodplain of Holland Brook up to Thorpe le Soken;

- Soilscape 20: “Loamy and clayey floodplain soils with naturally high groundwater, with a loamy and clayey texture”. Drainage is classified as being ‘naturally wet’ and drains into the river via the local groundwater. This covers the floodplain of Holland Brook to the south of Thorpe le Soken to the confluence of Picker’s Ditch; and
- Soilscape 21: “Loamy and clayey soils of coastal flats with naturally high groundwater, with a loamy and clayey texture”. Drainage is classified as being ‘naturally wet’ and drains to local groundwater.

2.3.2 Hydrogeology

39. The superficial deposits identified as Quaternary Sand and Gravel is defined as either unproductive aquifer or as Secondary A aquifer, whilst the Till is generally defined as Secondary A aquifer or Secondary B aquifer. Secondary A and Secondary B aquifers have the potential to store and yield water at a local scale. The northernmost section of the hydrology and flood risk study area (from Little Bromley to 0.36 km north of Lodge Lane in Tendring) is within a Groundwater Source Protection Zone (SPZ) 3. EA designated Source Protection Zones (SPZ 3) are also present in the western portion of the onshore ECC beyond Great Bentley with no sensitive zones (i.e. SPZ1 or 2) in the area.

40. Shallow groundwater is present within the study area through the presence of the localised areas of superficial Sands and Gravels. These groundwater bodies are not used for public water supply but support a number of uses including a significant number of small domestic abstractions for domestic and agricultural purposes. There are a large number of borehole records in the study area, along the route of the A120 and A133 and concentrated in the northern part of the study area, to the north of the A120. Similarly, there are a large number of groundwater wells in this section of the part of the study area.

2.4 Existing Site Drainage

41. Given the greenfield nature of the majority of land crossed by the onshore ECC, with the exception of agricultural land drains, there is no formal drainage infrastructure controlling runoff. During a rainfall event, surface water will infiltrate into the ground or, if the soil is saturated, flow over the surface, ponding in topographic lows or following the topographic slope into open drainage ditches/ streams or the main watercourse network.

42. A review of local utilities has been undertaken to inform the onshore ECC route selection and it is noted that a number of utilities including water mains will be crossed by the onshore cabling. The crossings will be either trenched or use trenchless crossing techniques such as horizontal directional drilling (HDD) and each crossing would require agreement from the utility provider.

3.0 Flood Risk Screening

43. A screening study has been completed to identify whether there are any potential sources of flooding along the onshore ECC which may warrant further consideration. If required, any potential significant flooding issues identified in the screening study would then be considered in subsequent sections of the assessment.

44. There are a number of potential sources of flooding and these include:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal flooding;
- Flooding from land / surface water flooding;
- Flooding from groundwater;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.

45. The EA Flood Risk Mapping for Planning provides a dataset which categories flood risk over land into three categories detailed below. Hydraulic models are used to produce this data where the presence of flood defences has not been included in the assessment of risk. As such, this mapping indicates the flood risk on land in the absence of defences. Conceptually it should be acknowledged that this data also does not consider finished floor levels of property and other flood sources, and thus the risk to specific properties would require further assessment. Details on the EA flood risk zones are as follows:

- Flood Zone 1 - Land which has less than 1 in 1,000 (0.1%) AEP flooding from the river and/or sea each year. This is classified as a ‘low’ probability of flooding via these sources;
- Flood Zone 2 - The land which has between a 1 in 1, 000 (0.1%) AEP and a 1 in 100 (1%) AEP chance of flooding from rivers each year; or a less than a 1 in 200 (0.5%) AEP but higher than a 1 in 1,000 (1%) AEP chance of flooding from the sea. This is classified as a ‘medium’ probability of flooding from these sources; and
- Flood Zone 3 -The land which has a 1 in 100 (1%) AEP or greater chance of flooding each year from Rivers; or with a 1 in 200 (0.5%) AEP or greater chance of flooding each year from the sea. This is classified as a ‘high’ probability of flooding from these sources.

3.1 Flooding from Rivers or Fluvial Flooding

46. As mentioned in Section 2.1, there are five EA statutory Main Rivers within or draining the onshore ECC and wider study area.

47. An excerpt of EA Flood Zone mapping is displayed in Figure 3-1. Most of the land crossed by the onshore ECC is classified as having a ‘low’ probability of fluvial flooding (less than 0.1% AEP). Flood risk is concentrated along three EA Main Rivers (Holland Brook, Tendring Brook and Kirby Brook), which are within EA flood zone 2 and 3b

according to Tendring District Council Strategic Flood Risk Assessment (SFRA). Only a fluvial flood risk is present for Holland Brook upstream of Thorpe le Soken.

48. Holland Brook downstream of Thorpe le Soken, Beaumont Cut, Pickers Ditch and Landermere Creek, are shown to be areas benefitting from coastal flood defences.

49. Whilst most of the cable installation will be constructed using an open trench, non-trenched methods such as the use of HDD methods will be used to avoid obstructions such as Main Rivers. This technique aims to avoid disturbances to the natural river flow and course during the construction phase of the project and as such, should not increase any pre-existing flood risk associated with the respective watercourses. During the construction phase the Environmental Statement (ES) details embedded mitigation to manage this.

50. As the main risk of flooding to site is from tidal sources at landfall and the immediate reach of the onshore ECC inland from this point, the risk of flooding from rivers or fluvial sources is considered to be managed and will not be assessed further.

3.2 Flooding from the Sea or Tidal Flooding

51. An extract of the EA Flood Map for planning[1] is provided in Figure 3-1. The mapped flood outline is also confirmed Tendring Council Strategic Flood Risk Assessment[11].

52. EA Flood Risk for Planning shows areas within the study area at risk of inundation during extreme events along the whole coastal reach including Kirby Brook, and extending upstream of Holland Brook to Thorpe le Soken, as well as in the upper reaches of Tenpenny Brook and Landermere Creek. These areas fall within EA Flood Zone 3 (high probability) of flooding from tidal sources. At the east of the study area, Hamford Water NNR and Beaumont Cut is in Flood Zone 2 and 3. This flood map does not consider the presence of any coastal flood defences in its modelling of flood extents across the land.

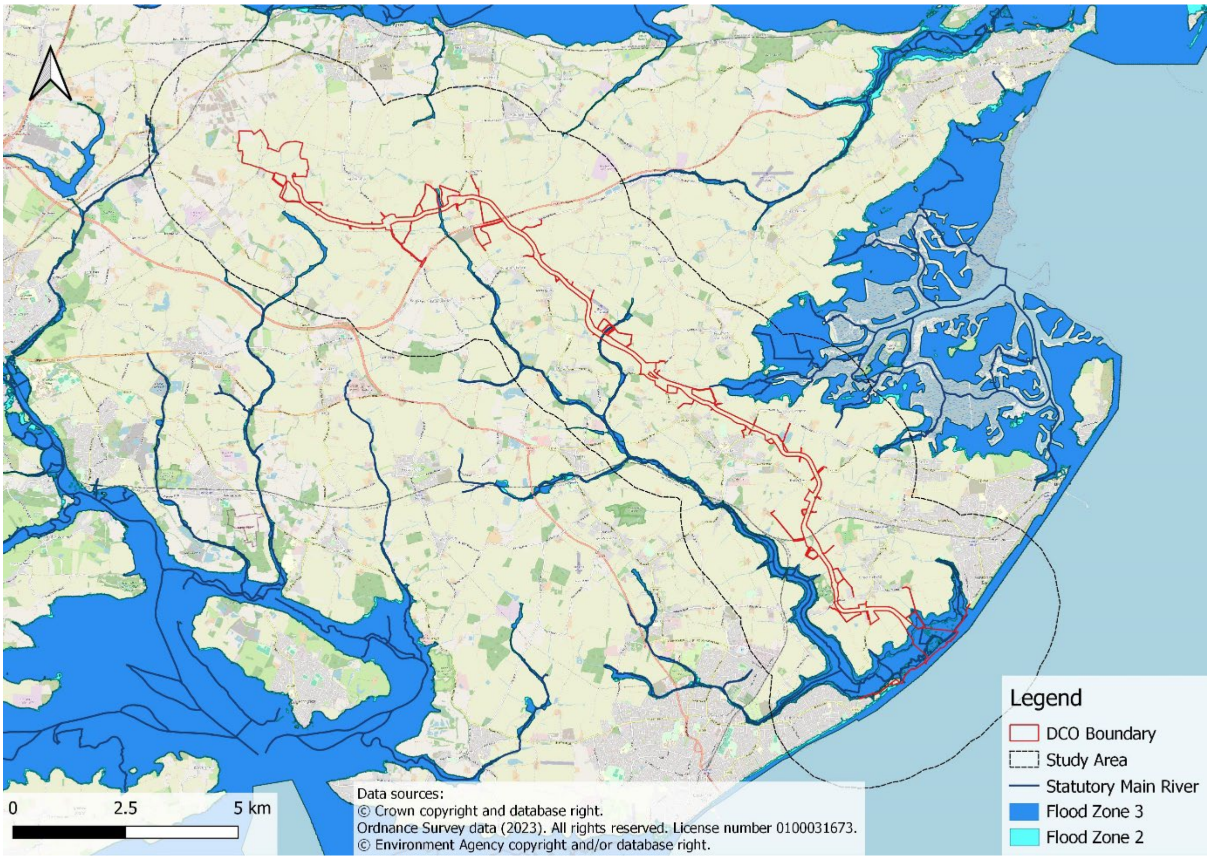
53. Several coastal flood defences are present in the vicinity of the onshore ECC offering protection. This includes sea walls, groynes, embankments, engineered high ground and natural high ground. The sea walls offer protection against tidal flooding to most of the land behind it, therefore the proportion of the landfall site area which lies north of the seawall is considered to be within the defended tidal floodplain classified in Flood Zone 3. The height of the sea wall defences along this frontage is detailed in the EA Asset Management data as having an actual upstream crest level of 6 m AOD. Tidal defences in this area offer current day protection from sea flooding for 1 in 200 (0.5%) AEP events.

54. Cables within the ECC will be buried at landfall and thus it is expected that the development on the surface of the onshore ECC will not increase, nor be affected by incidences of tidal flooding should the defences be breached during the operational phase. Breaching or failure of coastal flood defences is considered to be a residual risk to the site and should be considered for the construction phase.

55. As mentioned, the tidal defences are constructed to provide protection of 0.5% AEP. It is reasonable to determine that flooding from tidal sources will not impact construction activity at the site unless there is an extreme event of if defences were to fail. The residual risk existing due to the potential failure of these coastal flood defences will be considered in Section 4.2.1.

56. There will be a risk of tidal flooding to activities on the seaward site of coastal defences at landfall during the construction phase. Any works at this location will need to be cognisant of the risk of flooding and will be subject to an emergency flood response plan specific to this location.

Figure 3-1 Extract of Environment Agency Flood Map for Planning



57. Due to the residual risk of flooding at the lower extent of the site, the residual risk of flooding from tidal sources is considered further in Section 4.2.

3.3 Flooding from Surface Water or Overland Flow

58. Surface water modelling has been undertaken by the EA to establish areas at risk of surface water flooding. An extract of the resulting surface water flood map is reproduced in Figure 3-2.

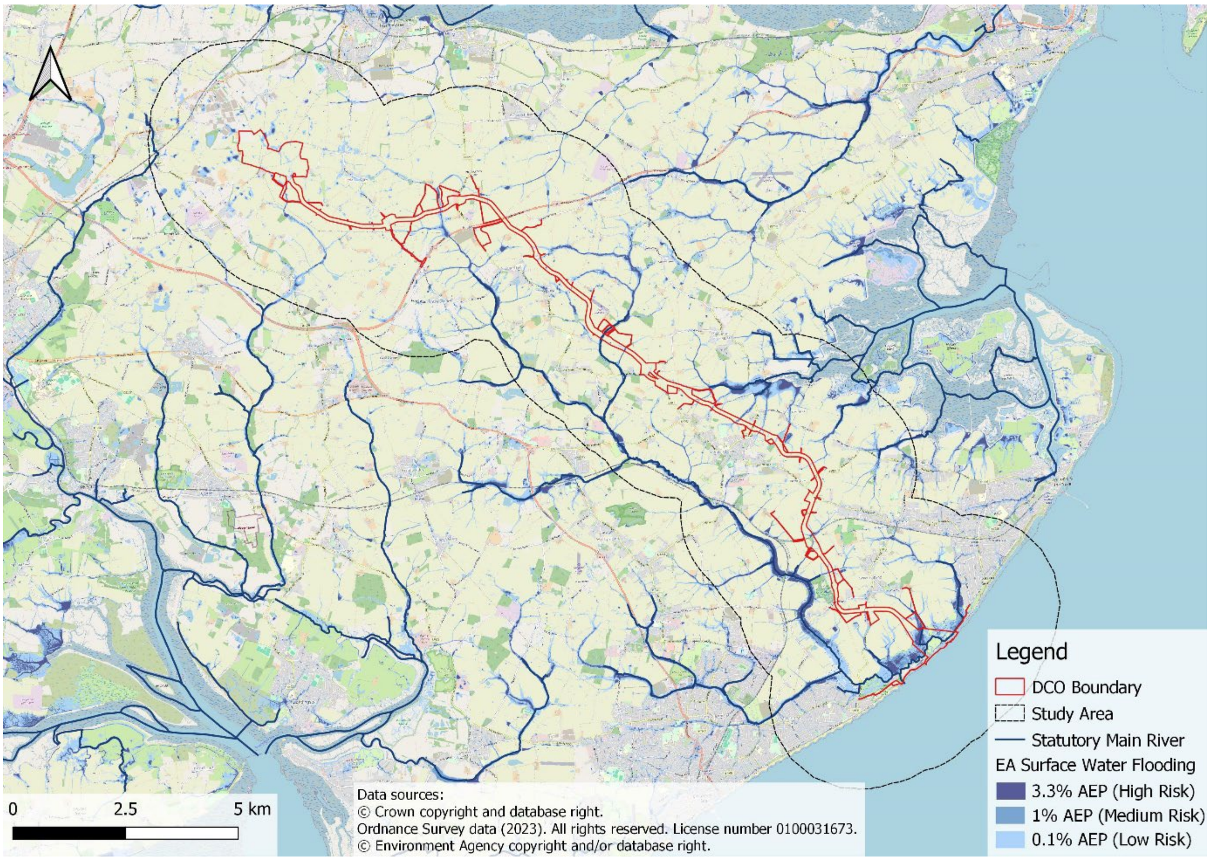
59. The EA defines the surface water flood risk categories as:

- Very Low: less than 0.1% AEP (1 in 1,000 chance) of flooding in any given year;

- Low: less than 1% AEP (1 in 100 chance) but greater than or equal to 0.1% AEP (1 in 1,000 chance) of flooding in any given year;
- Medium: between 1% AEP (1 in 100 chance) and 3.3% AEP (1 in 30 chance) of flooding in any given year; and
- High: greater than 3.3% AEP (1 in 30 chance) of flooding in any given year.

60. It should be noted that this information does not take into consideration, or include in modelling, any formal surface water drainage infrastructure installed beneath the ground surface.

Figure 3-2 Environment Agency Surface Water Flood Map



61. Mapping contained in Figure 3-2 indicates the risk of flooding from surface water to the vast majority of the onshore ECC to be very low (less than 0.1% AEP). The modelling is in absence of road drainage infrastructure and therefore the risk of flooding in this area is more likely very low provided that the storm water drainage network functions as designed.

62. Surface water flood risk mapping produced by the EA confirms the conceptual understanding and indicates areas in the study area at potential risk of inundation from extreme rainfall in limited isolated areas. The majority of risk ranging from medium to high (3.3%) appears to be related to the corridor of existing ordinary watercourses draining into Main Rivers, with limited smaller isolated zones of risk, associated with areas of low ground, generally in rural areas. Even so, when these areas intersect the

onshore ECC, the surface water flooding risk is confined along these watercourses and does not appear to affect large areas of the onshore ECC route.

63. Several drainage ditches were identified across the study area which were isolated from ordinary watercourses, whilst others facilitated drainage from these smaller watercourses.

64. During the construction phase of the onshore ECC , open trench construction methods will be used which involves the temporary removal of topsoil and subsoil along the onshore ECC. This change of land cover and potential need to temporarily divert smaller ditches will potentially affect pre-existing surface water drainage patterns, with potentially more surface water being directed into current drainage networks. Management of this additional risk will be provided in the form of a temporary surface water drainage strategy for construction activities, prepared by the principal contractor, which will adhere to the principles contained in the CoCP. This strategy will be agreed through liaison with the Lead Local Flood Authority (LLFA) of Essex County Council. This drainage strategy will adhere to Sustainable Drainage System (SuDS) principles.

65. As the cables will be buried, and all land at the surface fully reinstated, it is not expected that the risk of surface water flooding will be heightened during the operational lifetime of the development. The modification to land cover during the project construction phase will be re-set after the cable installation, thus the risk of surface water flooding to the site will remain as it is today, except for the influence climate change, due to the absence of changes to hydrological and hydrogeological catchment characteristics.

66. It is noted that the Shoreline Management Plan[14] (SMP) outlines strategy for managing flood and erosion risk along the coastline, over short, medium and long-term periods. The study area within the shoreline management plan (SMP) which covers landfall is contained within Management Unit C, Tendring Peninsula, and the Policy Development Zones for Holland-on-Sea (PDZ C2) and Clacton-on-Sea (PDZ C3) are relevant. The SMP states that for PDZ C2 the current line will be held until 2055 and from this point a dual policy of either managed realignment or hold the line. For PDZ C3, the policy states that the current line will be maintained for all future epochs. Once installed, the cable will be buried at depth and any future change to management of shoreline coastal defences is highly unlikely to affect the installed infrastructure.

67. Considering the information regarding the cable construction mitigation measures to prevent long term changes to surface water drainage, the risk of flooding via this source will not be a concern for the operation and decommissioning phase of the development and as such will not be considered further.

14 Essex and South Suffolk Shoreline Management Plan 2, October 2010

3.4 Flooding from Groundwater

68. As detailed in Section 2.3, the BGS[8] mapping indicates that the site is underlain by Thames Group, clay, silt, sand and gravels of Paleogene age, which is considered to be relatively impermeable, however localised superficial deposits of Quaternary Sand and Gravel are present within the study area.

69. Conceptually, the presence of a more permeable lithology in the form of superficial deposits overlaying less permeable bedrock can provide a storage location for groundwater accumulation which supports the Essex Gravel deposits being a source for private groundwater abstractions, confirming the presence of groundwater across the northern part of the onshore ECC.

70. Private groundwater wells were observed during site visits and the groundwater levels across several boreholes were observed between 4-5m below the surface. There are also several BGS borehole records present within the study area, with the majority being clustered around Little Bromley.

71. Mapping contained in the Tendring Council Strategic Flood Risk Assessment[11] (Appendix 10) indicates that there is a potential risk of flooding from groundwater, and this is highest over Hamford Water National Nature Reserve (NNR) and to the west of Clacton-on-Sea with a classification of 75% and over susceptibility to groundwater flooding. The former of these two locations does not intersect the site. Across Great Holland, Tendring, and Great Bromley there are patches of susceptibility classified as higher than 25% but less than 50%; most of the site is considered to have a susceptibility lower than 25% of flooding from this source.

72. Based on this understanding, the risk of groundwater flooding to the onshore ECC is low and not considered further.

3.5 Flooding from Sewers

73. It is assumed that section 1 of the ECC (Section 1.1), containing Holland Haven Site of Special Scientific Interest (SSSI) Marshes is unlikely to have formal sewerage infrastructure controlling surface runoff from these areas. Due to the presence of the wetland, during a rainfall event surface water is expected to infiltrate and provide natural attenuation before following the topographical slope into open drainage ditches/ streams or the main watercourse networks.

74. The area inland, from Section 2 to Section 7 of the site as detailed in Section 1.1 (Figure 1-1), is predominantly farmland. Data from Tendring District Council confirms private groundwater abstraction licences for agricultural and domestic purposes; also domestic sewerage discharge consents, for several properties across the site which indicates a lack of public sewer network infrastructure in places. Aside from this, the remainder of the farmland is not expected to have an adopted sewerage network.

75. JBA Consulting SFRA for Tendring District Council indicates that the Anglian Water DG5 register of incidents of sewerage flooding indicates that although there have been recorded historical incidents of flooding from this source (Appendix 2), it is not a notable problem in Tendring District.

76. Failure or surcharge (blocked or collapsed sewer, or burst main) of the private sewerage networks would result in the limited emergence of flood water at the surface, which would progress in accordance with the topographic gradient and be infiltrated or pass to local surface water features.

77. The risk of flooding from sewers is therefore concluded to be low and is not considered further.

3.6 Flooding from Reservoirs, Canals, or other Artificial Sources

78. EA mapping[7] indicates that part of the floodplain bordering Holland Brook from Clacton Road inland to Tendring is at risk of reservoir breach under a wet and dry day scenario when the river is at normal levels. The EA 'wet day' scenario map indicates that Holland Brook floodplain upstream of its estuary; the most downstream section of Picker's Ditch; Kirby Brook extending through Holland Haven Marshes SSSI Site, are all susceptible to flooding via reservoir failure flooding. Sections of these areas are within the proposed landfall section of the ECC. The risk of flooding is associated with a reservoir at Dairy House Farm, to the southwest of the onshore ECC. The flood extent does not intersect the ECC other than at Holland Marshes.

79. Essex Council SFRA indicates that large reservoirs are regularly inspected by registered engineers and as such the risk of failure or breach is considered to be low.

80. There are no canals within the ECC and thus the risk of flooding via this source will not be considered further.

3.7 Flooding from Infrastructure Failure

81. Coastal flood defences are located along the landfall section of the onshore ECC. These defences run parallel to the coastline and protect the land from Clacton-on-Sea to Frinton-on-Sea, which includes the coastwards bordering section of the onshore ECC. The following defences are present:

- Sea Walls:
  - Holland Gap to Chevaux de frise Point (wall);
  - Chevaux de frise to Holland Cliffs (wall);
  - Holland Cliffs (wall); and
  - Defences at Holland Sluice (wall).
- Embankment:

  - Defences behind Holland Haven Beach.
- Groynes:
  - The South Frinton beach groynes.
- Engineered High Ground:
  - Martello Bay to Holland Haven.
- Defences are also present around Hamford Water NNR to the east of the study area; Beaumont Cut and Holland book are afforded protection by natural high ground along most of their course. These defences are regularly inspected and maintained by the EA, however there is a residual risk of failure which will be considered in Section 4.2.1.

3.7.1 Culverts

82. Several culverts were observed during site visits, mostly along ordinary watercourses and field drainage channels. In the event of blockage through vegetation growth or littering there is potential for the water flow to be affected or reduced. The pre-existing risk of culvert blockage can be mitigated through regular maintenance regimes to ensure that that these structures are cleaned regularly. As mentioned in Section 3.3, the construction techniques will aim to preserve the current state of the ordinary watercourses within the site and thus will not increase the current flood risk for the development.

83. While the local fluvial and coastal flood defences provide a high standard of protection there is inherently a residual risk of failure from these structures, including culverts, around the onshore ECC. This is therefore considered further within Section 4.2

3.8 Flood Risk Summary

84. A summary of the potential sources of flooding and the flood risk arising from them is presented in Table 3-1.

Table 3-1 Potential Sources of Flooding

Potential Source of flooding	Significant Flood Risk at the Site (Y/N)
Rivers or Fluvial Flooding	N
Sea or Tidal Flooding	Y
Surface Water or Pluvial Flooding	N
Groundwater	N
Sewers	N
Reservoirs, Canals and other Artificial Sources	N
Infrastructure Failure	Y- residual risk of Sea or Tidal Flooding

85. A detailed assessment of the risks to the Site as emphasised in Table 3-1 are considered further in Section 4.0.

4.0 Analysis of Flood Risk

86. The flood risk screening provided in Section 3.0 has demonstrated that parts of the onshore ECC are potentially at risk of tidal flooding and infrastructure failure is also flagged as a residual risk for flooding from the sea and tidal sources.

4.1 Historical Flooding

87. With reference to EA Historical Flood Mapping[15], there is one recorded incident of flooding within the study area. This tidal flood incident originated from Hamford Water NNR and extended inland within the study area between Beaumont Cut, Kirby, and Thorpe le-Soken. This event was caused through overtopping of tidal defences present across the NNR and persisted from January 31 1953 to 01 February 1953.

4.2 Flooding from Tidal Sources

88. As discussed in Section 3.2, flooding from tidal sources from the residual risk of failure of the coastal flood defences is present. The extent of flooding in the event of a coastal flood defence failure can be different than that which is indicated on EA Flood Risk Zone mapping therefore additional assessments and modelling has been conducted to determine the potential outcome of these events. The residual failure of the coastal flood defences caused by the mechanisms of defence breach has been assessed by TuFLOW modelling software; defence overtopping has been considered separately.

4.2.1 Residual Risk: Coastal Flood Defence Failure

89. Tendring District Council SFRA provides information on EA coastal defence frontage in relation to the onshore ECC, with Clacton and Holland defence frontage totalling 5.92 km, Frinton and Walton at 5.92 km and Dovecourt and Harwich defences extending 4.56 km. These defences provide protection to the land behind it for a 1 in 200 (0.5%) AEP or higher, and consist of the following:

- Beaches (In-between Clacton-on-sea and Walton on the Maze;
- Sea Walls;
    - Walls from Martello Bay to Holland Haven;
    - Chevaux de frise to Holland Cliffs;
        - Downstream crest level of 6.03 mAOD.
    - Holland Cliffs Wall;
        - Downstream crest level of 5.72 mAOD.
    - Holland Sluice (wall);

15 Historic Flood Map, Environment Agency, Historic Flood Map - data.gov.uk

        - Downstream crest level of 6.16 mAOD.
        - Holland Gap to Chevaux de frise Point;
            - Downstream crest level of 6 mAOD.
- Embankments;
    - Defences behind Holland Haven Beach
        - Downstream crest level of 6.36 mAOD.
- Groynes;
    - South Frinton Beach Groynes;
- Engineered High Ground;
    - Martello Bay to Holland Haven.

90. Tendring Council SFRA outlines the specification for breach models developed by JBA Consulting for a potential breach location along the defences at Clacton (Holland Haven) (Appendix D). These 2D TuFLOW models produced flood extents in the event of defence breaches under 1 in 200 (0.5%) AEP; 0.5% AEP plus climate change to 2100; and 1 in 1000 (0.1%) AEP.

91. The breach model only simulates the effect of a breach and does not consider the future changes likely to be made to pre-existing defence levels that will be at increased risk of experiencing overtopping in the future. All breaches were simulated using a width of 50 m, as recommended by the EA. This breach mapping shows an extreme risk of tidal flooding for all the breach scenarios along the ECC landfall at Holland Haven beach, along Holland Haven Marshes in the east, along Pickers ditch in the coastal west and a distance inland of Holland Haven.

92. Flood depths, as expected are modelled to be the lowest (1.5 - 2 m) across Holland Haven Marshes for the 0.5%) AEP plus climate change to 2100 scenario; and 2.5 - 3.0 m at the deepest along Holland Brook for the same breach scenario. This variation in breach depth is consistent across the scenarios which validates conceptual understanding on the flood attenuation provided by marshland. The deepest depth reading from the 0.1% AEP scenario is 2.0 - 2.5 m, and the shallowest for that scenario is at 0 - 0.5 m.

4.2.2 Defence Failure by Overtopping

93. Tendring District SFRA indicates that improvements to the defence heights were made for coastal and estuary banks after the 1953 tidal surge, which largely affected areas outside of the site (Harwich, Brightlingsea and Jaywick and Point Clear). Overtopping from wave run-up is likely due to the defences being open to wave attack, however site visits have shown the use of rip rap at the base of the Holland Cliffs Wall which is beneficial in reducing wave action and toe scour.

94. Defences experiencing clear water overtopping during extreme events may result in smaller areas behind the defence being inundated, however this is influenced by the

defence crest level. Embankments experiencing this phenomenon may have localised areas of overtopping due to the variability of defence height characteristic of this type of defence.

4.3 Summary

95. Flood risk to the site in the event of defence failure from overtopping is considered to be lower in comparison to the risk of failure from a breach of the defences.

96. We note that with potential changes in flood severity associated with climate change will gradually increase the residual risk at the site associated with a breach of defences, however once constructed there will be no surface features in areas at risk and very limited need for personnel to maintain the ECC. The SMP[14] indicates that this section of the coastline is currently classified under 'hold the line' which indicates that the defences will be supported further in protecting this stretch of coastline and the site. Beyond 2055 the policy will change to a dual policy of either managed realignment or hold the line.

97. The regular maintenance, management and required defence level as per the EA's legal duties further assists to reduce the likelihood of overtopping. Trenchless construction techniques will be used at the landfall area so that the existing sea defences are not compromised, to assist with protecting sensitive features, and minimise the extent of direct interaction with coastal features. The nature of construction techniques to be adopted are subject to further ground investigations and associated feasibility studies. Considering this, the flood risk to the ECC in the event of a breach caused by this development is likely to be very limited.

98. As discussed in Section 3.2, there will be a risk of tidal flooding to activities on the seaward site of coastal defences at landfall during the construction phase. Any works here will need to be cognisant of the risk of flooding and will be subject to a site-specific emergency flood response plan.

5.0 Mitigation

99. From the analysis of flood risk discussed in Section 4.0, flooding of the ECC from any source is considered to be low or negligeable due to the type of development where infrastructure will be buried underground. There is a residual risk of flooding to the onshore ECC from a tidal breach of coastal flood defences, however as the electricity cables and the Transition Joint Bay (TJB) will be buried underground, this risk would only affect the construction phase.

5.1 Flood Response

100. The main risk of flooding to the onshore ECC is derived from the residual risk existing from coastal flood defence failure and the risk of tidal flooding to any landfall activities on the seaward side of coastal defences during the construction phase. Flood response awareness and procedures will be included in the principal contractors emergency flood response planning for an incoming tidal event. This should be included

for any proposed works on the seaward side of coastal flood defences and also areas of the site at residual risk from defence failure. The flood alerts and warnings available for the site are as follows:

- The coastal section of the site extending along Holland Brook to Thorpe le Soken and surrounding Hamford Water NNR, are areas covered by the EA's general early notification (Floodline) of possible flooding, known as 'Flood Alerts'.
- The same areas noted above are also covered by the EA's flood warning service which notifies all subscribers on an impending flood. It is recommended that the principal contractor sign up to the Floodline service for general awareness of on an oncoming tidal event in relation to the onshore cable connection point at the proposed landfall area of the Site.

101. The emergency flood response planning should form part of a wider emergency response plan for the proposed ECC.

5.2 Maintenance and Management

102. The EA already check the surrounding defence infrastructure on a regular basis, however any signs of degradation, particularly after an extreme tidal flood event should be reported to the EA immediately.

103. All works that cross coastal flood defences will require prior approval from the EA. The principal contractor will be required to liaise with the EA during the construction phase where it is expected that the development procedure will involve HDD under the coastal flood defences. This is to ensure the viability of the coastal defences during this phase of the project.

104. Regular maintenance and clearing of debris from culverts along ordinary watercourses is essential and may require consultation with the LLFA (Essex County Council) during the construction phase to ensure that no blockages are present. In the operational and decommissioning phase of VE, the onshore ECC is not expected to be affected by these issues in relation to any works.

105. It is recommended that the construction phase maintenance and management measures are incorporated into the Code of Construction Practice (CoCP), with records kept demonstrating compliance. All flood defences, watercourses and drainage culverts will be inspected for damage or debris following a flood event.

5.3 Surface Water Drainage

106. Prior to commencement of the construction works, a number of surveys and studies will be undertaken to inform the development of the final design including ecological surveys, geotechnical investigations and drainage assessments.

107. Surface water drainage requirements during construction will be dictated by a temporary surface water drainage strategy which will be prepared by the principal contractor post consent. This strategy will be designed to meet the requirements of the

NPPF, NPS EN-1 and NPS EN-5, with runoff limited, through the use of SuDS and infiltration techniques, where feasible, and accommodated within the onshore ECC development area.

108. The temporary surface water drainage strategy will be developed according to the principles of the SuDS discharge hierarchy. Generally, the aim will be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- Into the ground (infiltration);
- To a surface water body;
- To a surface water sewer, highway drain or another drainage system; or
- To a combined sewer.

109. During construction works there are a number of smaller agricultural land drains and watercourses, along the onshore ECC route, that may be only seasonally wet. Trenched crossings will be used for these watercourse crossings. It will be necessary to ensure that flow along the watercourse is maintained and there is no increase in flood risk as a result of the temporary works.

110. There is a risk of surface water flooding from these smaller agricultural land drains and watercourses and / or the flow routes into them being affected by construction of the onshore ECC. Measures to intercept and collect flow will be implemented along the onshore cable route to ensure there is no increase in flood risk to off-site receptors. This will typically include the temporary installation of interceptor drainage ditches parallel to the trenches and soil storage areas to provide interception of surface water runoff.

111. The temporary surface water drainage strategy will be developed and implemented by the Contractor, to minimise water within the working areas, ensure ongoing drainage of surrounding land and that there is no increase in surface water flood risk. This will assess the current and proposed runoff rates, volume of storage required and the proposed approach for discharge of water from each location.

6.0 Conclusion

112. Based on the information available, the assessment of flood risk at the ECC for VE finds that the development is at risk of tidal flooding (residual risk) through failure of defence infrastructure. With reference to EA mapping, the onshore ECC is indicated to be located across Flood Zone 1, 2 and 3, however the main risk is from potential tidal flooding between Frinton-on-Sea and Clacton-on-Sea which are in Flood Zone 3. As the coastal extent of the onshore ECC benefits from protection of several coastal flood defences, the risk of tidal flooding is reduced however there is still a residual risk, albeit very low probability, of flooding via a coastal flood defence failure scenario.

113. The residual risk of coastal flood defence failure is being managed by the use of trenchless construction techniques to cross beneath the existing sea defences in an aim to prevent any damage to their operation or integrity. Tendring District SFRA breach modelling from a failure in the current sea wall at Clacton-on-Sea indicates a breach hazard for the landfall section of the onshore ECC. The extent of flooding under the varied scenarios 0.5% AEP, 0.5% AEP plus climate change to 2100, and 0.1% AEP all indicate higher flood depths for the immediate area around Holland Brook and Piker's Ditch confluence and upstream of Holland Brook. These tidal defences are regularly checked and maintenance by the EA and it is expected that future changes to defence heights will be in line with the Essex and South Suffolk Shoreline Management Plan 2 where 'Hold the Line' is the current strategy. Strategy for coastal defences may change at landfall beyond 2055, however this will not impact on the buried infrastructure and will have no effect on flood risk.

114. Flood risk from all other potential sources is not considered to be significant and is assisted by the construction methods which promote the protection of the current states of the watercourses within the ECC. This includes trenchless construction for Main Rivers, trenched methods for smaller watercourses and control of surface water within construction work areas. Trenchless construction will be used at the landfall area so that the existing sea defences are not compromised.

115. No flood risk to infrastructure is considered as the electricity cables will be buried underground and the site predominantly covers rural agricultural land.

116. The Code of Construction Practice (CoCP) requires that flood response awareness and procedures will be included in the principal contractor's emergency response planning where there are works near to or within a flood zone or area of residual risk existing from coastal flood defence failure. It is recommended that as part of this plan, the principal contractor subscribe to the 'Floodline' EA flood warning service to raise awareness of impending tidal event. All flood defences, watercourses and drainage culverts will be inspected for damage or debris following a flood event. Remedial clearing of gullies and clean-up of debris from working areas may also be required.

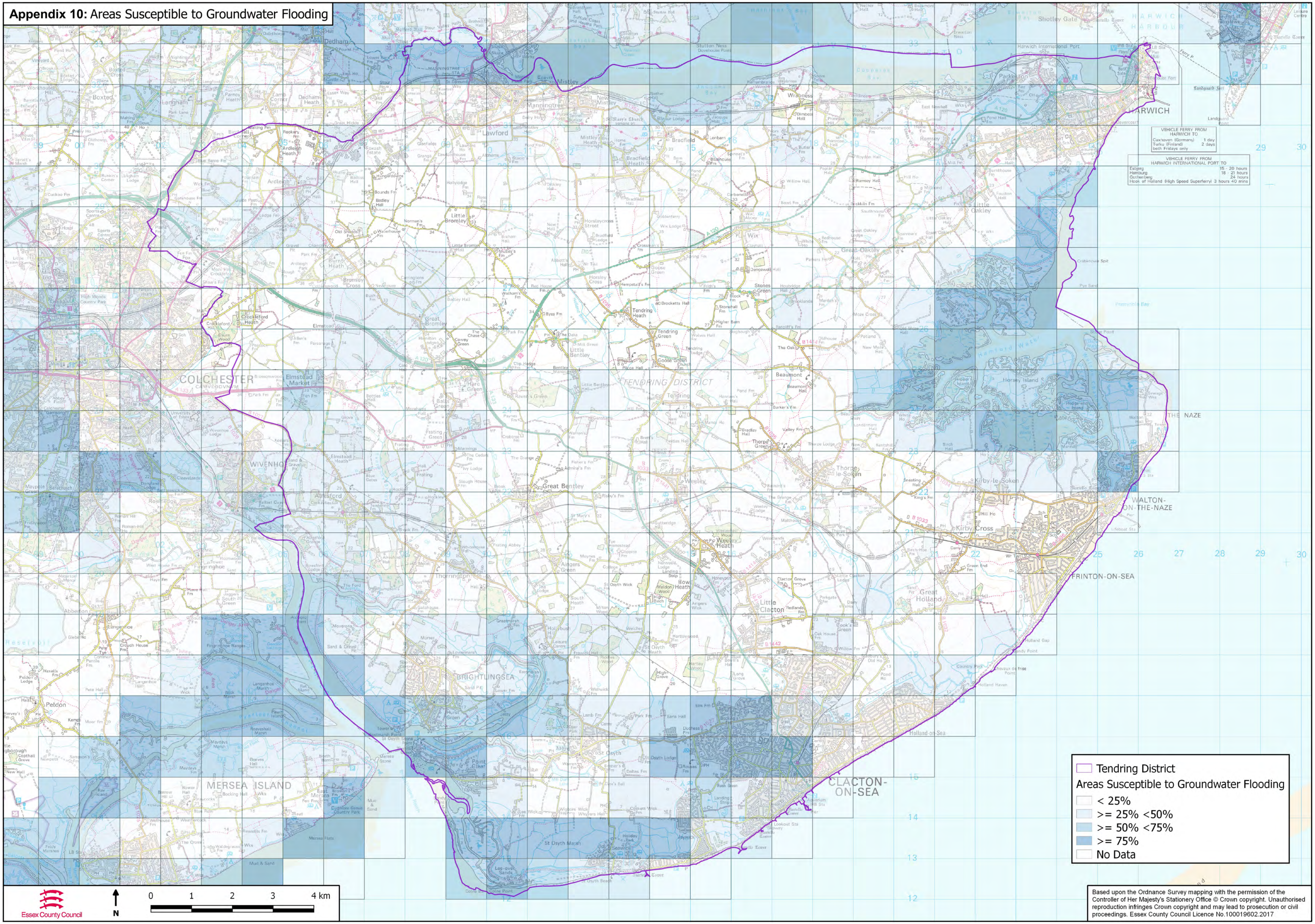
117. On the basis of well-maintained coastal flood defences, it can be concluded the site is protected from flooding up to and including the 0.5% AEP event. This means that provided coastal flood defences remain effective, the risk of flooding at the ECC site will be equivalent to areas designated as Flood Zone 1.

118. In conclusion, based on the information outlined within this Flood Risk Assessment, the perceived level of flood risk to and caused by the development is low and the development would be safe, without significantly increasing flood risk elsewhere.

Appendix A

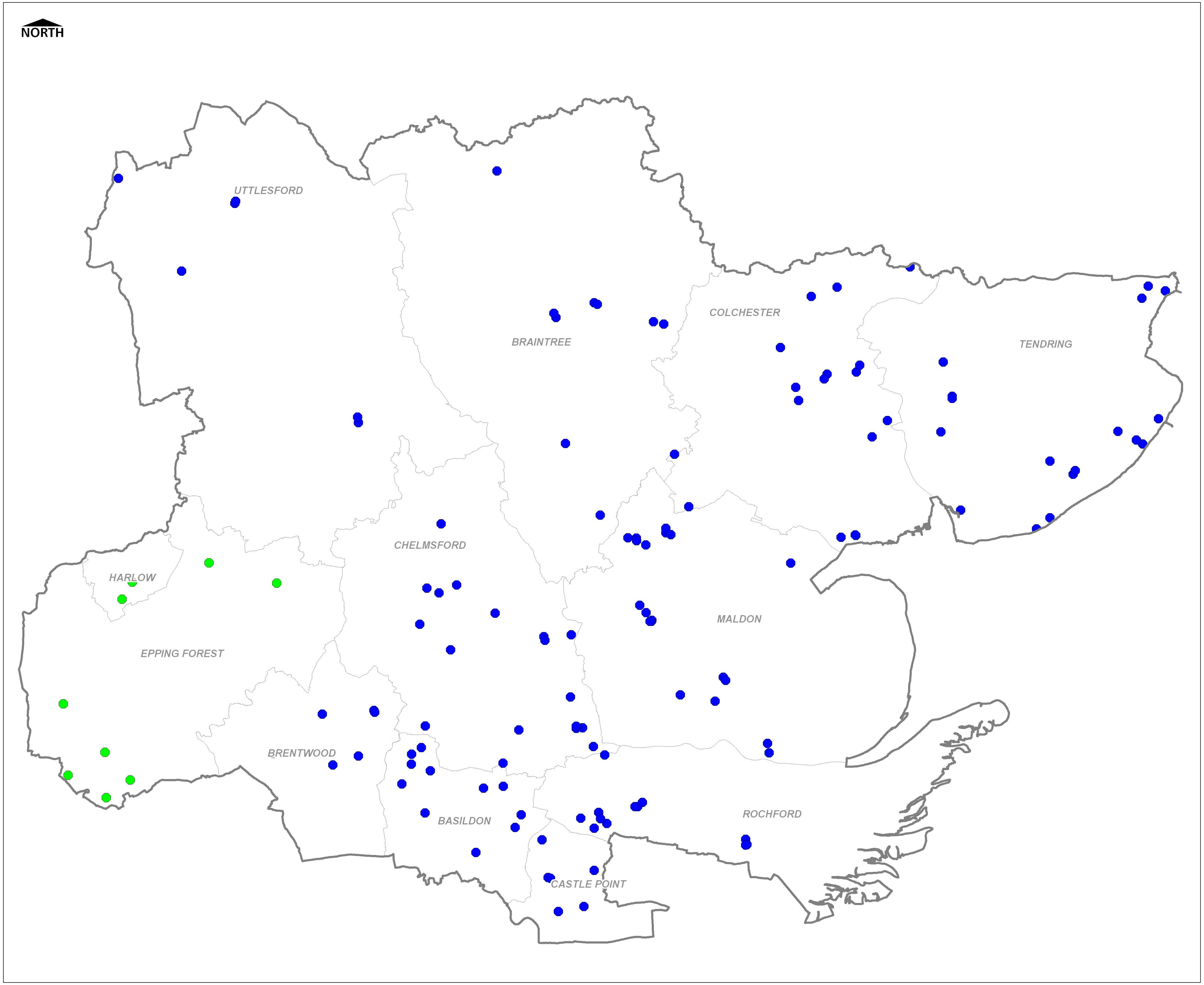
Tendring Council Strategic Flood Risk Assessment Groundwater Flooding Map

Appendix 10: Areas Susceptible to Groundwater Flooding



Appendix B

Historic Sewer Flooding Record Plan



LEGEND

- Essex County Boundary
- Sewer Flooding Records [Thames Water]
- Sewer Flooding Records [Anglian Water]

DRAWN BY	CHECKED BY	PASSED BY	DATE
SL	EG	EG	OCT 2012

SCALE @ A3	ISSUING OFFICE
1 : 250,000	London

MINERALS LOCAL PLAN LEVEL ONE STRATEGIC FLOOD RISK ASSESSMENT [REVISION OCT 2012]

HISTORIC SEWER FLOODING RECORDS

Essex County Council
Essex County Council
County Hall
Market Road
Chelmsford, CM1 1QH

URS Infrastructure and Environment UK Ltd
6-8 Greencoat Place
London, SW1P 1PL
Tel: (020) 7798 5000
URS

DRAWING NUMBER

FIGURE 8.0

REV 04

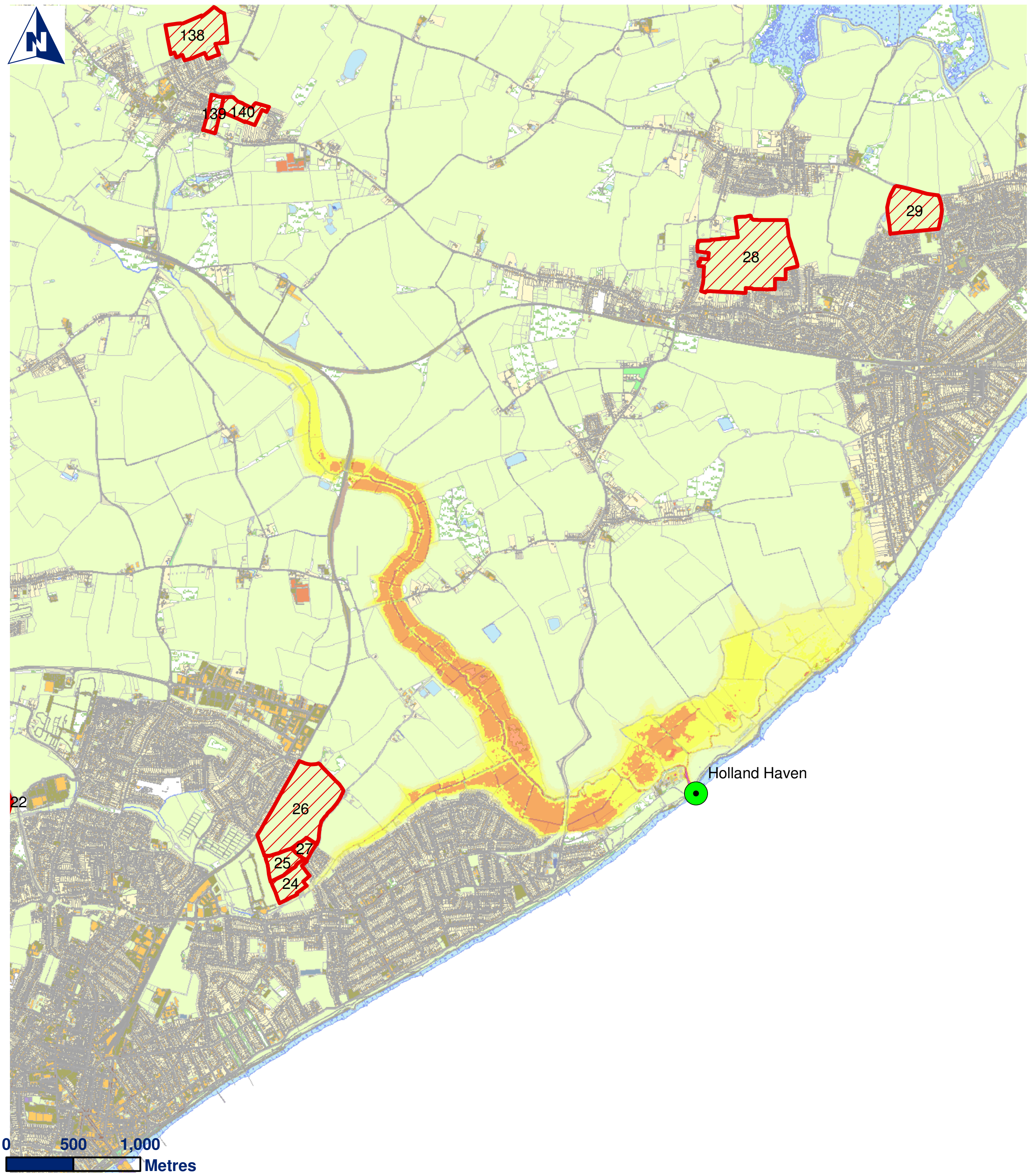
Appendix C

Environment Agency Breach Modelling

Tendring DC Development Area

Residual Flood Risk

Breach Analysis Results at Clacton-On-Sea



Legend

- Breach Locations
- Area of Search of Potential Development Sites

Maximum Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 4.0
- 4.0 - 5.0
- > 5.0

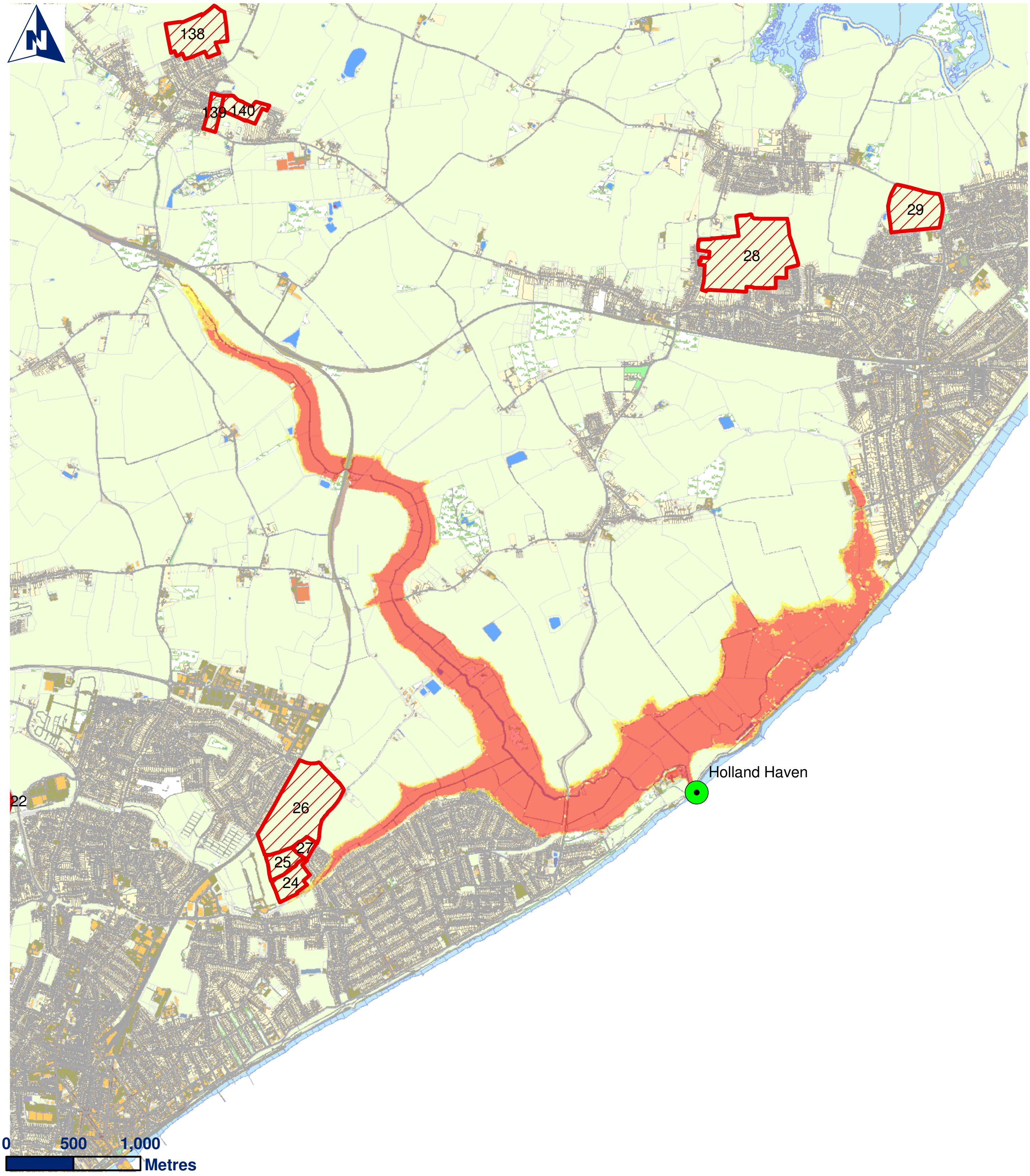
jba CONSULTING

Maximum Depth of Breach Innundation (2007 0.5% AEP Event)

Date:	Mar 27, 2009
File Location:	N:\2008\Projects\2008s3779\Tendring

Tendring DC Development Area
Residual Flood Risk - Hazard

Breach Analysis Results at Clacton-On-Sea



Legend

- Breach Locations
- Walton Pier Regeneration Area
- Area of Search of Potential Development Sites

Hazard Rating
- Low (Caution)
- Moderate (Dangerous for some i.e. children)
- Significant (Dangerous for most people)
- Extreme (Dangerous for all)

jba consulting

Hazard Rating from Breach Inundation (2007 0.5% AEP Event)

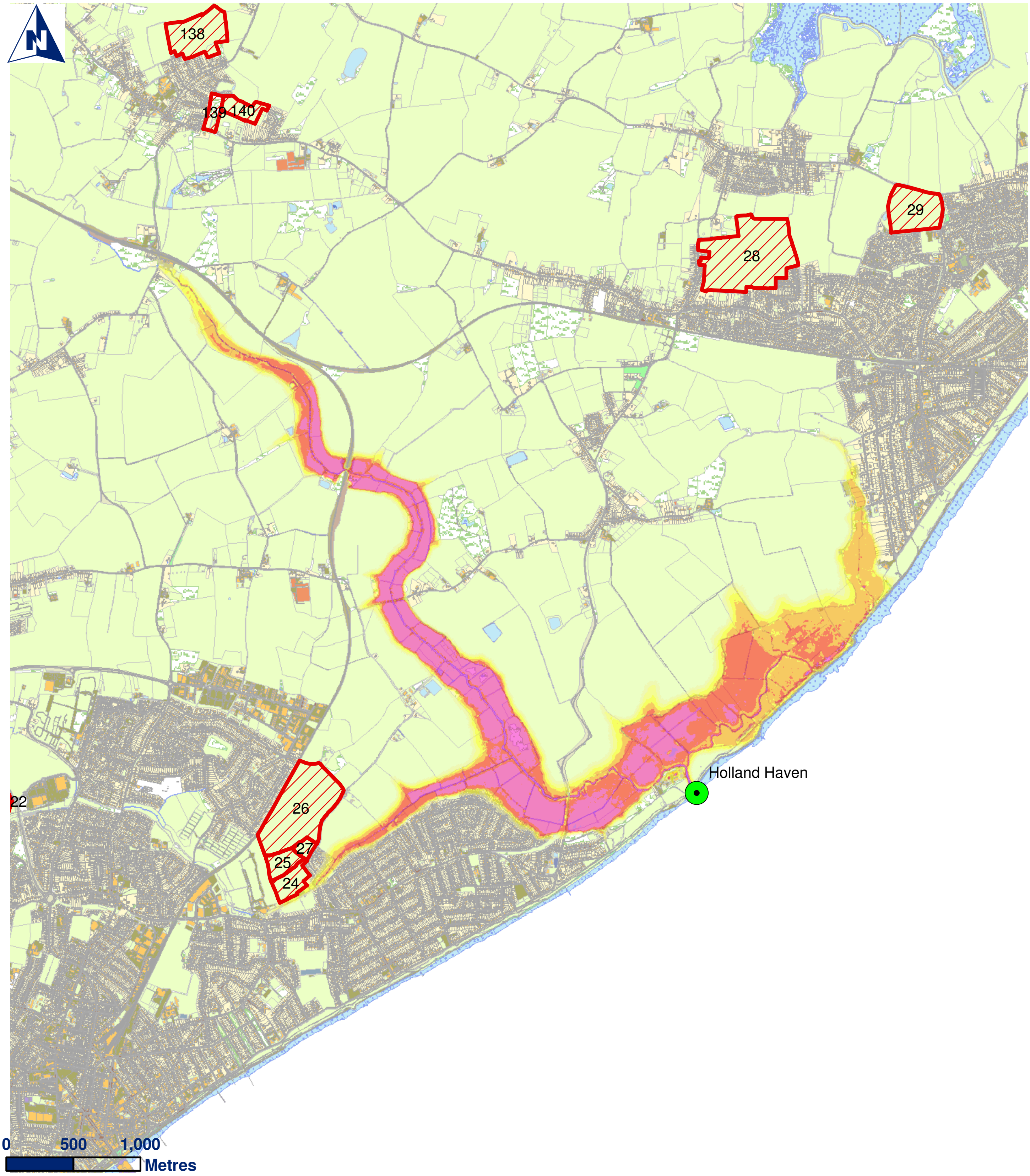
Date: Mar 25, 2009

File Location: N:\2008\Projects\2008s3779\Tendring

Tendring DC Development Area

Residual Flood Risk

Breach Analysis Results at Clacton-On-Sea



Legend

- Breach Locations
- Area of Search of Potential Development Sites

<VALUE>

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 4.0
- 4.0 - 5.0
- > 5.0

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Maximum Depth of Breach Innundation with Climate Change (2107 0.5% AEP Event)

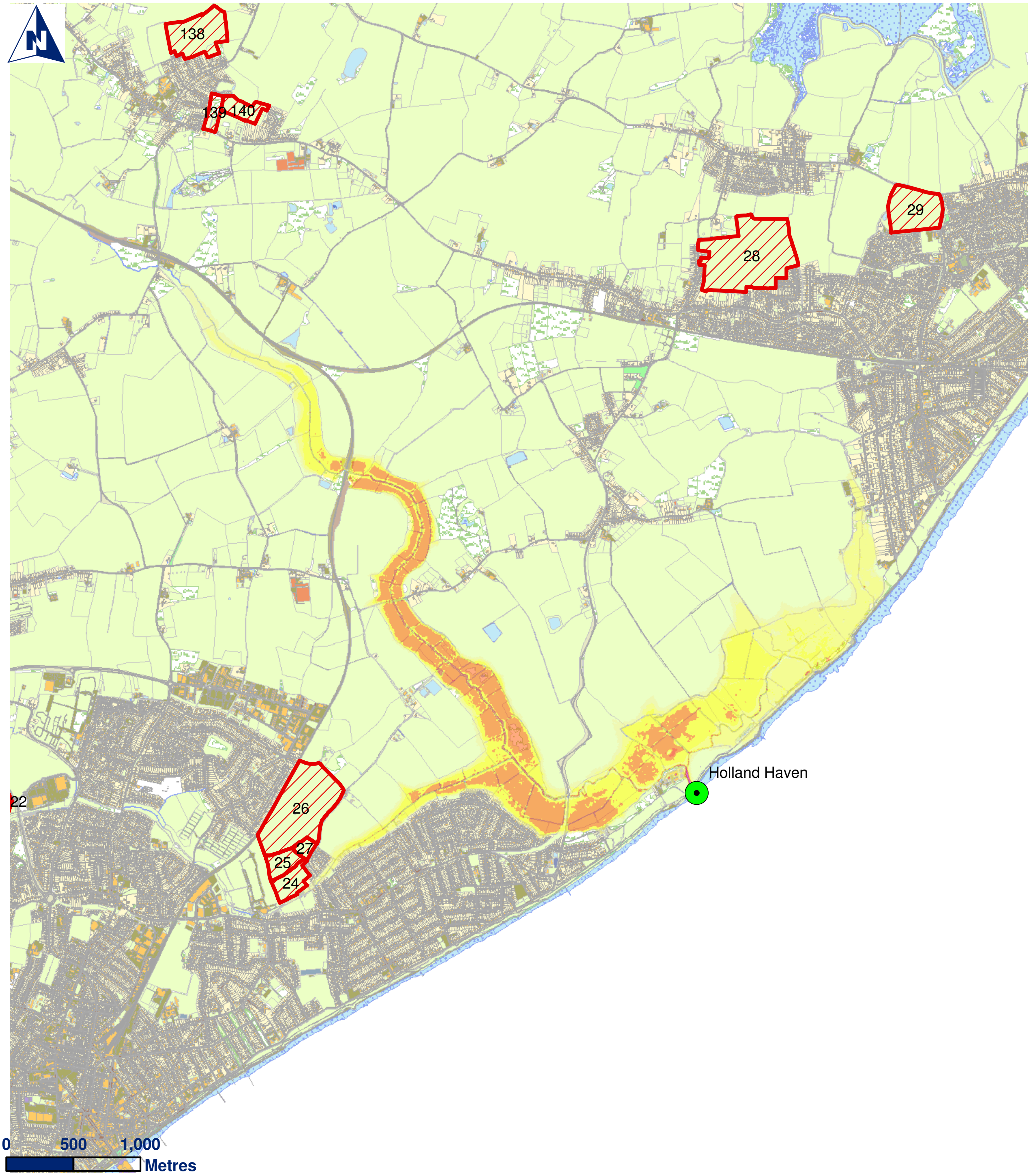
Date: Mar 30, 2009

File Location: N:\2008\Projects\2008s3779\Tendring

Tendring DC Development Area

Residual Flood Risk

Breach Analysis Results at Clacton-On-Sea



Legend

- Breach Locations
- Area of Search of Potential Development Sites

Maximum Depth (m)

- 0.0 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 4.0
- 4.0 - 5.0
- > 5.0

jba CONSULTING

Maximum Depth of Breach Inundation (2007 0.5% AEP Event)

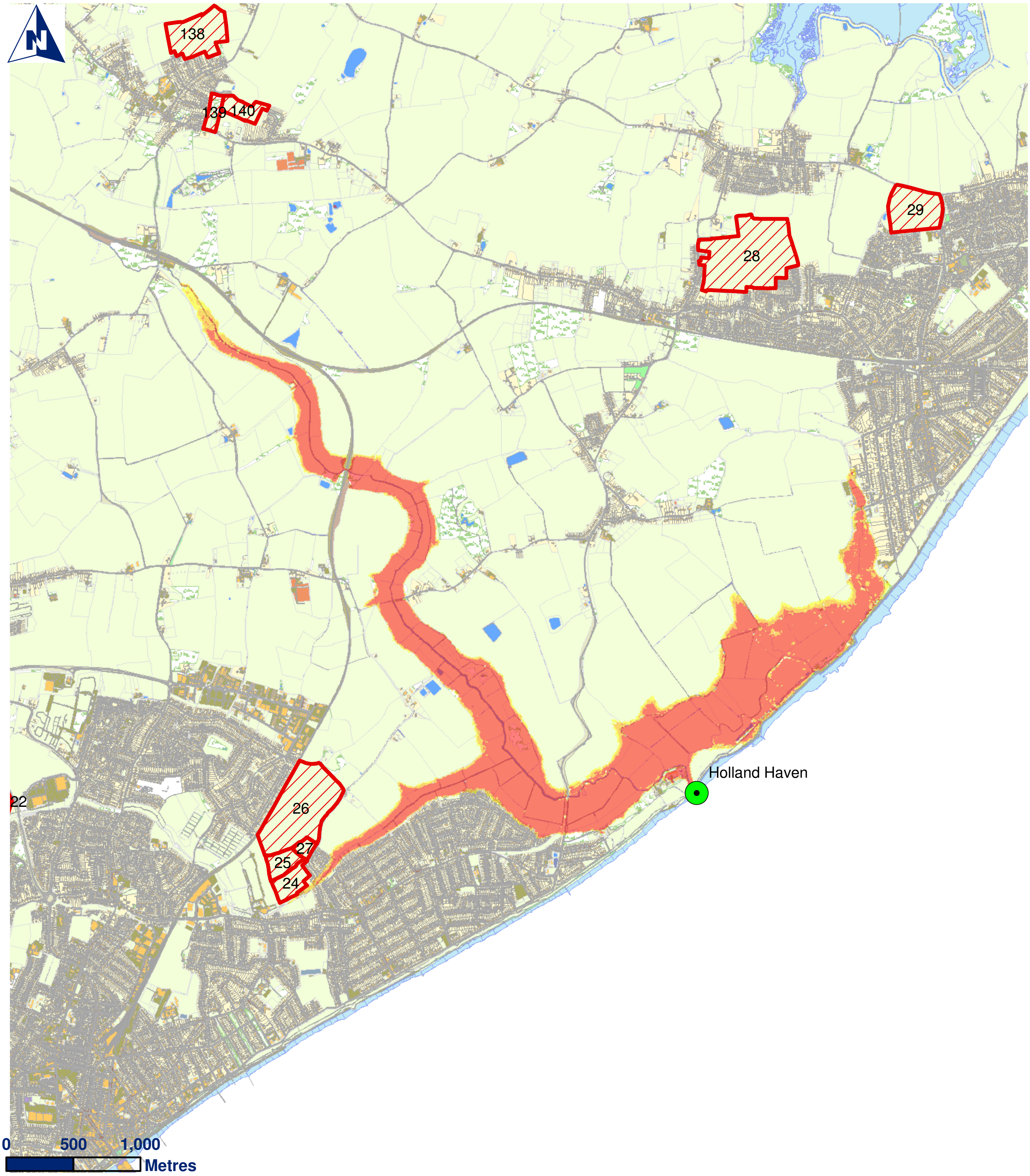
Date: Mar 27, 2009

File Location: N:\2008\Projects\ 2008s3779\Tendring

Tendring DC Development Area

Residual Flood Risk - Hazard

Breach Analysis Results at Clacton-On-Sea



Legend

- Breach Locations
- Walton Pier Regeneration Area
- Area of Search of Potential Development Sites

Hazard Rating

- Low (Caution)
- Moderate (Dangerous for some i.e. children)
- Significant (Dangerous for most people)
- Extreme (Dangerous for all)

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Hazard Rating from Breach Inundation (2007 0.5% AEP Event)

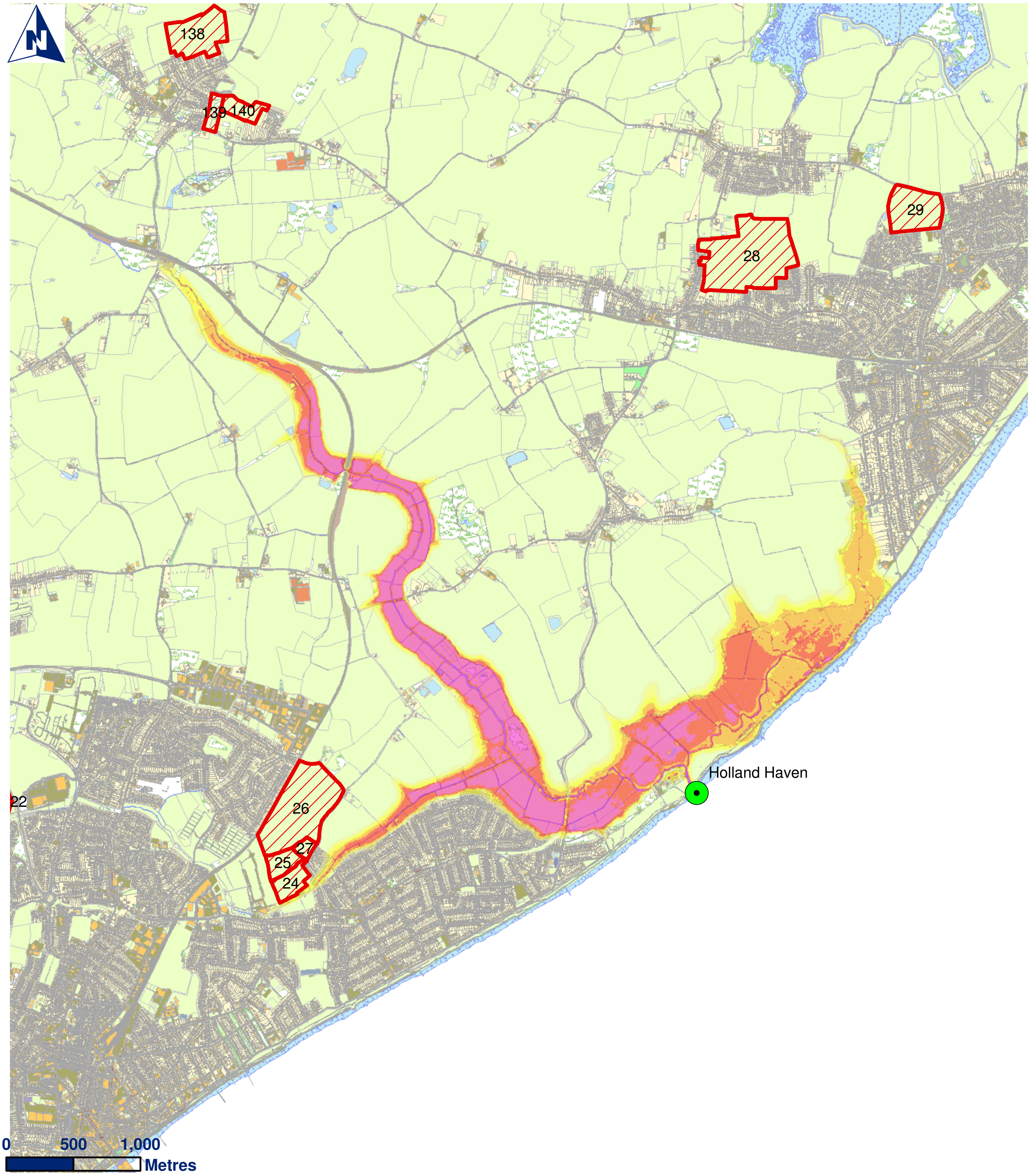
Date: Mar 25, 2009

File Location: N:\2008\Projects\2008s3779\Tendring

Tendring DC Development Area

Residual Flood Risk

Breach Analysis Results at Clacton-On-Sea



Legend

Breach Locations

Area of Search of Potential Development Sites

<VALUE>

0.0 - 0.5

0.5 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 2.5

2.5 - 3.0

3.0 - 4.0

4.0 - 5.0

> 5.0

jba consulting

Maximum Depth of Breach Innundation with Climate Change (2107 0.5% AEP Event)

Date: Mar 30, 2009

File Location: N:\2008\Projects\2008s3779\Tendring

Making Sustainability Happen

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