REPORT

Boston Alternative Energy Facility – Environmental Statement

Appendix 13.2 Flood Risk Assessment

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Executive Summary

This Flood Risk Assessment (FRA) was prepared as a Technical Appendix to support **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** of the Environmental Statement (ES) for the proposed Boston Alternative Energy Facility ('the Facility').

Under the National Planning Policy Framework (NPPF) Flood Risk and Coastal Change, Planning Practice Guidance, the Facility would be considered as 'Essential Infrastructure'. The Principal Application Site for the Facility forms part of a larger area of land that has been allocated for industrial and commercial employment development with reference to the Lincolnshire Minerals and Waste Local Plan – Site Locations (adopted 2017) and the South-East Lincolnshire Local Plan. The Facility is essentially located within the allocated area WA22-BO which has been assessed as a potentially suitable location for a broad range of open and enclosed industrial facilities, including resource recovery, waste treatment, transfer and recycling, and energy recovery.

The Principal Application Site is located in Flood Zone 3; however, the Environment Agency has confirmed this is associated with tidal flood risk rather than fluvial flood risk.

Current primary tidal defences provide a 1 in 150-year standard of protection. Ongoing flood defence improvement works, as part of the Boston Combined Strategy, will provide a 1 in 300-year standard of protection from tidal flooding once complete, in line with future climate change adaptation values, to the Principal Application Site.

Surface water flood risk to the Principal Application Site is primarily very low, with small areas of increased surface water flood risk associated with existing drains / watercourses and localised low-lying points. The Principal Application Site is largely agricultural, although there may be some highway drainage associated with Nursery Road which bisects the western part of the Principal Application Site.

The risk of flooding from sewers and groundwater is considered to be low. The Principal Application Site is not located in an area at risk of flooding from canals or reservoirs.

Therefore, based on the identified flood risk to the Principal Application Site and the proposed flood risk management techniques, including resilience measures, it is considered that the Principal Application Site is appropriate in line with the NPPF.

A13 Flood Risk Assessment

A13.1 Introduction

13.1.1 This Flood Risk Assessment (FRA) was prepared as a Technical Appendix to support **Chapter 13 Surface Water, Flood Risk and Drainage Strategy** of the Environmental Statement (ES) for the proposed Boston Alternative Energy Facility ('the Facility').

13.1.2 The purpose of this FRA is:

- To describe the existing environment in relation to flood risk;
- Present the assessment of the potential impacts to the Facility;
- Provide details of potential mitigation measures; and
- Provide discussion where significant impacts are identified.

13.1.3 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF), NPPF Planning Practice Guidance (PPG) for Flood Risk and Coastal Change and the Environment Agency's Climate Change Allowance guidance (July 2020). The Climate Change Allowance guidance sets out the Environment Agency's recommended climate change allowances for development, when considering flood risk and coastal change for planning purposes.

13.1.4 The principal aim of the above policies and guidance documents is to avoid inappropriate development in areas at risk of flooding and, wherever possible, to direct development away from areas at highest risk.

A13.2 Location and Development Description

Principal Application Site Location

13.1.5 The Principal Application Site is on the western bank of the River Witham, to the south of Boston, Lincolnshire and to the east of the adjacent Riverside Industrial Estate (**Figure A13.2.1**). The tidal extent of the River Witham at this point is known as The Haven, which starts from the Grand Sluice in Boston town upstream of the Facility, to the mouth of The Wash.

13.1.6 The South-East Lincolnshire Local Plan (SELLP) (2019) defines a mixture of current land use classifications for the Principal Application Site. The east of the Principal Application Site largely comprises current and former agricultural fields, which are greenfield. The western parts of the Principal Application Site are marked as both established and proposed Employment Areas within the SELLP and are a mixture of brownfield and greenfield areas. The Lincolnshire Minerals and Waste Local Plan (LMWLP) (2017) Site Allocations document adopted in December 2017 notes that the Principal Application Site has been allocated for industrial development (Site Allocation WA22-BO).

13.1.7 The eastern boundary of the Principal Application Site is defined, in part by flood defences along The Haven. The areas immediately to the north, west and south of the Principal Application Site are defined by industrial and business units. The Principal Application Site forms part of the wider emerging industrial and commercial area, defined by local planning documents, including the SELLP and LMWLP.

Geology

13.1.8 The British Geological Survey (BGS) online mapping indicates that the Principal Application Site is located over bedrock of the Ampthill Clay Formation, formed of mudstone. The solid geology is overlain at the Principal Application Site by superficial deposits comprising Tidal Flat Deposits formed of clay and silt.

13.1.9 Ground investigations have been previously undertaken close to the Facility. During ground investigations in 2011 six boreholes adjacent to the boundary of the Facility were drilled for the Boston Waste Transfer Station (Lincs Laboratory, 2011) as shown in **Appendix 11.2**. They recovered up to 9.45 m (but mostly 5.8 m to 6.7 m thick) of silt and clay (with occasional silty fine sand layers) on top of glacial diamicton or sand and gravel. The base of the Pleistocene deposits was reached in one borehole at a depth of 23.4 m (thickness of 16.7 m) where Ampthill Clay was recovered. The boreholes were not reduced to a datum so only

thicknesses are available.

13.1.10 The borehole and trial pit locations carried out as part of this investigation are shown on **Figure 11.6**. At each of the borehole locations, the underlying natural strata was represented by a sequence of Tidal Flat or Alluvial deposits (clay, silt and sand) underlain by Glacial Till. This rested on a band of wet medium dense greenish brown and yellowish silty sand with coarse gravels. The band was underlain by boulder clay. Occasionally, lenses of sand were encountered or hard stony layers (see **Chapter 11 Contaminated Land, Land Use and Hydrogeology** for more information).

Hydrology

13.1.11 The eastern boundary of the Principal Application Site is defined in part by the flood defences along The Haven. The Haven is classified as a 'Main River' by the Environment Agency and flows in a south-easterly direction into the Wash approximately 7 km to the south-east of the Facility. The Haven forms part of the Witham transitional waterbody.

13.1.12 The Port of Boston is located approximately 750 m upstream to the north-west.

13.1.13 The eastern boundary of the Black Sluice Internal Drainage Board (IDB) district is defined by the River Witham and The Haven at the location of the Principal Application Site. As such the Principal Application Site is located within the Black Sluice IDB district. Analysis of the publicly available Black Sluice IDB 'watercourse' data (Black Sluice IDB, undated) indicates that the Facility is located within the Wyberton Marsh catchment.

13.1.14 The Wyberton Marsh catchment is a pumped system, which discharges into The Haven, at Wyberton Pumping Station, located approximately 2.5 km downstream of the Principal Application Site.

13.1.15 Ordnance Survey (OS) mapping identified several ordinary watercourses or land drains located within the Principal Application Site boundary. However, following development of the Biomass UK No. 3 Ltd power station some of these were removed, and surface water has been redirected to an attenuation pond to the south-east of the Principal Application Site.

13.1.16 It is understood that at the time of construction of the Biomass UK No. 3 Ltd power station, the attenuation pond was sized appropriately to allow sufficient capacity for surface water from the Principal Application Site. However, design allowances to account for climate change from the Environment Agency have been updated

since construction, most recently in July 2020. Therefore, the Principal Application Site's Surface and Foul Water Drainage Strategy (SFWDS) will need to review the ongoing suitability of the attenuation basin in line with the latest guidance.

13.1.17 Watercourses or drainage ditches are located along several of the Principal Application Site boundaries, following hedge lines and / or field boundaries. Online data indicates that all ordinary watercourses / drains on the Principal Application Site are not currently maintained by the Black Sluice IDB.

13.1.18 **Figure A13.2.1** shows the Principal Application Site relative to key locations including the Port of Boston and Wyberton Pumping Station.

Existing Flood Defences

13.1.19 A request for the Product 4 and 8 data packages was submitted to the Environment Agency to inform this FRA. Flood risk information was provided by the Environment Agency in October 2018 (Environment Agency, 2018c) which included information related to the existing flood defences in the area. Additional information related to flood risk and flood defences in the area was discussed at a meeting between the Applicant, Environment Agency and Royal HaskoningDHV on 13th December 2018.

13.1.20 The Environment Agency's flood risk information confirms that the Principal Application Site benefits from the presence of existing tidal flood defences, which provide a 1 in 150-year standard of protection. The tidal defences at this location are formed of earth embankments and have been classed as being in 'Good' condition by the Environment Agency. Current effective crest levels for the defences have been confirmed by the Environment Agency to be 6.1 mAOD (metres Above Ordnance Datum).

13.1.21 The Principal Application Site also benefits from the presence of a linear secondary flood defence, known as Roman Bank (or 'Sea Bank'). The Environment Agency flood data does not identify this as an Environment Agency flood defence and as such no effective crest levels have been provided. It is assumed that the secondary flood defence is classed as a private defence (See **Chapter 8 Cultural Heritage** for more information).

13.1.22 Analysis of remotely sensed topographic LiDAR data with a 25 cm resolution shows the crest level of the Roman Bank is approximately 5.2 mAOD. However, it is noted that the Facility will utilise an existing low spot in the Roman Bank to provide a conveyor and access road between the wharf and the main facility. This low spot is currently approximately 20 m in width, with a level of approximately 4.6

mAOD, some 600 mm lower than the rest of the bank. Ground levels on the seaward side of the secondary defence are approximately 3.1 mAOD. On the landside, ground levels are approximately 2.5 mAOD.

The Facility

13.1.23 The Facility will deliver approximately 80 megawatts electric (MWe) of renewable energy to the National Grid using Refuse Derived Fuel (RDF) as a feedstock into a thermal treatment facility generating power via steam turbine engines. A full description and site layout drawing of the Facility is provided in **Chapter 5 Project Description**. The Facility has an expected operational period of 25 years after which its ongoing operation will be reviewed. The Facility would comprise the following main elements:

- a wharf and associated infrastructure (including re-baling facility, workshop, transformer pen and welfare facilities);
- a RDF bale contingency storage area, including sealed drainage, with automated crane system for transferring bales;
- conveyor system running in parallel to the wharf between the RDF storage area and the RDF bale shredding plant. Part of the conveyor system is open and part of which is under cover (including thermal cameras);
- bale shredding plant;
- RDF bunker building;
- thermal treatment plant comprising three nominal 34 MWe combustion lines (circa 120 megawatts thermal (MWth)) and associated ductwork and piping, transformer pens, diesel generators, three stacks, ash silos and ash transfer network; and air pollution control residues (APCr) silo and transfer network;
- turbine plant comprising three steam turbine generators, make-up water facility and associated piping and ductwork;
- air-cooled condenser structure, transformer pen and associated piping and ductwork;
- lightweight aggregate (LWA) manufacturing plant comprising four kiln lines, two filter banks with stacks, storage silos for incoming ash, APCr, and binder material (clay and silt), a dedicated berthing point at the wharf, silt storage and drainage facility, clay storage and drainage facility, LWA workshop, interceptor tank, LWA control room, aggregate storage facility and plant for loading aggregate / offloading clay or silt;

- electrical export infrastructure;
- two carbon dioxide (CO_2) recovery plants and associated infrastructure, including chiller units; and
- associated site infrastructure, including site roads, pedestrian routes, car parking, site workshop and storage, security gate, control room with visitor centre and site weighbridge.

13.1.24 An area approximately 170 m to the south of the Principal Application Site has been identified as an additional Habitat Mitigation Area. Works in this location would be within the channel and comprise small scrapes and creation of shallow pools at low tide as well as localised movement of rocks. The proposed works are located approximately 17 m to the riverward side of the Environment Agency flood defence and therefore would not impact on the continued defence line or alter the flood risk in this location. The proposed works would be classed as appropriate development in this location based on its function providing habitat mitigation, which is categorised as nature conservation and biodiversity by NPPF. Therefore, this element has not been considered further within this FRA.

13.1.25 The construction of the first section of wharf is anticipated to take approximately six months, to allow raw materials to be received by ship. The remaining section of the wharf will take a further 12 months (approximately) to complete and would comprise one of the earliest elements of the construction phase.

13.1.26 The construction period for the whole development, including commissioning, is anticipated to be between 46 to 48 months. Throughout construction there will be a need to provide continued protection in terms of the flood defences and as such the existing Standard of Protection will be maintained.

Area Wide Proposed Flood Defence Works

Boston Combined Strategy (BCS)

13.1.27 The Principal Application Site is located in an area which benefits from tidal flood defences with an existing 1 in 150-year standard of protection. Flood risk information was provided, as part of the Product 4 and 8 data packages, by the Environment Agency in October 2018 (Environment Agency, 2018c) including information relating to the improvement works to the tidal defences within the area.

13.1.28 Further information related to the flood defence works in the wider area were provided at a meeting between the Applicant, Environment Agency and Royal HaskoningDHV on 13th December 2018. These improvement works are part of

the Boston Combined Strategy (BCS). The BCS consists of five phases of flood defence improvements which will ultimately provide Boston town with a 1 in 300-year standard of protection against tidal flooding.

Boston Barrier

13.1.29 Phase 3 of the BCS is the Boston Tidal Barrier which will provide protection against tidal surges to Boston town and was installed in late 2019. However, the Barrier is required to go through a commissioning process and there will also be construction works on the Port of Boston wet dock throughout 2019 – 2020 as part of the overall Barrier project. The Boston Tidal Barrier is due for completion by Winter 2020.

13.1.30 Upon completion the Boston Barrier will have a crest height of 7.55 mAOD which includes a freeboard allowance for wave action due to wash from ships. The Principal Application Site is located downstream of the Boston Barrier and will not directly benefit from the barrier's tidal flood protection.

Haven Banks

13.1.31 Phase 5 of the BCS is the Havens Banks Project, an adaptive defence scheme enabling the Haven Banks flood defences to adapt to climate change. The Haven Banks Project shall raise the earth embankment defences by approximately 150 – 200 mm over two or three lifting stages and was programmed for construction between Summer 2019 and Winter 2020.

13.1.32 The Principal Application Site is located within the frontage that will be subject to improvement and upgrade works as part of the Haven Banks Project, specifically the Witham Haven banks. Improvement works associated with the Witham Haven banks project will be constructed along the frontage in front of the Principal Application Site prior to the construction of the Facility.

13.1.33 It is understood that the current scheme of works as part of the Haven Banks Project was scheduled for completion by the end of 2020, at which point the crest levels of the banks would be 6.5 mAOD which allows for 50 years of climate change adaptation values.

13.1.34 An adaptive management approach is being adopted for the defences within the BCS such that once all lifting stages have been completed the scheme will provide a 1 in 300-year Standard of Protection.

13.1.35 The final crest level of the scheme is currently projected to be increased in height to a total of 7.2 mAOD, providing a 1 in 300-year Standard of Protection in 100

years. Improvements over time to the Haven Banks will ensure adaptation to future sea level risk. The final crest level will be informed by updating climate change information to dictate the levels of this adaptive scheme.

13.1.36 The proposed wharf will require a crest level to be constructed such that it maintains a continual defence line, both during construction and operation, and so that it shall tie into the improved flood defences (as part of the Haven Banks project) at either end of the wharf.

13.1.37 As highlighted in **Plate A13.2-1**, and following consultation with the Environment Agency, the wharf will include a crest level of 7.2 mAOD. The wharf will be maintained throughout construction, and during operation, for the entirety of the operational life of the Facility and will be tied into the existing Environment Agency defences at each end.

13.1.38 Maintenance of the flood defences along the Principal Application Site frontage is likely to become the responsibility of the Landowner. However, the Environment Agency will require continued access to the frontage to check its condition and integrity. Ongoing consultation with the Environment Agency will establish the necessary legal agreements to ensure required access to the area is not impeded.

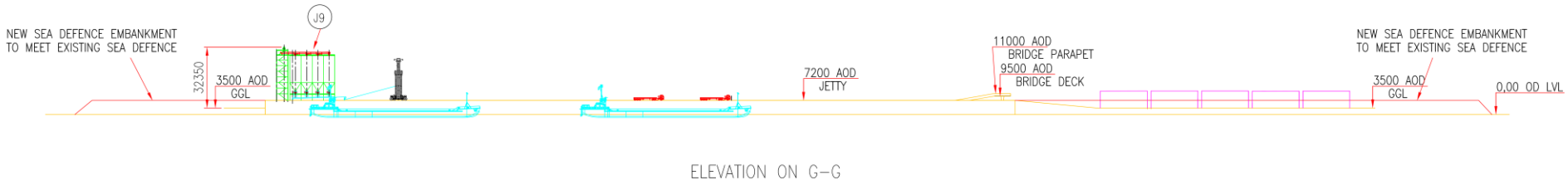

Plate A13.2-1 Long section of proposed wharf (yellow), tying in with final height of Environment Agency adaptive defences at 7.2 mAOD

A13.3 Development and Flood Risk

National Planning Policy Framework

13.1.39 The NPPF PPG for Flood Risk and Coastal Change (NPPF, 2019) provides direction on how flood risk should be considered at all stages of the planning and development process. The planning system should ensure that new development is safe and not exposed unnecessarily to the risks associated with flooding. This FRA sets out the planning and wider context within which the Facility needs to be considered along with the flood risk to the Principal Application Site.

Local Development Documents

Preliminary Flood Risk Assessment

13.1.40 Lincolnshire County Council (LCC), in their role as Lead Local Flood Authority (LLFA) produced a Preliminary Flood Risk Assessment (PFRA) in June 2011. The PFRA is a countywide preliminary assessment of flood risk from surface water, groundwater and ordinary watercourse sources.

13.1.41 Following completion of the PFRA the Lincolnshire Flood Risk Management Partnership was developed and formally established in April 2010. Its members include:

- LCC;
- Environment Agency (Anglian Region, Northern Area);
- 14 Internal Drainage Boards;
- Seven District Councils;
- Two Water Companies;
- Natural England;
- The Regional Flood & Coastal Committee (Anglian Region, Northern Area); and
- The Lincolnshire Resilience Forum.

13.1.42 The Partnership is designed to provide co-ordinated management and delivery of flood risk and drainage functions at all relevant organisations across Lincolnshire.

Strategic Flood Risk Assessment

13.1.43 Boston Borough Council (BBC) produced a Strategic Flood Risk Assessment (SFRA) in October 2010 which identifies several sources of flooding within the borough, including tidal and fluvial sources. This has subsequently been superseded by the South East Lincolnshire SFRA, which was published in March 2017 by the South East Lincolnshire Joint Planning Unit (SELJPU).

13.1.44 The SFRA contains hazard mapping for parts of the South East Lincolnshire study area, including both fluvial and tidal flood events for Boston, Spalding, Sutton Bridge, Pinchbeck, Crowland and Surfleet.

13.1.45 The Principal Application Site is located adjacent to The Haven, which has been identified as a source of tidal flooding by the SFRA. The Principal Application Site is located within the study area of the SFRA, details of the report's findings are included in **Section A13.5**.

South-East Lincolnshire Local Plan

13.1.46 The South-East Lincolnshire Local Plan 2011 – 2036 is a joint venture created by the South-East Lincolnshire Joint Strategic Planning Committee. The Local Plan was submitted to the Secretary of State in June 2017 and was adopted on 8th March 2019.

13.1.47 The Principal Application Site forms part of a larger area of land that has been allocated for industrial and commercial employment development with reference to the South-East Lincolnshire Local Plan. The Principal Application Site is located within a proposed Main Employment Area, identified as BO006 Riverside Industrial Estate, Boston under Policy 7: Improving South-East Lincolnshire's Employment Land Portfolio.

13.1.48 Policy 4 of the Local Plan covers the 'Approach to Flood Risk'. This policy sets out many of the same requirements as NPPF and the Environment Agency guidance on preparing FRAs. However, one extract pertinent to the Principal Application Site is "*No development will be permitted within a 50m buffer from the toe of the raised Witham Haven Banks (flood defences), as shown on the indicative Plan contained in Appendix 10, to allow access for construction and maintenance."* Further discussion on this is provided in **Section A13.8**.

Lincolnshire Mineral and Waste Local Plan

13.1.49 The Lincolnshire Minerals and Waste Local Plan – Site Locations (adopted in 2017) identifies the Principal Application Site to be in the allocated area WA22-BO which has been assessed as a potentially suitable location for a broad range

of open and enclosed industrial facilities and specifically identifies waste treatment, recycling and energy recovery.

A13.4 Definition of Flood Hazard

13.1.50 A FRA must consider the issues associated with all sources of flooding in accordance with NPPF and the supporting PPG for Flood Risk and Coastal Change. These have been considered in this FRA with respect to the Principal Application Site. The following sections provide a review of publicly available flooding information and relevant planning documents.

Probability of Flood Risk – Flood Zones

13.1.51 **Table A13.2-1** outlines the definitions of each Flood Zone and associated probability, which has been taken from Table 1 of the NPPF PPG. The NPPF through the application of the Sequential Test aims to steer development towards areas at lowest risk of flooding (Flood Zone 1) and away from medium and high flood risk areas (Flood Zone 2 and 3).

Table A13.2-1 Summary of Flood Zone Definitions

Flood Zone	Probability of Flooding	Return Periods
1	Low	Land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1 %).
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1 % - 0.1 %); or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5 % - 0.1 %).
3a	High	Land having a 1 in 100 or greater annual probability of river flooding (≥1 %); or Land having a 1 in 200 or greater annual probability of sea flooding (≥0.5 %).
3b	High – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

Historic Flooding

13.1.52 The Product 4 and 8 data packages obtained from the Environment Agency confirms a tidal surge flood event occurred in December 2013 which affected the southern half of the Principal Application Site.

13.1.53 A data enquiry was submitted to Lincolnshire County Council, in its role as LLFA related to historic flood incidents affecting the Principal Application Site. Communication with the LLFA confirmed this tidal surge occurred on 5th

December 2013.

13.1.54 Further information related to the tidal surge flood event was provided by the LLFA through the Lincolnshire Resilience Forum's Response & Recovery 'After Action' Report (Lincolnshire Resilience Forum, 2018). A Flood Warning was issued for the area by the Environment Agency on the morning of 5th December 2013, and later upgraded to a Severe Flood Warning by the evening of the same day.

13.1.55 The report states that between 18 km and 20 km of flood defences were overtopped and defences breached at four locations across the district. Defence breaches occurred at Boston Haven, Gibraltar Point, Tetney Marsh and Friskney. The maximum total water level, including the tidal surge water levels, at Immingham coastal monitoring location (the closest to the Principal Application Site) were recorded as 5.2 mAOD on 5th December 2013.

Flooding from Rivers

13.1.56 The Principal Application Site is located on the western bank of The Haven, which is primarily tidally influenced in this location. Consultation with the Lincolnshire and Northamptonshire Area office of the Environment Agency[1] has confirmed the Principal Application Site is not covered by modelled fluvial flood extents. This consultation also confirmed that the greatest flood risk in this area is tidal and that Hazard Mapping depths should be used to inform planning applications.

Flooding from Tidal Sources

13.1.57 The Environment Agency has confirmed the primary source of flooding to the Principal Application Site is from The Haven, which is predominantly tidal in this reach. Mapping from the Environment Agency (**Figure A13.2.2**) confirms that the Principal Application Site is located in Flood Zone 3 and therefore it would be affected by tidal flooding during the 1 in 200-year event, ignoring the presence of any flood defences.

13.1.58 The South East Lincolnshire SFRA (SELJPU, 2017) confirms that there is currently no Functional Floodplain in the Boston Borough (i.e. the areas within which the Principal Application Site is located). Therefore, when considering flood risk to the Principal Application Site it is assessed on the basis that it is located in Flood Zone 3a.

13.1.59 The flood risk information confirms that the Principal Application Site benefits from the presence of existing earth embankment tidal flood defences, which provide a

[1] *Email communication with PSOLINCS@environment-agency.gov.uk, Received; 24/10/2018.*

1 in 150-year standard of protection at 6.1 mAOD. The Principal Application Site also benefits from a secondary flood defence, Roman Bank (See **Section A13.2** for more details). Ongoing tidal defence improvement works as part of the BCS are discussed in **Section A13.3**.

13.1.60 Consultation with the Environment Agency confirmed that the Hazard Mapping, specifically maximum water depths, should be considered alongside tide levels to inform planning applications. Tidal still water levels for the South Humber, East and The Wash were previously provided by the Environment Agency for several return periods to support the development of the Preliminary Environmental Information Report (PEIR).

13.1.61 To assess the tidal water levels in line with the latest Environment Agency Guidance on Climate Change (updated July 2020), two tidal still water level points were identified from the Coastal Flood Boundary Extreme Sea levels dataset. Both points are located on The Haven, which is part of The Wash dataset. Node ID: 1825 is located upstream from the Principal Application Site close to the newly installed Boston Barrier. Node ID: 1828 is located approximately 1km downstream from the Principal Application Site (**Figure A13.2.1**). Tidal data for The Wash has a base date of 2017.

13.1.62 The Environment Agency's tidal climate change allowances have been used to uplift the 1 in 200-year and 1 in 1,000-year still water levels to the present day scenario i.e. 2020 (**Table A13.2-3**). In line with the latest guidance, the water levels have been calculated for both the 'Higher Central' and 'Upper End' climate change allowances. The allowances are presented in **Table A13.2-2**.

Table A13.2-2 Environment Agency Climate Change Guidance Sea Level Allowances for each Epoch in mm per Year, Based on a 1981 to 2000 Baseline

Area	Allowance	2000 to 2035	2036 to 2065	2066 to 2095	2096 to 2125
Anglian	Higher Central	5.8 mm	8.7 mm	11.6 mm	13 mm
Anglian	Upper End	7 mm	11.3 mm	15.8 mm	18.1 mm

Table A13.2-3 Tidal Water Levels uplifted with Climate Change Allowances for 2020

Year	Sea Level Allowance	Return Period	Node 1825	Node 1828
			Location: Upstream	Location: Downstream
Still water level (mODN) 2017	Baseline	1 in 200	6.09	6.05
		1 in 1,000	6.26	6.30

Still water level (mODN) 2020	Higher Central	1 in 200	6.11	6.07
		1 in 1,000	6.28	6.32
	Upper End	1 in 200	6.11	6.07
		1 in 1,000	6.28	6.32

13.1.63 It is noted that for the Baseline allowance, the upstream water level is observed to be higher than the downstream. This is thought to be due to the funnelling effect of water as it moves up the estuary, which narrows in width towards node ID: 1825.

13.1.64 For the Higher Central allowance, the still water level during the 1 in 200-year event in 2020 at the upstream node ID: 1825 has been calculated to be 6.11 mAOD. Downstream at node ID: 1828, this is calculated to be 6.07 mAOD. For the 1 in 1,000-year event in this has been calculated to be 6.28 mAOD and 6.32 mAOD for nodes 1825 and 1828 respectively.

13.1.65 For the Upper End allowance, the still water level during the 1 in 200-year event in 2020 at the upstream node ID: 1825 has been calculated to be 6.11 mAOD. Downstream at node ID: 1828, this is calculated to be 6.07 mAOD. For the 1 in 1,000-year event in this has been calculated to be 6.28 mAOD and 6.32 mAOD for nodes 1825 and 1828 respectively. When rounding to one decimal place, the 1 in 1,000-year event for both nodes is calculated to be 6.3 mAOD.

13.1.66 The existing primary flood defence at the Principal Application Site has an existing crest level of 6.1 mAOD. However, the proposed works as part of the Environment Agency Haven Banks Project, as outlined in **Section A13.3**, will increase this crest level to 6.5 mAOD. Works to raise the level of the banks along this frontage has commenced. Therefore, following completion of the Haven Banks Project, the primary defence along this frontage will provide a crest level of 6.5 mAOD.

13.1.67 By adopting the increased crest level as part of the Haven Banks Project, it will provide protection to the Facility during both the 1 in 200-year still water level and 1 in 1,000-year still water level for the existing scenario i.e. 2020 (Upper End calculated at 6.32 mAOD).

13.1.68 The South East Lincolnshire SFRA (SELJPU, 2017) shows that in the event of a breach in The Haven's tidal defences in 2115, the Principal Application Site's flood hazard is classified as 'Danger to All'.

13.1.69 The SFRA notes that the crest (height) of the defences used in all modelling scenarios was based on present defence heights. As such, the SFRA does not

indicate that this hazard mapping considers the beneficial effect that the presence of the improved primary defence or secondary flood defence line would have on the flood hazard. The SFRA does not include any maps showing the locations of the breach events used to create the district wide flood hazard mapping.

13.1.70 The Environment Agency provided Hazard Mapping data for the 1 in 200-year and 1 in 1,000-year breach events occurring in 2006 and 2115 as part of the Product 4 and 8 data request. The Hazard Mapping for each of the four scenarios included information on maximum flood depth, maximum velocity and the maximum hazard. No information was provided in relation to rapid inundation zones.

13.1.71 Breach locations, utilised by the Environment Agency, are included in **Plate A13.2-2**. These include breach locations along the frontage within the Principal Application Site. These maps are at a better resolution than the SFRA mapping and consider breach locations in proximity to the Principal Application Site. Therefore, these are considered more relevant to the FRA than the SFRA mapping. Hazard mapping incorporating overtopping has not been included at the Principal Application Site location. Although it should be noted that like the SFRA mapping, the Environment Agency breach modelling (published in 2006) does not consider the improvements to the flood defences as part of the BCS, nor the existence of the secondary flood defence.

13.1.72 The maximum depth of water during a 1 in 200-year breach event for 2006 to the Principal Application Site is shown to be predominantly between 1.0 and 1.6 m, with very small areas on the Principal Application Site shown to be at risk of flood depths over 1.6 m (**Plate A13.2-2**).

13.1.73 The maximum depth of water during a 1 in 1,000-year breach event for 2006 to the Principal Application Site is shown to be predominantly between 1.0 and 1.6 m with areas of at risk of flood depths over 1.6 m (**Plate A13.2-3**).

13.1.74 The overall existing risk of tidal flooding to the Principal Application Site is low, as the Facility is protected by the presence of defences. The residual risk of tidal flooding to the Principal Application Site following a breach event is moderate to low, as the defences are classed as being in a ‘Good’ condition.

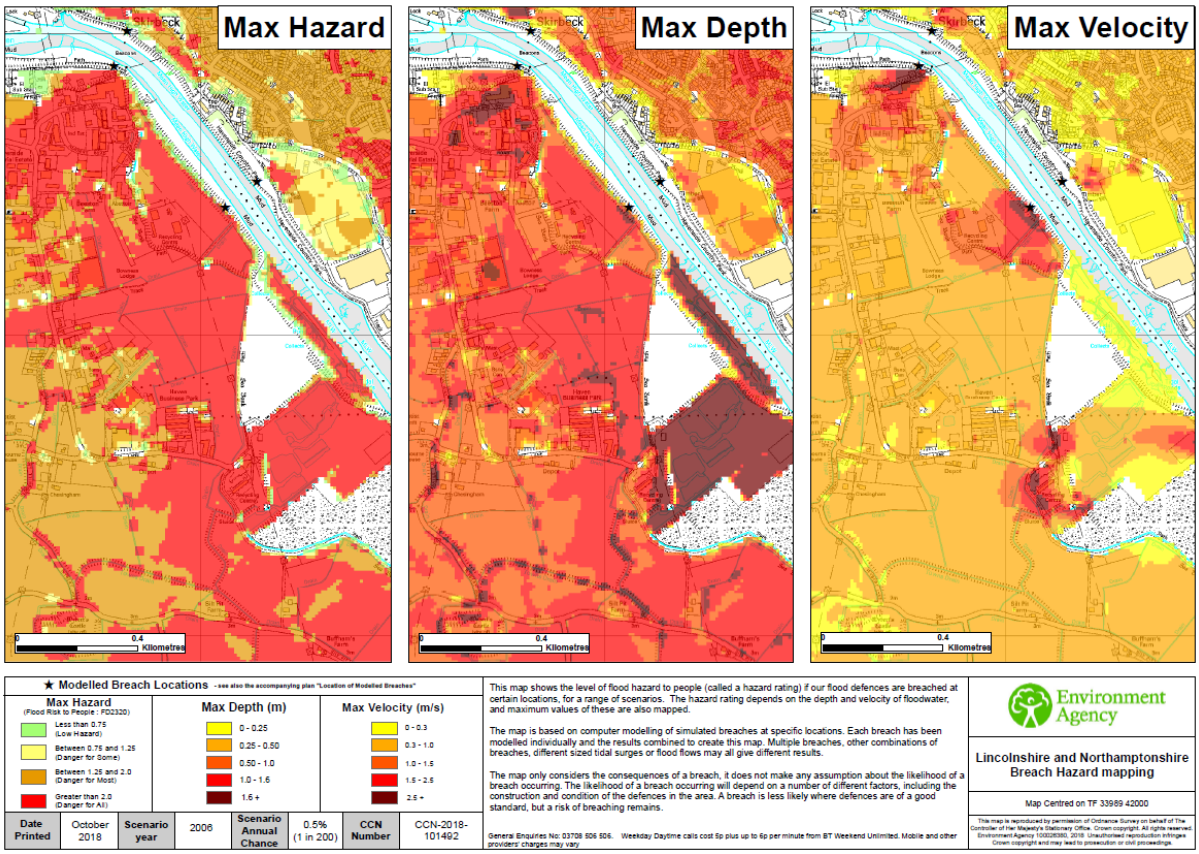

Plate A13.2-2 Breach Hazard Mapping for a 1 in 200-Year Event in Year 2006

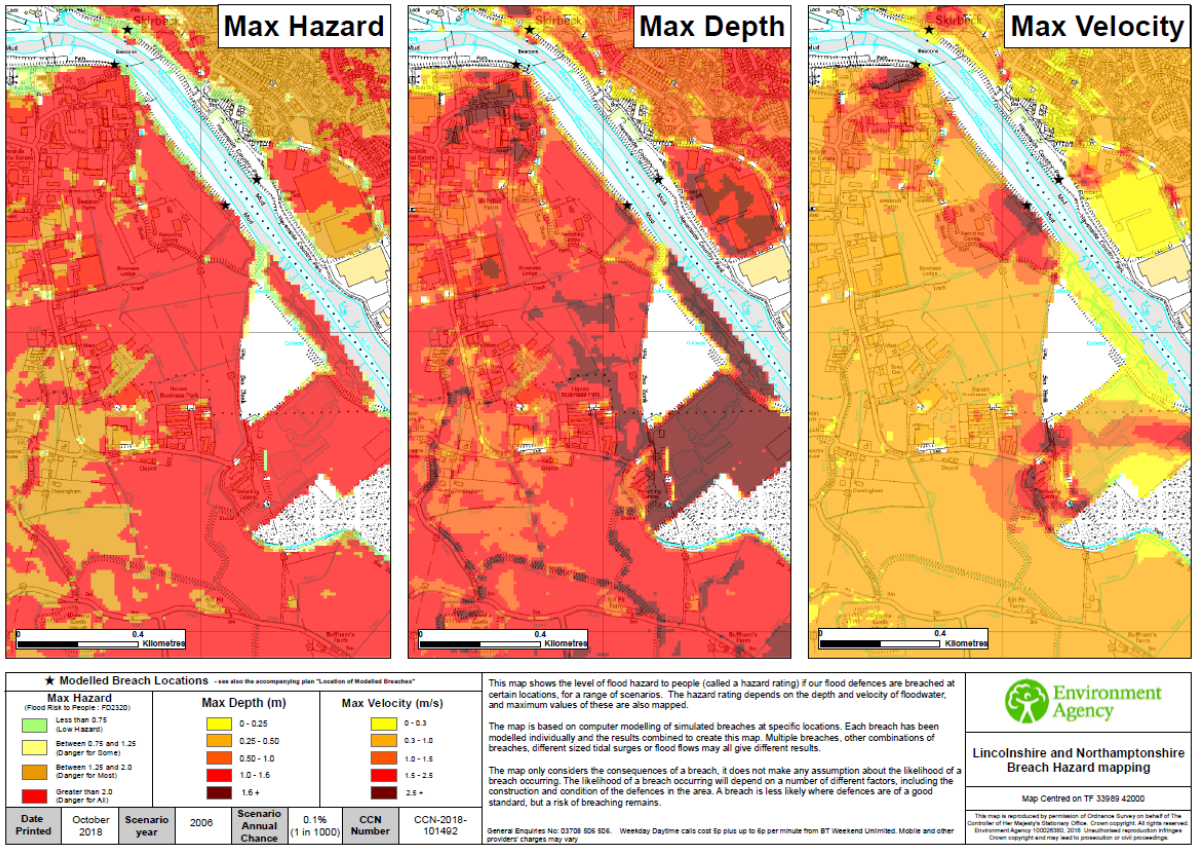

Plate A13.2-3 Breach Hazard Mapping for a 1 in 1,000-Year Event in Year 2006

Flooding from Groundwater

13.1.75 Groundwater emergence can occur when water stored beneath the ground reaches the surface and is generally associated with porous rocks e.g. sands and gravels. However, depths of water would have to accumulate to impact receptors before it is considered to cause flooding. It is understood that the Environment Agency holds borehole information for the Principal Application Site and surrounding area. At the time of writing this FRA, relevant information has not been provided. An assessment of groundwater flood risk is difficult without more detailed investigation into groundwater records, geological conditions and predictive methods to correlate rainfall to groundwater flooding.

13.1.76 Due to the proximity of the Principal Application Site to The Haven, and the presence of IDB maintained drains, raised groundwater levels may be evident across the Principal Application Site. No details of groundwater flood risk have been identified in the reviewed local development documents.

Flooding from Surface Water

13.1.77 The Environment Agency's Flood Risk from Surface Water (2018b) map shows the majority of the Principal Application Site to be at very low risk of flooding from surface water sources. Small areas of low, medium and high risk of flooding from surface water are located across the Principal Application Site. These areas appear to be largely associated with the existing surface water drainage network within the Principal Application Site as well as topographic low points.

13.1.78 The Environment Agency's Surface Water Flood Depth map (**Figure A13.2.3**) shows that during a 1 in 30-year storm event surface water flood depths would be below 300 mm. During the 1 in 100-year storm event water depths are shown to be largely below 300 mm with very small areas, within or adjacent to the existing drainage channels, shown to have water depths between 300 and 900 mm. During the 1 in 1,000-year storm event water depths are shown to be no greater than 900 mm.

13.1.79 The risk of surface water flooding within the Principal Application Site is generally very low, with an increased flood risk located in proximity to the existing drainage channels and topographically low-lying land.

Flooding from Reservoirs, Canals and Other Sources

13.1.80 The Environment Agency's Flood Risk from Reservoirs map (2018a) shows the Principal Application Site is not located within an area at risk of flooding from reservoir failure. Therefore, there is no risk of flooding from reservoirs.

13.1.81 No canals are located in proximity to the Principal Application Site and therefore there is no risk of flooding from this source.

Summary of Flooding

13.1.82 The Principal Application Site is located in Flood Zone 3; however, the Environment Agency has confirmed this is associated with tidal flood risk rather than fluvial flood risk. The Principal Application Site would be at high risk of tidal flooding if it was not defended. However, primary defences will provide an effective crest level of 7.2 mAOD following completion of the Facility. This will provide a present day 1 in 1,000-year standard of protection, with the worst-case 'Upper End' still water levels for the present-day scenario (i.e. 2020 calculated to be 6.32 mAOD). Areas of the Principal Application Site also benefit from a secondary flood defence, known as the Roman Bank.

13.1.83 Surface water flood risk to the Principal Application Site is primarily very low, with small areas of increased surface water flood risk associated with existing drains / watercourses and localised low-lying points. The Principal Application Site is largely agricultural, although there may be some highway drainage associated with Nursery Road along the western part of the Principal Application Site.

13.1.84 The risk of flooding from sewers is considered to be low. The Principal Application Site is not located in an area at risk of flooding from canals or reservoirs.

13.1.85 Therefore, the primary source of flooding that may affect the Principal Application Site is from tidal flooding with a minimal risk of surface water flooding.

A13.5 Flood Risk Vulnerability

Sequential and Exception Test

13.1.86 The aim of the NPPF PPG Sequential Test is to ensure that a sequential approach to steer new development to areas with the lowest probability of flooding (i.e. Flood Zone 1). Where there are no reasonably available sites in Flood Zone 1, the local planning authority (LPA) can consider reasonably available sites in Flood Zone 2. Only when there are no reasonably available sites for development in Flood Zone 1 and 2, should the suitability of sites in Flood Zone 3 be considered.

13.1.87 Following application of the Sequential Test, if it is not possible for the development to be located in zones with a lower probability of flooding whilst remaining consistent with wider sustainability objectives, the Exception Test can be applied, if appropriate. For the Exception Test to be passed:

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

13.1.88 Both elements of the Exception Test must be passed for development to be allocated or permitted. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

Sequential Test Vulnerability Assessment

13.1.89 The vulnerability of different types of development is classified in the NPPF Technical Guidance. The definition of Highly Vulnerable, More Vulnerable, Less Vulnerable, Water Compatible and Essential Infrastructure from the NPPF Technical Guidance is summarised as follows:

- **Highly Vulnerable** – Buildings used for: Police, ambulance and fire stations and command centres; basement dwellings; caravans and mobile homes; and installations requiring hazardous substances consent.
- **More Vulnerable** – Buildings used for: hospitals; dwellings and accommodation; residential institutional accommodation; non-residential health services, educational facilities; drinking establishments; nightclubs and hotels.
- **Less Vulnerable** – Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food and takeaways; offices; general industry and storage etc.
- **Water Compatible** – Development used for: flood control infrastructure; amenity open space, nature conservation and biodiversity; outdoor sports facilities; water / sewerage pumping stations; docks marinas and wharves; and navigation facilities.
- **Essential Infrastructure** – Essential transport infrastructure, wind turbines and essential utility infrastructure which has to be located in a flood risk area for operational reasons including electricity generating power stations.

13.1.90 Table 3 in the NPPF PPG sets out suitable development based on the Flood Zone and Flood Risk Vulnerability and is reproduced in **Table A13.2-4**.

Table A13.2-4 Flood Risk Vulnerability and Flood Zone 'Compatibility' (Reproduced from NPPF PPG)

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	✓	✓	✓	✓	✓
2	✓	Exception test required	✓	✓	✓
3a	Exception test required	X	Exception test required	✓	✓
3b	Exception test required	X	X	X	✓

Site Vulnerability Assessment

13.1.91 Under the NPPF PPG: Flood Risk and Coastal Change, the Facility would be considered as 'Essential Infrastructure' (Table 2 of the NPPF). 'Essential Infrastructure' development is considered appropriate by the NPPF in Environment Agency Flood Zones 1 and 2. In Flood Zone 3a and 3b 'Essential Infrastructure' development is required to undertake the Exception Test.

13.1.92 The Environment Agency Flood Zone Map (**Figure A13.2.2**) shows the Principal Application Site to be located in Flood Zone 3; however, the Environment Agency has confirmed that the Principal Application Site currently benefits from tidal flood defences with a 1 in 150-year standard of protection. The BCS, which incorporates the new Boston Barrier and an adaptive defence scheme along The Haven, will when constructed provide a 1 in 300-year standard of protection to the Principal Application Site.

13.1.93 The Facility has a requirement to be located adjacent to The Haven to facilitate the future delivery of materials via boat and unloading of those materials utilising the proposed new wharf.

13.1.94 The Principal Application Site forms part of a larger area of land that has been allocated for industrial and commercial employment development with reference to the Lincolnshire Minerals and Waste Local Plan – Site Locations (adopted 2017) and the South-East Lincolnshire Local Plan. The Facility is within the allocated area WA22-BO which has been assessed as a potential suitable location for a broad range of open and enclosed industrial facilities, including resource recovery, waste treatment, transfer and recycling, and energy recovery.

13.1.95 . The allocation of the Principal Application Site within the Local Plan and as an alternative energy facility which provides renewable energy from waste, the Facility provides wider sustainability benefits to the community. Therefore, the Facility is considered to be in accordance with the first part of the Exception Test, whereby it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk.

13.1.96 When considering the second part of the Exception Test, it must be demonstrated that a 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.

13.1.97 The detailed flood risk assessment reviews all sources of potential flood risk and shows that the Principal Application Site is at low risk of flooding when considering

the existing surface water risk, tidal flood risk and the wider BCS as well as the proposed defences along the frontage of the Facility. It must be located in proximity to The Haven for operational purposes and therefore, based on the presence of the defences and the Standard of Protection afforded to the Principal Application Site both now and in the future, the risk of flooding to the Principal Application Site is a residual risk. However, measures to limit flood risk to the Facility are considered in **Section A13.7** and will ensure that the development is safe for its lifetime without increasing flood risk elsewhere

13.1.98 On the basis of the above, and remaining information presented in the FRA, it is considered that the Facility is in accordance with both the first and second part of the Exception Test and therefore is appropriate in terms of the type of development and its proposed location.

13.1.99 Notwithstanding the above, the final decision regarding the application of the Sequential and the Exception Test is for the Planning Inspectorate to confirm whether they agree that the Principal Application Site satisfactorily passes the tests.

A13.6 Climate Change

13.1.100 Given the potential sources of flooding outlined within **Section A13.5**, there are two main aspects of climate change likely to impact the Principal Application Site comprising an increase in tidal water levels; and an increase in the duration and intensity of rainfall events likely to affect surface water flooding.

Sea Level Allowances

13.1.101 The Environment Agency issued updated guidance in July 2020 on climate change allowances to be considered within FRAs. Sea level allowances have been designated for four epochs, using a baseline sea level from 2017 (**Table A13.2-2**).

13.1.102 The Facility is industrial and expected to become operational in 2026 with an expected operation period of 25 years before its ongoing operation is reviewed. This calculates the end of life to be in 2051. However, to allow for a minimal extension in operational life, a conservative assessment of flood risk has been taken. For this calculation of the effects of climate change on still tidal water levels, a lifespan up to 2055 has been used (**Table A13.2-5**).

Table A13.2-5 Still tidal water level for 2055

Year	Sea Level Allowance	Return Period	Node 1825	Node 1828
			Location: Upstream	Location: Downstream
Still water level (mODN) 2017	Baseline	1 in 200	6.09	6.05
		1 in 1,000	6.26	6.30
Still water level (mODN) 2055	Higher Central	1 in 200	6.37	6.33
		1 in 1,000	6.54	6.58
	Upper End	1 in 200	6.44	6.40
		1 in 1,000	6.61	6.65

13.1.103 The BCS consists of five phases of flood defence improvements which will ultimately provide Boston town with a 1 in 300-year standard of protection against tidal flooding. The Haven Banks Project will comprise a minimum crest height of 6.5 mAOD. However, the adaptive approach to raising the defence level will be reviewed in line with up to date climate change guidance.

13.1.104 Consultation with the Environment Agency on the expected final crest level indicated that the proposed primary flood defence would have a crest level of 7.2 mAOD. This is the crest level to be adopted, from the outset, for the wharf as part of the development.

13.1.105 Therefore, the Principal Application Site will be protected from the 1 in 1,000-year tidal event during the worst-case 'Upper End' scenario in 2055 (i.e. conservative end of operational life for the Facility).

Future Breach Scenarios

13.1.106 The Environment Agency provided Hazard Mapping modelled data for the 1 in 200 year and 1 in 1,000-year breach events occurring in 2115. The Hazard Mapping for each of the scenarios included information on maximum flood depth, maximum velocity and the maximum hazard.

13.1.107 The maximum depth of water during a 1 in 200-year breach event for 2115 to the Principal Application Site is shown to be predominantly over 1.6 m (**Plate A13.2-4**). The maximum depth of water during a 1 in 1,000-year breach event for 2115 to the Principal Application Site is shown to also be predominantly over 1.6 m (**Plate A13.2-5**). It is important to note that this breach hazard is considerably further into the future than the conservative end of operational life for the Facility (i.e. 2055).

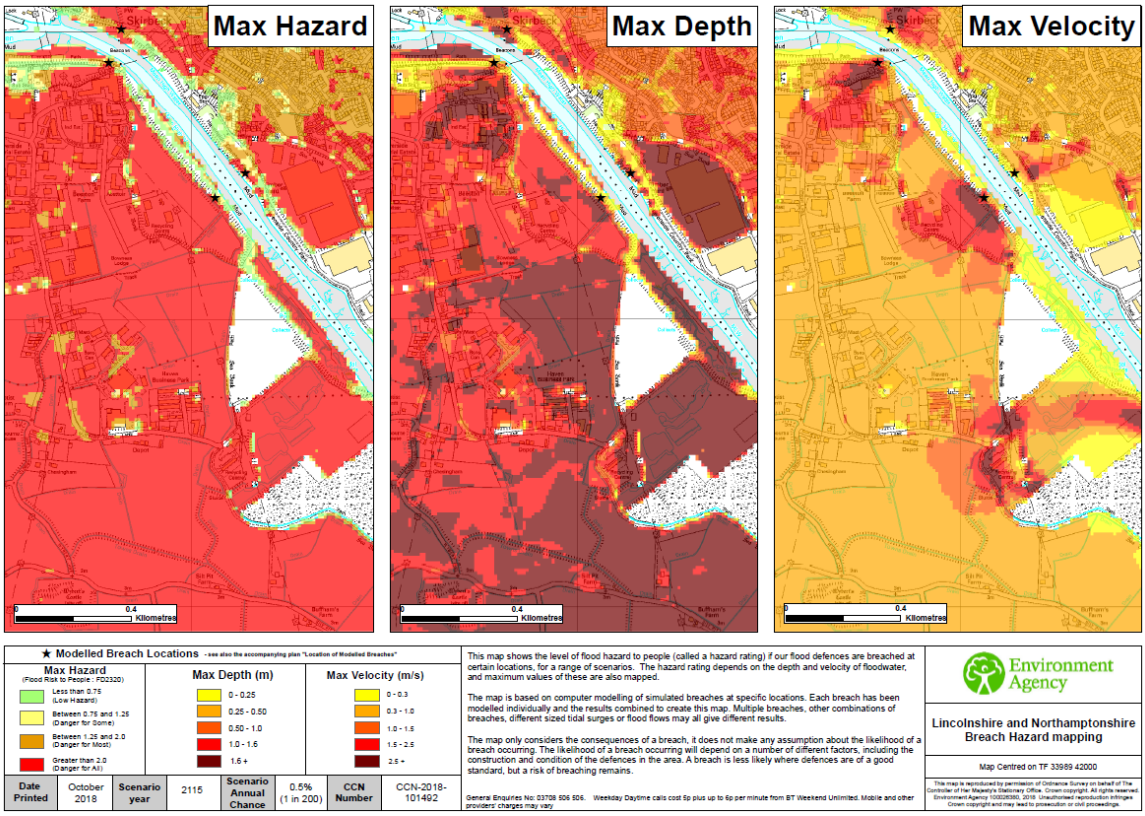

Plate A13.2-4 Breach Hazard Mapping for a 1 in 200-Year Event for the Year 2115

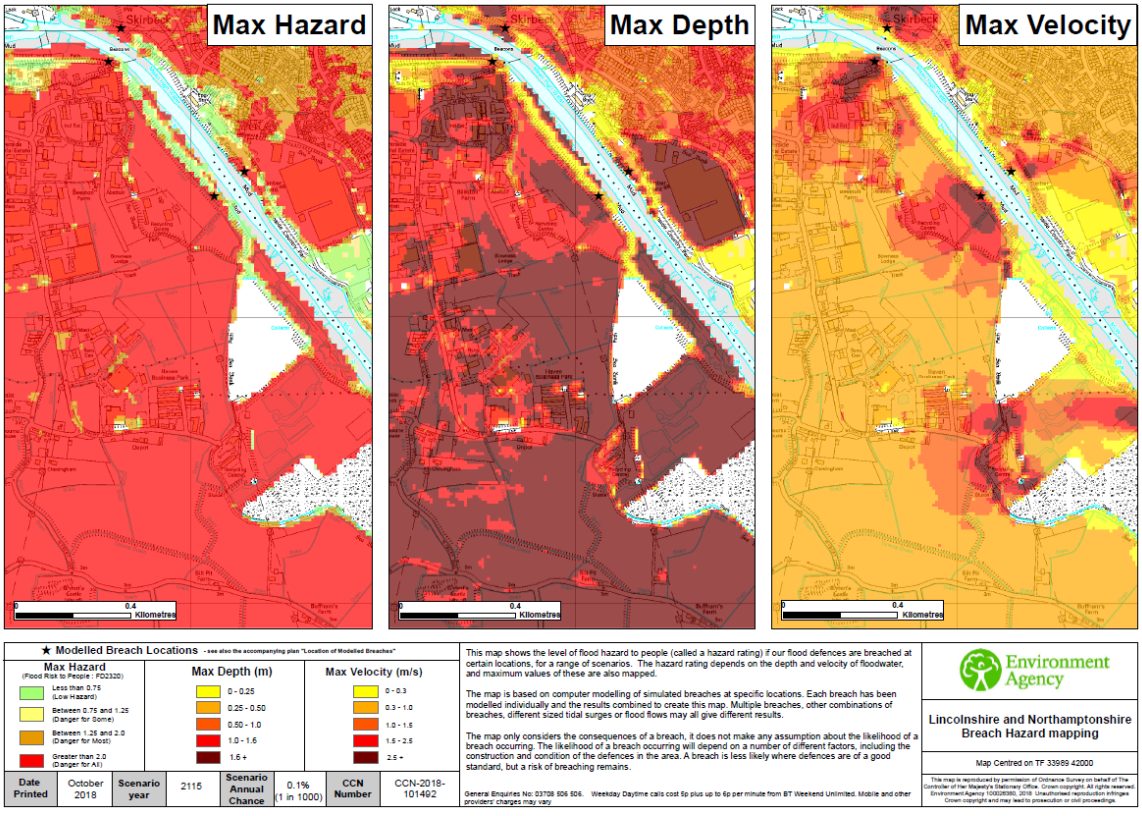

Plate A13.2-5 Breach Hazard Mapping for a 1 in 1,000-Year Event for the Year 2115

Peak Rainfall Intensity

13.1.108 The Environment Agency guidance on peak rainfall intensity taking into account climate change is outlined in **Table A13.2-6**. Both the central and upper end bands should be assessed to understand the range of impacts that may affect the Principal Application Site.

13.1.109 The Facility is industrial and has an expected operation period of 25 years before its ongoing operation is reviewed. The '2050's' epoch is therefore appropriate for this assessment and both the 10% and 20% allowance should be considered for the development of the surface water drainage design for the Facility.

Table A13.2-6 Peak Rainfall Intensity Allowance in Small and Urban Catchments (use 1961-90 baseline) (Source: Table 2, Environmental Agency Climate Change Allowances (12/08/20)

Applies across all of England	Total Potential Change Anticipated for the '2020s' (2015-2039)	Total Potential Change Anticipated for the '2050s' (2040-2069)	Total Potential Change Anticipated for the '2070s' (2070-2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

A13.7 Flood Risk Management Measures

13.1.110 There is always a potential for there to be a residual flood risk to people and property due to the failure of systems and defences, or more extreme events than those defined in the NPPF, or uncertainties associated with modelled water levels.

13.1.111 Residual risk may remain after flood management or mitigation measures have been installed. Therefore, an FRA should consider the residual flood risk and the need for any further measures to ensure the residual risk is managed appropriately.

Environmental Design and Embedded Mitigation

Flood Defences

13.1.112 Work on the Facility is programmed to be carried out after completion of the Boston Barrier and the Haven Banks project. As such the Facility, will benefit from the 1 in 300-year standard of protection provided by the BCS.

13.1.113 The Facility incorporates both primary and secondary flood defence lines. The primary flood defence line would be formed by the proposed wharf and would replace the existing Environment Agency flood defences at the Principal Application Site.

13.1.114 The proposed primary defence line, comprising the proposed wharf, would tie in with the improved flood defences provided as part of the Environment Agency's Haven Banks Project.

13.1.115 The design of the wharf carried out in communication with the Landowner and Environment Agency has set the crest height for the wharf at 7.2 mAOD. The secondary defence protecting part of the Principal Application Site is formed of the existing linear defence known as Roman Bank.

13.1.116 As highlighted in **Section A13.4**, Policy 4 of the South-East Lincolnshire Local Plan covers the 'Approach to Flood Risk'. It is stated that no development will be permitted within a 50 m buffer from the toe of the raised Witham Haven Banks, to allow access for construction and maintenance.

13.1.117 As the crest level of flood defences at the wharf will be increased as part of the Principal Application Site, it is understood that the Site Operator will take on the responsibility for maintenance along the length of the wharf and flood defence line that is within the Principal Application Site boundary.

13.1.118 Environment Agency access to these flood defences would not be restricted. However, this would need to be covered under a protective provisions arrangement and bound by legal agreement.

13.1.119 Ongoing consultation with the Environment Agency will confirm how the flood defences for the Principal Application Site will tie into the ongoing Haven Banks Project and planned future schemes. This process will also establish the necessary legal agreements to ensure Environment Agency access to the area is not impeded.

Finished Floor Levels

13.1.120 The Environment Agency standing advice (2017b) states for development in Flood Zone 2 or 3 to determine appropriate finished floor levels that ground floor levels should be a minimum of which is higher of:

- 300 mm above general ground level of the site; or
- 600 mm above the estimated river or sea flood level.

13.1.121 The standing advice also states that if finished floor levels cannot be raised above the estimated flood level extra resistance and resilience measures should be considered.

13.1.122 When reviewing the general ground level of the Principal Application Site

(i.e. 5 mAOD) the finished floor level would need to be set to 5.3 mAOD. However, modelled still tidal water levels for 2020 are 6.11 mAOD for the 1 in 200-year event, and as such finished floor levels would be required to be set no lower than 6.71 mAOD.

13.1.123 As previously noted, the upgrades currently underway to flood defences at the Principal Application Site will provide the Facility with a 1 in 300-year standard of protection following completion. As the Principal Application Site benefits from tidal defences along The Haven, the risk of tidal flooding is considered to be a residual risk related to breaching of the defences. The Environment Agency states the current tidal defences consist of earth embankments which are in a 'Good' condition, and the condition of these is expected to be improved to 'Very Good' following completion of the works.

13.1.124 Due to the nature and condition of the defences the risk of a breach flood event occurring which would affect the Facility is considered to be low. It is not a requirement to set finished floor levels based on a residual flood risk. However, extra flood resistance and resilience measures could be incorporated into the Facility to allow water to pass through any structures to avoid structural damage.

Flood Resistant and Resilient Design

13.1.125 The Environment Agency extra flood resistance and resilience measures guidance (2017a) states for water depths that are greater than 0.6 m any buildings or development on the Principal Application Site should be designed to allow water to pass through the structure to avoid structural damage by:

- Using materials with low permeability to at least 0.3 m;
- Making it easy for water to drain away after flooding; and
- Ensuring there is access to all spaces to enable drying and cleaning.

13.1.126 There are several additional flood mitigation measures which should be incorporated to minimise flood risk through the use of flood resilient construction practices, specifically of relevance to the LWA facility which is to be located behind the primary defence line but in front of the secondary defences. The following are examples that are appropriate for this element of the Facility:

- Where possible, raising electrical equipment, plant, machinery and electrical sockets above the 1 in 200-year breach flood level taking into account climate change; and
- Recommend a concrete and/or tiled surface on the ground floors that can be easily cleaned and dried following potential flood water ingress.

RDF Bale Contingency Storage Area and Quarantine Zone

13.1.127 Since PEIR, the design of the Facility has changed (**Section A13.2**). The majority of RDF will be stored in a sealed RDF bunker within the main facility, situated behind both the primary and secondary flood defences. This will remove the risk of the waste material being washed away during a flood.

13.1.128 However, when the RDF bunker reaches full capacity, the RDF bales will be kept in a temporary storage area, situated behind the primary flood defence but in front of the Roman Bank secondary defence. Bales would be temporarily stacked in stockpiles pending transfer to the bale shredding facility. This area of the Site would also include an RDF bale quarantine zone for bales that have been identified as overheating or containing an unusual substance.

13.1.129 Any damaged bales would be transferred immediately to a damaged bale store located behind the primary flood defence. This would be a fully enclosed building for re-baling, ensuring that the risk of the bales content polluting the watercourse or area around the Principal Application Site is fully mitigated.

13.1.130 The storage area and quarantine zone would be located behind the primary flood defence, but in front of the secondary defence. They are to be surfaced with hardstanding and include a sealed drainage system. The surface would be graded to flow to the sealed drainage. Water collected from the sealed drainage system would be used in the processing of LWA.

13.1.131 Whilst the bale storage area sits below the flood defence crest level, bales will only be at risk of being transported away by flood water in the event of a tidal event that causes flooding to inundate the storage area to a depth exceeding the flood defence crest level of 7.2 mAOD.

13.1.132 In such an event, the height of the secondary defence is less than 6m AOD (approx. 5.5m AOD). Therefore, should there be a flood event that exceeds the primary defence line water is likely to flow inland rather than into The Haven, due to the higher elevation of the wharf crest level.

13.1.133 Subscription to the Environment Agency flood warning service (see section on Flood Information Service below) will ensure that in the event of a predicted extreme tidal surge event, no vessels will be delivering RDF bales to the Principal Application Site. Therefore, in the period leading up to the forecast event, priority would be given to removing bales from the storage areas and sending to the bunker as a contingency measure.

Surface and Foul Water Drainage Strategy

13.1.134 The Principal Application Site is currently largely undeveloped, and the majority of the land is permeable. The Facility will increase the impermeable area on the Principal Application Site.

13.1.135 Changes in surface water runoff as a result of the increase in impermeable area from the Facility will be attenuated and discharged at a controlled rate, in consultation with the IDB and Environment Agency.

13.1.136 The surface water drainage requirements will be finalised post-DCO submission and prior to construction. The SFWDS will be designed to meet the requirements of the NPPF, NPS EN-1 and the CIRIA SuDS Manual C753 (CIRIA, 2015) with runoff limited where feasible, through the use of infiltration and / or attenuation which can be accommodated within the area of the development.

13.1.137 In accordance with the NPPF PPG, consideration should be given to the potential for incorporating Sustainable Drainage Systems (SuDS) within the fabric of the Proposed Development. The impact of climate change (increased rainfall intensity and duration) has the potential to increase the volume of surface water runoff from the Principal Application Site.

13.1.138 The SFWDS 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:

i) into the ground (infiltration);

ii) to a surface water body;

iii) to a surface water sewer, highway drain or another drainage system; or

iv) to a combined sewer.

13.1.139 The detailed design of the SFWDS will be based on the results of a series of infiltration / soakaway tests to be carried out on the Principal Application Site. The tests will be undertaken prior to construction and in accordance with the BRE Digest 365 Guidelines. The SFWDS will ensure that the current greenfield run-off rates are identified and agreed with the IDB and the Environment Agency and are monitored to ensure that the agreed rate of discharge is maintained.

13.1.140 The final impermeable areas of the Principal Application Site are not yet defined; however sufficient storage will be provided to attenuate surface water from the Facility such that it can be discharged at a controlled rate during surface water events. The volume and location of the attenuation will be detailed within

the SFWDS post-DCO submission and prior to construction.

13.1.141 A Surface Water Drainage Strategy was previously undertaken by H.H. Adkins in 2013 to support the planning application for 'Biomass UK No. 3 Ltd' power station. The Surface Water Drainage Strategy for the 'Biomass UK No. 3 Ltd' power station was designed to manage surface water runoff from development across the entire site for a 1 in 100-year storm event with a 30 % climate change allowance.

13.1.142 It is understood that the attenuation pond developed as part of this previous project was also sized to accommodate the surface water drainage from the Principal Application Site. However, increases in run-off to account for climate change have been updated since its construction, with revised guidance published by the Environment Agency, most recently in July 2020. Therefore, the Principal Application Site's SFWDS will need to review the suitability and capacity of the attenuation basin in line with latest guidance.

13.1.143 Attenuation features will be required to restrict the surface water runoff to the existing 1 in 1-year rate for a 1 in 100-year rainfall event plus climate change. A review of the current requirements in relation to the increase in rainfall intensity as a result of climate change is also required.

13.1.144 The controlled runoff rate will be equivalent to the greenfield runoff rate. The resultant storage / attenuation volume provided will be sufficient to ensure that during the 1 in 100-year event plus an allowance for climate change there will be no increase in runoff from the Principal Application Site.

13.1.145 Behind the primary flood defence, a sealed surface water drainage system will be built as part of the enabling works to manage any potential increase in surface water runoff, with a primary aim of capturing surface water for use in the LWA facility on-site. This drainage system will be located in front of the secondary defence and only provide surface water drainage to those elements that are located between the two flood defences, such as the contingency bale storage area.

13.1.146 Any surplus surface water collected in front of the Roman Bank and not used in the LWA facility, would be discharged directly back into The Haven (in accordance with an Environmental Permit).

13.1.147 Behind both the primary and secondary flood defences, where the main elements of the Facility are to be located, it is anticipated that surface water will be managed through the use of the existing attenuation pond located to the south

of the Principal Application Site before discharging via surface water ditches at a controlled rate into the IDB drain adjacent to the Principal Application Site. Details of the drainage routes and required capacity will need to be confirmed as part of the SFWDS following review of latest climate change allowances.

13.1.148 Any works, either temporary or permanent, which will alter the flow of water along a watercourse or require the erection of a culvert, bridge or modification to the channel will require consent from the corresponding relevant authorities such as the Environment Agency or IDB. All necessary application(s) for ordinary watercourse consent shall be made to the appropriate authority, which for the drains and ditches on the Principal Application Site will be the IDB and agreed prior to construction.

13.1.149 The approach to the SFWDS has been adopted to ensure no surface water falling on the Principal Application Site will enter the public sewer network.

13.1.150 The proposed surface water drainage system specification for the size, dimensions and location of the attenuation storage and the SFWDS including plans of the proposed drainage layout will be completed as part of detailed design post-DCO submission and prior to construction.

Flood Information Service

13.1.151 The Environment Agency operates a flood warning service available to businesses and residents located in areas of flood risk. The Principal Application Site is located within a flood warning area and it is advised that all relevant staff and the operators sign up to this service. This can be undertaken by registering online at https://www.gov.uk/sign-up-for-flood-warnings.

Safe Access and Egress

13.1.152 The Principal Application Site benefits from tidal defences with a 1 in 150-year standard of protection which is being improved as part of the Haven Banks Project. It will provide a 1 in 300-year standard of protection following completion of tidal defence improvements as part of the BCS. Safe access and egress can be achieved from the Principal Application Site whilst defences remain functional.

13.1.153 In the event of a defence breach during the 1 in 200-year event (2006) water depths on the Principal Application Site have been modelled as being between 1.0 and 1.6 m. During the 1 in 200-year event (2115) water depths on the Principal Application Site have been modelled to be over 1.6 m.

13.1.154 The Environment Agency Hazard Mapping confirms that during a breach

event for both the 2006 and 2115 scenario there would be a ‘danger for all’. On the basis, that the primary source of flood risk to the Facility is tidal flooding then should there be a storm surge forecast or flood warning issued, in line with the proposed operational procedures for closure of the Boston Barrier users of the site should take action to ensure safe egress from the Principal Application Site.

13.1.155 Information related to the operational procedures for the proposed Boston Barrier have been requested from the Environment Agency but were not available at the time of writing this FRA. These will be considered within a Flood Risk Emergency Plan (FREP) for the Principal Application Site, post-DCO submission and prior to operation of the Facility (further details below). The FREP will be produced in accordance with the 2019 ADEPT document “Flood risk emergency plans for new development”.

13.1.156 Additionally, due to the operational nature of the Facility no personnel are required to sleep on-site and an emergency FREP should be implemented for the Principal Application Site which includes the identification of areas for safe refuge.

Flood Risk Emergency Plan

13.1.157 Due to the high hazard rating to the Principal Application Site, should there be a breach in the defences during construction or operation the Facility will require a FREP. This should include procedures to receive flood warnings (including communication lines to cover shift patterns and / or staff leave), and closure of or evacuation of the Facility with sufficient lead time to ensure no personnel or vehicles are left within the Principal Application Site during times of a flood warning (ADEPT, 2019).

13.1.158 Areas of emergency refuge should also be identified to be located above the modelled breach flood depths. These aspects, including features to mitigate, are likely to require further consultation with the Environment Agency.

A13.8 Conclusions

13.1.159 This FRA has reviewed the existing flood risk to the Principal Application Site and future flood risk to the Facility. It has identified that:

- Topographic levels at the Principal Application Site are between 2 – 5 mAOD;
- The Facility is located within Flood Zone 3;
- The Principal Application Site benefits from the presence of linear tidal flood defences. These earth embankments are currently undergoing improvement works, as part of the Haven Bank Project, which will provide an effective crest

level of 6.5 mAOD following their completion, scheduled for Winter 2020. This will provide a 1 in 300-year standard of protection allowing for 50 years of climate change;

- The Facility incorporates the creation of new formal flood defences, which shall be tied into the wider flood defences in the area and, following consultation with the Environment Agency, has been designed with an effective crest level of 7.2 mAOD;
- The flood defence improvement works known as the BCS will ultimately provide Boston town with a 1 in 300-year standard of protection;
- The key potential source of flooding to the Principal Application Site is from The Haven (i.e. tidal flooding);
- Worse case tidal still water level, during the present day 1 in 200-year event, have been calculated to be 6.11 mAOD and 6.32 mAOD during the present day 1 in 1,000-year event. The present day 1 in 200-year tidal still water level is below the effective crest level (i.e. 6.5 mAOD) for the improved defence in this location;
- Worst case tidal still water level during the 1 in 200-year event for 2055 has been calculated to be 6.44 mAOD and 6.65 mAOD during the 1 in 1,000-year event for 2055. Based on the agreed implementation of a minimum defence crest level of 7.2 mAOD, the Principal Application Site will continue to be protected from tidal flooding during the lifetime of the Facility; and
- Hazard mapping data shows modelled flood depths, should there be a breach in the defences, across the Principal Application Site to be predominately 1.0 – 1.6 m deep.

13.1.160 The following are key conclusions identified as part of the FRA:

- The risk of flooding from fluvial, surface water, groundwater and sewer flooding sources is considered to be low;
- There is no risk of flooding from reservoir or other artificial sources;
- The presence of the defence in this location is such that the risk of tidal flooding is considered to be low and limited to a residual risk should there be a failure in the defences;
- On the basis of the flood risk to the Principal Application Site and the proposed flood risk management techniques, including resilience measures, it is considered that the Facility will be safe for its lifetime without increasing flood risk elsewhere; and

- Based on the information presented in the FRA, it is considered that the Facility is in accordance with both the first and second part of the Exception Test and therefore is appropriate in terms of the type of development and its proposed location. Therefore, it is considered to meet the requirements of the NPPF.

13.1.161 The following recommendations are provided to mitigate the residual flood risk:

- It is recommended that the Facility incorporate flood resistant and resilient design;
- Surface water drainage shall be managed mostly through its use on site within the LWA facility, with surplus water managed via the use of an attenuation pond prior to discharge at a controlled rate into the IDB maintained drain adjacent to the Principal Application Site;
- Due to the high hazard rating and residual risk of a breach in the defences, a FREP should be produced and implemented for the Principal Application Site. This should include the identification of areas for safe refuge. Should there be a storm surge forecast or flood warning issued, users of the site should take action to ensure safe egress from the Principal Application Site as set out in the FREP.

A13.9 References

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