Associated British Ports

Immingham Eastern Ro-Ro Terminal

Preliminary Environmental Information
Chapter 11: Coastal Protection, Flood Defence and Drainage

January 2022





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11.1 Introduction

11.1.1 This chapter provides a preliminary assessment of the potential significant effects of the proposed Immingham Eastern Ro-Ro Terminal (IERRT) on coastal protection, flood defence and drainage receptors. This chapter has been prepared by AECOM Ltd.

11.1.2 The following receptors have been considered as part of the assessment:

- People;
- Property (buildings and services);
- Infrastructure (such as roads, footpaths, and railways);
- Flood Defence assets;
- Drainage and sewers systems; and
- Waterbodies (such as ponds, streams, rivers, and lakes).

11.1.3 A number of figures support the description of the existing environment (baseline) and are provided in Volume 2 to this Preliminary Environmental Information Report (PEIR). Figure 1.1 shows the location of the proposed IERRT site. Figure 1.2 shows the layout of the proposed marine works at the site, Figure 1.3 shows the layout of the proposed landside works at the site. Image 11.1 shows the location of surface watercourses and flood defences in proximity to the site.

11.1.4 Due to the interdisciplinary nature of effects, this chapter cross references other chapters including Chapter 7 Physical Processes, Chapter 8 Water and Sediment Quality and Chapter 12 Ground Conditions including Land Quality. It is also supported by Appendix 11.1 Preliminary Flood Risk Assessment (FRA) (AECOM, 2021) (PEIR Volume 3) in which flood risk impacts from tidal, fluvial, pluvial, groundwater and artificial sources, as well as surface water drainage impacts that could arise as a result of the project are considered; and

11.1.5 Details of how surface water generated on site will be managed (including surface water attenuation and discharge of surface water to Habrough Marsh Drain) will be provided in the final Environmental Statement (ES).

11.1.6 This chapter describes the impacts and effects that are anticipated, and outlines proposed design and other measures to help mitigate these potential effects. As well as the full FRA and Drainage Strategy, this chapter references the requirement for development of, and adherence to a Construction Environmental Management Plan (CEMP) in order to mitigate the magnitude and significance of potential effects during construction.

11.1.7 At this preliminary stage, where detailed information has not been available, reasonable assumptions have been made, and have been clearly set out, based on experience of developments of similar type and scale to enable assessment of likely significant effects.

11.2 Definition of the study area

11.2.1 The study area for this assessment is the area over which potential direct and indirect effects of the IERRT project are predicted to occur during the construction and operational periods.

11.2.2 The direct effects on coastal protection, flood defence and drainage receptors are those confined to within the footprint of the IERRT project red line boundary.

11.2.3 Indirect effects are those that may arise due to changes in the hydrodynamic (wave) environment or surface water as a result of the Eastern Ro-Ro Terminal project. Indirect effects may occur outside the red line boundary.

11.2.4 Considering the above, the study area for the coastal protection, flood defence and drainage topic comprises the area denoted by the adjacent flood cells in the Humber Estuary Strategy (Environment Agency, 2008). The study area also extends upstream into Habrough Marsh Drain to the limit of tidal influence, including any new surface water discharges into this waterbody).

11.3 Assessment methodology

Data and information sources

11.3.1 Current baseline conditions have been determined by a desk-based review of available information.

11.3.2 The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the proposed development include:

- Google Maps website;
- BGS GeoRecords Plus online interactive map;
- Map and Geographic Information Centre (MAGIC) interactive online maps;
- Flamborough Head to Gibraltar Point Shoreline Management Plan (SMP) (various authors including Lead Authority East Riding of Yorkshire Council, 2011);
- Humber Flood Risk Management Strategy (FRMS) (Environment Agency, 2008) (note that this Strategy is currently being updated and will be incorporated into the assessment should the update be completed and made publicly available);
- Immingham Section 19 Flood Investigation Report (Balfour Beatty, 2012);

- Environment Agency Product 4, 5 and 8 data consultation responses; and
- Environment Agency Flood Maps for Planning (available online) (Environment Agency, accessed Oct 2021):

Determining significance of effects

11.3.3 To facilitate the impact assessment process and ensure consistency in the terminology of significance, a standard assessment methodology has been applied. This methodology has been developed using a range of guidance.

11.3.4 There is no standard guidance in place for the assessment of the likely significant effects on the water environment from developments of this type. Based on professional judgement and experience of other similar schemes, a qualitative assessment of the likely significant effects on surface water quality and water resources has been undertaken.

11.3.5 The classification and significance of effects has been determined using the principles of the guidance and the criteria set out in Design Manual for Roads and Bridges (DMRB) Lifecyle Appraisal (LA) 113 (Highways England, 2020a) adapted to take account of hydromorphology. Although these assessment criteria were developed for road infrastructure projects, this method is suitable for use on any development project and it provides a robust and well tested method for predicting the significance of effects. The methodology also considers advice set out in Department of Transport (Transport Analysis Guidance) TAG Unit A3, Environmental Impact Appraisal (Department for Transport, 2019).

11.3.6 Approaches to mitigating potential impacts during construction and operational phases have been described with reference to good practice guidance and design.

11.3.7 Following the DMRB LA 113 (Highways England, 2020a) guidance, the importance of the receptor (Table 11.1) and the magnitude of impact (Table 11.2) are determined independently and are then used to determine the overall classification and significance of effects (see Table 11.3).

11.3.8 Where significant adverse effects are predicted, options for mitigation have been considered and proposed where possible. The residual effects of the proposed development with identified mitigation in place have also been assessed and presented in Table 11.8.

Table 11.1. Sensitivity (value) of coastal protection, flood risk and drainage receptors(adapted from DMRB LA 113 Table 3.70)

Importance	General Criteria	Attributes
Very High	The receptor has little or no ability to absorb change without fundamentally altering its present character, is of very high environmental value, or of international importance.	▪ Human receptors – general public/visitors; ▪ Floodplain or defence protecting more than 100 residential properties from flooding; ▪ Flood Zone 3b; ▪ Essential Infrastructure or highly vulnerable development; ▪ Offsite regional sewerage networks
High	Receptor of national or regional importance with a low ability to absorb change without fundamentally altering its present character.	▪ Human Receptors – Construction workers and site operatives with knowledge of site conditions; ▪ Floodplain or defence protecting between 10 and 100 residential properties or industrial premises from flooding; ▪ Flood Zone 3a; ▪ More vulnerable development; ▪ Low lying land and local pumped drainage network.
Medium	Receptor of regional or local importance, with medium ability to absorb, adapt to or recover from change. The receptor is of regional or local importance and has medium capacity to absorb change, adapt to or recover from change without significantly altering its present character.	▪ Floodplain or defence protecting 10 or fewer industrial properties from flooding; ▪ Flood Zone 2; ▪ Less vulnerable development ▪ Surface water drainage network including drainage ditches.
Low	The receptor is of local importance and tolerant of change without detriment to its character (i.e. has some ability to absorb, adapt to or recover from change).	▪ Floodplain with limited constraints and low probability of flooding of residential and industrial properties; ▪ Flood Zone 1; ▪ Water compatible development ▪ Local drainage network (existing private site drainage or soakaway.

Importance	General Criteria	Attributes
Negligible	Receptor is resistant to change and is of little or no environmental value.	Not applicable
Note – Essential Infrastructure, Highly Vulnerable, More Vulnerable, Less Vulnerable development and water compatible development are defined in the Planning Policy Guidance Flood Risk and Coastal Change (Department for Levelling Up, Housing and Communities, 2021b)		

11.3.9 The impact assessment for the coastal defence, flood risk and drainage topic will be informed by the draft FRA, presented in Appendix 11.1 (PEIR Volume 3).

11.3.10 The impact assessment is based on existing flood risk information, such as the Product 4 and Product 8 datasets provided by the Environment Agency. This data is currently the most up to date publicly available information for flood risk, therefore no new or additional modelling is required to inform the assessment.

11.3.11 Evidence of previous flood events in the study area have been considered, as provided by ABP, statutory consultees and described in the Immingham Section 19 Flood Investigation Report (Balfour Beatty, 2012).

11.3.12 The effect of climate change has been assessed by considering the national government guidance for sea level rise and changes to precipitation levels. The latest guidance, published by the Environment Agency, entitled Flood Risk Assessments: climate change allowances, detailing climate change allowances for flood risk assessments and planning (Environment Agency, 2021) is provided on the GOV.UK website. The guidance includes changes to peak rainfall intensity levels and sea level rise allowances for different points in time over the next century.

11.3.13 A desk-based review has been undertaken to ascertain the likely surface water and drainage issues at the study area relevant to the IERRT project. This preliminary review was informed by available LiDAR data for the study area (in lieu of site-specific topographic survey data, historic drawing of the site showing the existing drainage infrastructure, where available, and an existing infrastructure review report.

Magnitude of Impacts

11.3.14 The magnitude of potential impact upon coastal protection, flood risk and drainage takes account of the scale of the predicted change to baseline conditions and where there are potential pathways between an impact source/ hazard and identified receptors. This takes into account the spatial scale of the impact, as well as its duration and reversibility (e.g., the impact magnitude may be moderated if the impacts are temporary rather than permanent; or are reversible rather than irreversible).

11.3.15 The magnitude of impact on a receptor (Coastal protection, Flood Risk and Drainage) ranges from Major to No Change, with additional Magnitude descriptions of Minor beneficial to Major beneficial. The criteria for

determining the magnitude of impact on a receptor are given in Table 11.2. The significance (effect) of a potential effect on a resource is dependent on its assigned value and the magnitude of impact and is broadly categorised according to the matrix included as Table 11.3.

Table 11.2. Magnitude of impact coastal protection, flood risk and drainage (adapted from DMRB LA 113 Table 3.71)

Level of Magnitude	Definition of Magnitude and Examples
Major Adverse	Results in a loss of attribute and/ or quality and integrity of the attribute. For example: ▪ Change in flood risk to receptor from low or medium to high; ▪ Increase in peak flood level (>100 mm); ▪ Permanent adverse effect on local drainage system and subsequent capacity implications.
Moderate Adverse	Results in impact on integrity of attribute, or loss of part of attribute. For example: ▪ Change in flood risk to receptor from low to medium; ▪ Increase in flood peak level (>50 mm); ▪ Severe temporary adverse effect on local drainage system and subsequent capacity issues
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability. For example: ▪ Change in flood risk to receptor from no risk to low risk; ▪ Increase in peak flood level (>10 mm); ▪ Minor effect on local drainage system and subsequent capacity issues
Negligible	Results in impact on attribute, but of insufficient magnitude to affect the use or integrity. For example: ▪ No change in flood risk leading to a negligible change in the attribute's integrity; ▪ Negligible change to peak flood level ≤ +/- 10 mm; ▪ Minute unidentifiable change on local drainage system
Minor Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative impact occurring. For example: ▪ Change in flood risk to receptor from low risk to no risk; ▪ Creation of flood storage and decrease in peak flood level (> 10 mm); ▪ Minor reduction in surface water run-off and subsequently the impact on the local drainage system
Moderate Beneficial	Results in moderate improvement of attribute quality. For example: ▪ Change in flood risk to receptor from medium to low; ▪ Creation of flood storage and decrease in peak flood level (>50 mm) ▪ Moderate reduction in surface water run-off and subsequently the impact on the local drainage system

Level of Magnitude	Definition of Magnitude and Examples
Large Beneficial	Results in a gain of attribute and/ or quality and integrity of the attribute. For example: ▪ Change in flood risk to receptor from high to medium or low; ▪ Creation of flood storage and decrease in peak flood level (>100 mm); ▪ Major reduction in surface water run-off and subsequently the impact on the local drainage system
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.
Note: All references to peak flood level in Table 3.71 are for a 1 % annual probability event, including climate. Where access or egress routes are affected, the magnitude of the impact is defined by the change in the Flood Hazard Rating as defined by Defra and the Environment Agency (Flood Risk Assessment Guidance for New Development Phase 2) FD2320 .	

Significance of Effects

11.3.16 Once the Value (Significance) of each resource and the Magnitude of the potential Impact upon it are established, the Significance (Effect) matrix included in Table 3.8.1 DMRB Sustainability & Environmental Appraisal, LA 104 Environment Assessment and monitoring (Highways England, 2020b) is used to determine the Significance (Effect) of the potential impact as reported in Table 3.7, these have been reproduced and presented as Table 11.3 and Table 11.4, respectively.

Table 11.3. Significance (Effect) Matrix

		Magnitude of Impact (degree of change)			
Receptor Value	No Change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate or large	Large or very large	Very large
High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Source: DMRB Table 3.8.1 LA 104

Table 11.4. Significance Categories (Effects) and Typical Descriptions

Significance Category	Typical Description
Very large	Effects at this level are material in the decision-making process.
Large	Effects at this level are likely to be material in the decision-making process.
Moderate	Effects at this level can be considered to be material decision-making factors.
Slight	Effects at this level are not material in the decision-making process.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Source: DMRB Table 3.7 LA 104 (Highways England, 2020b).

11.3.17 The methodology described above has been used to assess the significance for the following stages of the proposed development:

- Construction;
- Operation; and
- Cumulative effects.

11.3.18 Where possible, each effect has been classified both before and after mitigation measures have been applied. Effects remaining after mitigation measures are applied are referred to as 'residual' effects.'.

11.4 Consultation

11.4.1 Consultation has been undertaken with statutory authorities, as appropriate, with regards likely coastal protection, flood defence and drainage effects of the IERRT project . This includes the Environment Agency, Anglian Water, Witham Internal Drainage Board and North East Lincolnshire Council in its role as the Local Lead Flood Authority (LLFA).

11.4.2 The consultation that has been undertaken, along with the outcome of such consultation and how it has influenced the coastal defence, flood risk and drainage topic is provided in Table 11.5.

Table 11.5. Summary of consultation to date

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
Planning Inspectorate (PINS)	Scoping Opinion, October 2021 Table ID 4.6.2	It is noted that the FRA will be provided as an appendix to the coastal defence, flood risk and drainage assessment in the ES. The FRA should as a minimum, address the requirements listed in paragraph 5.2.5 of the Policy Statement for Ports.	The FRA that will be provided with the ES will address these requirements. See Appendix 11.1.
Environment Agency	Scoping Opinion, October 2021 Appendix 2 Environment Agency response	Any potential impacts on flood risk infrastructure should be linked to the FRA outcomes. Any resulting mitigation / monitoring of the impacts should be linked to the detailed approvals that would normally be considered in the Flood Risk Activities of an Environmental Permit.	Comments to be addressed in the full FRA, which will inform the ES chapter on coastal protection, flood defence and drainage.
Environment Agency	Scoping Opinion, October 2021 Appendix 2 Environment Agency response	Invitation to discuss the details of the proposed works to determine whether an Environmental Permit for Flood Risk Activities is required and if so, whether this can be incorporated into the Development Consent Order (DCO) or Marine Licence.	Comments to be discussed and used to inform the ES chapter on coastal protection, flood defence and drainage.
Environment Agency	Scoping Opinion, October 2021 Appendix 2 Environment Agency response	Any new terminal buildings for “less vulnerable” uses should raise Finished Floor Levels (FFLs) as high as practicable and, if these will be below the predicted flood depth (referring to the relevant 2115 0.5 % AEP tidal breach map), suitable flood resistance / resilience measures identified.	Comments to be addressed in the full FRA, which will inform the ES chapter on coastal protection, flood defence and drainage.
Environment Agency	Scoping Opinion, October 2021	Single storey buildings should be built with FFLs above the predicted flood depth (referring to the relevant 2115 0.5 % AEP tidal breach map).	Comments to be addressed in the full FRA, which will inform the ES chapter on coastal

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
	Appendix 2 Environment Agency response	If this is not practicable, an area of safe refuge will need to be provided, or an appropriate flood warning and evacuation plan (to be assessed by the Local Planning Authority (LPA)) will need to demonstrate how this risk will be managed.	protection, flood defence and drainage.
Anglian Water	Scoping Opinion, October 2021 Appendix 2 Anglian Water response	All surface water during construction and operation of the project should be managed via Sustainable Drainage Systems (SuDS) and not via the public sewer network.	Comments to be addressed in the full Drainage Strategy, which will inform the final chapter in the ES.
Anglian Water	Scoping Opinion, October 2021 Appendix 2 Anglian Water response	Anglian Water should be consulted, and data sought on historic sewer flooding, if on site design and offsite impacts from the project, and cumulatively with other development, potentially cause increased risk to the existing sewer network.	Comments to be addressed in the full FRA and full Drainage Strategy, which will inform the ES chapter on coastal protection, flood defence and drainage.
Witham Internal Drainage Board (IDB) (North East Lindsey Drainage Board)	Data Consultation Response, October 2021	There is a network of Board maintained watercourses near the site. Habrough Marsh Drain is a gravity system with a flapped outfall into the Humber within the port site. There is a link to the Immingham pumped drainage system which allows flow into the Drain only when there is spare capacity available. High levels within this system have a potential flood risk for the area, particularly if rainfall events combine with high water levels in the Humber.	Comments to be addressed in the full FRA and full Drainage Strategy, which will inform the ES chapter on coastal protection, flood defence and drainage.

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
Witham IDB (North East Lindsey Drainage Board)	Data Consultation Response, October 2021	The proposals show new infrastructure in the Humber near to the gravity outfall of Habrough Marsh Drain. The FRA should address this and put in place measures to mitigate siltation that could impede the existing discharge.	Comments to be addressed in the full FRA, which will inform the ES chapter on coastal protection, flood defence and drainage.
Witham IDB (North East Lindsey Drainage Board)	Data Consultation Response, October 2021	The prior written consent of the Board is required for any proposed temporary or permanent works in, under, over or within 7 m of the top of bank of a Board maintained watercourse (A revised Byelaw distance of 9 m is expected in the near future). This width is required to be kept clear of all obstructions.	Comments to be addressed in the full FRA, which will inform the ES chapter on coastal protection, flood defence and drainage.
Witham IDB (North East Lindsey Drainage Board)	Data Consultation Response, October 2021	Surface water discharge into the Boards drainage system from any re-development should be reduced to 70 % of the existing discharge rate.	Comments to be addressed in the full Drainage Strategy, which will inform the ES chapter on coastal protection, flood defence and drainage .
North East Lincolnshire Council	Data Consultation Response. October 2021	ABP do not report incidents of flooding on their land, primarily because the drainage infrastructure serving the dock estate is nearly all under ABP ownership. The only information held by the Council Drainage Team is: ▪ There was extensive flooding of the dock estate during the tidal surge on 5 December 2013; ▪ The only watercourses on ABP land not owned by ABP are the North East Lindsey IDB drains.	Information provided has been used to inform the PEIR Chapter and the Preliminary FRA

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
		All information on flood risk from these is held by the IDB; and ▪ Any hydraulic models of the watercourses will be held by the IDB.	
Environment Agency	Consultation response. November 2021	The following data for the proposed development site and surrounding area has been provided: ▪ Flood Map for Planning showing Flood Zone Extents and location of flood defences; ▪ Historic flood event outlines map showing historical flood extents for events in 1953 and 2013; ▪ Fluvial flood risk information, this site is not considered to be at risk of flooding from main rivers. The site may be at risk from local ordinary watercourses for which other risk management authorities, such as the Lead Local Flood Authority (i.e. top tier council) or Internal Drainage Board (where they exist) have responsibility; ▪ Tidal flood risk and tidal water level data; and ▪ Tidal Hazard Mapping for breach and overtopping events for the years 2006 and 2115.	Information provided has been used to inform the PEIR Chapter and the Preliminary FRA

11.5 Implications of policy legislation and guidance

11.5.1 This section of the chapter sets out key aspects and implications of policy and guidance that are relevant to the assessment of likely impacts on coastal protection, flood defence and drainage receptors. It builds upon the overarching chapter covering the Legislative and Consenting Framework (Chapter 5). This will be kept under review as the assessment progresses.

EU legislation

11.5.2 The United Kingdom left the European Union (EU) on the 31 January 2020. The legislation discussed below has been adopted by the UK and remains applicable to the assessments in this PEIR.

The Flood Directive (Directive 2007/60/EC)

11.5.3 The Flood Directive (Directive 2007/60/EC) aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage, and economic activity. The Directive requires Member States to identify the river basins and associated coastal areas at risk of flooding. For such zones flood risk maps must be produced and flood risk management plans (FRMPs) established focused on prevention, protection, and preparedness. The Directive applies to inland waters as well as all coastal waters. The Flood Directive was transposed into domestic law by the Flood Risk Regulations 2009, which are discussed below.

UK legislation

The Environmental Permitting Regulations 2016

11.5.4 The Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016 came into force on 6 April 2016. They amend the Environmental Permitting (England and Wales) Regulations 2010 in order to extend the requirement for an environmental permit to flood risk activities in addition to polluting activities included under the previous regulations. The new permitting requirements for flood risk activities replaces the 'flood defence consent scheme', allowing the Environment Agency to concentrate on higher risk activities.

The Water Act 2014

11.5.5 The aim of the Water Act 2014 was to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as droughts and floods.

Flood and Water Management Act 2010

11.5.6 The Flood and Water Management Act 2010 (FWMA) aims to improve both flood risk management and the way we manage our water resources by creating clearer roles and responsibilities. This includes a lead role for local authorities in managing local flood risk (from surface water, ground water

and ordinary watercourses) and a strategic overview role of all flood risk for the Environment Agency. The FWMA provides opportunities for a comprehensive, risk-based approach on land use planning and flood risk management by local authorities and other key partners.

Flood Risk Regulations 2009

11.5.7 The Flood Risk Regulations 2009 transposed the Floods Directive (Directive 2007/60/EC) on the assessment and management of flood risk into domestic law in England and Wales and implemented its provisions. The regulations designate a LLFA and imposes duties on the Environment Agency and Lead Local Flood Authorities to prepare a number of documents including:

- Preliminary Flood Risk Assessments;
- Flood hazard and flood risk maps; and
- Flood Risk Management Plans.

Water Resources Act 1991

11.5.8 The Water Resources Act 1991 (WRA) (as amended) sets out the responsibilities of the Environment Agency in relation to water pollution, resource management, flood defence, fisheries, and navigation.

Water Industry Act 1991

11.5.9 The Water Industry Act relates to water supply and the provision of wastewater services in England and Wales.

Land Drainage Act 1991

11.5.10 The Land Drainage Act 1991 (as amended) requires that a watercourse be maintained by its owner. The Act provides functions to internal drainage boards and local authorities to manage watercourses and provide consenting powers for proposed works to watercourses associated with development.

National policy

National Policy Statement for Ports (NPSfP)

11.5.11 The National Policy Statement for Ports (NPSfP) (Department for Transport, 2012) is the framework for decisions on proposals for new port development that are Nationally Significant Infrastructure Projects (NSIPs). The aims of the policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, including 'water compatible' development, the policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. Port

development is water compatible development and, therefore, acceptable in high flood risk areas.

11.5.12 The policy states "*all applications for port development of 1 hectare or greater in Flood Zone 1 and all proposals for projects located in Flood Zones 2 and 3 should be accompanied by a flood risk assessment (FRA). This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account*" (Paragraph 5.2.4).

11.5.13 The policy notes that the latest set of UK Climate Projections should be used in assessments to ensure the appropriate adaptation measures have been identified. "*Applicants should apply, as a minimum, the emissions scenario that the independent Committee on Climate Change suggests the world is currently most closely following – and the 10 %, 50 % and 90 % estimate ranges. These results should be considered alongside relevant research which is based on the climate change projections such as Environment Agency Flood Maps*" (Paragraph 4.13.7).

11.5.14 Paragraph 5.2.18 of the policy states "*The Government's view is that there is no 'public good' need, on national resilience grounds, to require a higher specification than will secure commercial resilience of the individual facility, notwithstanding that some types of severe weather may effect ports in a region or along a particular stretch of coastline, for example from a storm surge. The NPSfP provides more generally for resilience and diversity of ports provision. Applicants will be in the best position to make a commercial judgement on the required appropriate adaptation measures to reduce the risk from long term climate change as it affects their own facilities*".

UK Marine Policy Statement (MPS)

11.5.15 The Marine Policy Statement (MPS) (HM Government, 2011) is the framework for preparing Marine Plans and taking decisions affecting the marine environment. It establishes a vision for the marine environment, which is for 'clean, healthy, safe, productive and biologically diverse oceans and seas'.

11.5.16 The MPS underpins the process of marine planning, which establishes a framework of economic, social, and environmental considerations that will deliver these high-level objectives and ensure the sustainable development of the UK marine area.

The East Inshore Marine Plan

11.5.17 The East Inshore Marine Plan (Department for Environment, Food and Rural Affairs (Defra), 2014) establishes the plan led system for the marine area in which parts of the proposed development site are located. Both the MPS and the East Inshore Marine Plan are discussed further in Chapter 5 Legislative and Consenting Framework.

National Planning Policy Framework (NPPF)

11.5.18 The National Planning Policy Framework (NPPF), (Department for Levelling Up, Housing and Communities, 2021a) and associated Planning Policy Guidance (PPG) documents, including the Flood Risk and Coastal Change PPG (Department for Levelling Up, Housing and Communities, 2021b), last revised in July 2021, states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

11.5.19 The NPPF states that when determining planning applications, Local Planning Authorities (LPA) should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific Flood Risk Assessment. Development should only be allowed in areas at risk of flooding where, in light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- The development is appropriately flood resistant and resilient;
- It incorporates Sustainable Drainage Systems (SuDS), unless there is clear evidence that this would be inappropriate;
- Any residual risk can be safely managed; and
- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

11.5.20 Major developments should incorporate SuDS unless there is clear evidence that this would be inappropriate. The systems used should:

- Take account of advice from the LLFA;
- Have appropriate proposed minimum operational standards;
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- Where possible, provide multifunctional benefits.

Local policy

North East Lincolnshire Local Plan 2013 – 2032

11.5.21 The proposed development is located within the administrative area of North East Lincolnshire Council. The existing North East Lincolnshire Local Plan (North East Lincolnshire Council, 2018) was adopted in 2018 and covers the period 2013 to 2032 and includes the following policies that are of relevance to the coastal protection, flood risk and drainage:

- Policy 33 – Flood Risk in the North East Lincolnshire Local Development Plan (Ref. 12-10) states that proposals should have regard to the

requirements of the flood risk sequential test and, if necessary, the exception test. The regeneration benefits of development in areas of high flood risk should also be considered in light of the Council's Guidance Note on the application of the Sequential and Exception Tests in North East Lincolnshire, and the Environment Agency's Standing Advice.

In order to minimise flood risk impacts and mitigate against the likely effects of climate change, development proposals should demonstrate that:

- A. where appropriate, a site-specific flood risk assessment has been undertaken, which takes account of the best available information related to all potential forms of flooding;
- B. there is no unacceptable increased risk of flooding to the development site or to existing properties;
- C. the development will be safe during its lifetime;
- D. SuDS have been incorporated into the development unless their use has been deemed inappropriate;
- E. opportunities to provide natural flood management and mitigation through green infrastructure have been assessed and justified, based upon sound evidence, and, where appropriate, incorporated, particularly in combination with delivery of other aspects of green infrastructure in an integrated approach across the site;
- F. arrangements for the adoption, maintenance and management of any mitigation measures have been established and the necessary agreements are in place.

Shoreline Management Plan 3:Flamborough Head to Gibraltar Point

11.5.22 Shoreline Management Plan (SMP) 3; Flamborough Head to Gibraltar Point (Scott Wilson, 2010) covers the study area. The SMP is a large-scale assessment of the risks associated with coastal processes which seeks to reduce these risks to people and the developed, historic, and natural environments. An SMP determines the natural forces which are shaping the shoreline to assess how it is likely to change over the next 100 years, taking account of the condition of existing defences. The SMP develops policies outlining how the shoreline should be managed in the future, balancing the scale of the risks with the social, environmental, and financial costs involved, and avoiding adverse impacts on adjacent coastal areas.

11.5.23 The Port of Immingham and adjacent areas are located within SMP Policy Unit L – East Immingham to Humberston Fitties (western section). The preferred management option for this SMP policy unit area is to Hold the Line (HTL) for short (by 2025), mid (by 2055) and long term (by 2105) which is to be achieved through maintaining or upgrading the level of protection provided by the existing defences. The baseline for the impact assessment assumes that the coastal defences on site will be maintained and upgraded as necessary in order to implement the HTL policy over the next 100 years.

Humber Flood Risk Management Strategy

11.5.24 The Humber FRMS (Environment Agency, 2008) sets out the Environment Agency's vision for managing the risk of flooding from the Humber Estuary to respond to climate change and sea level rise. The Strategy sets out the Environment Agency's general approach to managing the estuary's flood defences.

11.5.25 The IERRT project area is situated within Flood Area 24 in the Humber FRMS. In line with the SMP, the preferred management option is to HTL for the short (by 2025), mid (by 2055) and long term (by 2105) which is to be achieved through maintaining or upgrading the level of protection provided by the existing defences. Again, it is assumed that the coastal defences on site will therefore be maintained and upgraded in order to implement this policy.

Grimsby and Ancholme Catchment Flood Management Plan (CFMP)

11.5.26 In 2009, a Grimsby and Ancholme Catchment Flood Management Plan (CFMP) was produced by the Environment Agency for the Grimsby and Ancholme catchment (Environment Agency, 2009), addressing the scale and extent of flooding both now and in the future, and setting policies for managing flood risk. In the area considered in relation to the proposed development, (Sub-area 4 Immingham, Grimsby, and Buck Beck) the CFMP addresses the risk posed by the tidal risk from the Humber Estuary, tide locking of local watercourses and the pumping of drainage channels. The vision and preferred management policy for the sub-area is Policy option 4: Areas of low, moderate, or high flood risk where the Environment Agency are already managing the flood risk effectively but where further actions may be taken to keep pace with climate change.

North East Lindsey Drainage Board Byelaws

11.5.27 Internal Drainage Boards (IDBs) operate in the low-lying fen and valley areas, maintaining pumping stations and drainage channels to ensure that people are safe, and the risk of flooding is greatly reduced. The North East Lindsey Drainage Board (the 'Board') extends to an area of 11,250 hectares which is formed predominantly of the coastal strip extending from the Humber bridge southwards to Grimsby.

11.5.28 The North East Lindsey Drainage Board Byelaws and Land Drainage Act 1991 allow the Board to take action to ensure that free flow of water is unrestricted.

11.5.29 Watercourses maintained by the Board are cleaned out annually and it is important that access is preserved for machinery to enable this work to be undertaken. The Board's Byelaws prevent the erection of any building, structure (whether temporary or permanent) or planting of trees/ shrubs etc. within nine metres either side of a Board maintained watercourse irrespective of any planning permission. The Board's consent will be required to undertake works such as:

- works in, over, under or within nine metres of a Board maintained watercourse;
- installation of a culvert, weir, or other like obstruction within any watercourse; and
- any works that increase the flow of surface water or treated foul effluent to any watercourse within the Board's district.

Other Plans and Guidance

North East Lincolnshire Council Local Flood Risk Management Strategy (LFRMS)

11.5.30 As LLFA, North East Lincolnshire Council has a responsibility to develop a LFRMS (North East Lincolnshire Council, 2015) which sets out a clear plan for future flood risk management in the region, ensuring people, businesses communities and other risk management authorities have an active role in how flood risk is managed.

11.5.31 The LFRMS sets out how the Council intends to manage local flood risks, as well as contribute to management from non-local sources, and to engage and inform residents on their own responsibilities and enable them to contribute to the management of flood risk.

North and North East Lincolnshire Strategic Flood Risk Assessment (SFRA)

11.5.32 North and North East Lincolnshire Council Level 1 SFRA was published in 2011 (North Lincolnshire Council and North East Lincolnshire Council, 2011) to support the assessment of development sites in relation to flood risk. The SFRA was completed in consultation with the Environment Agency and IDB to provide information on the probability of flooding. The report also takes into account the impacts of climate change.

11.5.33 It is intended that the SFRA will be used by North East Lincolnshire Council's planning and building control department to inform the application of the Sequential Test when allocating land or determining applications, in line with the NPPF.

11.5.34 The SFRA locates the site within the Eastern Coastal Area where the main source of flooding is a combination of large waves and high water levels in the Humber Estuary. A more detailed assessment has been undertaken as part of the Level 2 SFRA for Flood Compartment 1T3 – Immingham and North Killingholme which indicates the Immingham area is liable to flooding should a breach of the flood defences occur.

Anglian Water's Policy for Surface Water Drainage

11.5.35 This document (Anglian Water, 2021) provides guidance on Anglian Water's position regarding the management of surface water arising from new and redeveloped areas. The document provides a series of design criteria for types of development. The developer must demonstrate that the site does

not increase flood risk both within the development and elsewhere, and that the surface water hierarchy has been considered.

11.5.36 In order of preference, the disposal hierarchy should be in the following order;

- Discharge by infiltration into the ground,
- Discharge to an open surface water body,
- Discharge to a surface water sewer, discharge to a combined sewer,
- Discharge to a foul sewer.

11.5.37 Surface water design criteria for connections to the existing network are provided, although these are not considered relevant to the IERRT project which will discharge surface water directly into a watercourse/ the sea.

Non-Statutory Technical Standards for Sustainable Drainage Systems

11.5.38 The Non-statutory Technical Standards for Sustainable Drainage Systems (Defra, 2015) was published by Defra in March 2015 and is the current guidance for the design, maintenance, and operation of SuDS. The standards set out the following:

- Peak runoff rates should be as close as is reasonably practicable to the greenfield rate, but should never exceed the pre-development runoff rate;
- The drainage system should be designed so that flooding does not occur on any part of a development site for a 1 in 30 year rainfall event, and that no flooding of a building (including basement) would occur during a 1 in 100 year rainfall event; and
- Pumping should only be used when it is not reasonably practicable to discharge by gravity.

11.5.39 Further industry good practice guidance on the planning for and design of SuDS is provided by C753 - The SuDS Manual (Construction Industry Research and Information Association (CIRIA) 2015).

11.6 Preliminary description of the existing environment

11.6.1 Baseline conditions established for this assessment are based on the collation and review of a wide range of data and information from published material and consultations with statutory bodies and other stakeholders.

11.6.2 The relevant baseline physical characteristics of the study area and the water features present are described in this section and with reference to Image 11.1.

Coastal Protection

11.6.3 There are tidal flood defences in place along the entire south bank of the Humber Estuary.

11.6.4 ABP is responsible for the sea walls around its land at Immingham Docks which is offered by concrete sheet piled walls, concrete revetment walls topped with rock filled gabion baskets. Information from the Environment Agency show the flood defences, along the Port of Immingham frontage up to Habrough Marsh Drain, have a crest elevation of 5.05 m above ordnance datum (AOD) and a wall height of 0.84 m resulting in a total defence elevation of 5.89 m AOD.

11.6.5 Topographic survey undertaken for ABP in 2018 indicates a varying crest height along the Immingham Dock frontage with levels between 5.52 m AOD and 6.15 m AOD. The crest level of the defences shown on the topographic survey for the section of defences in the location of the proposed jetty are approximately 5.80 m AOD – 6.0 m AOD with a low spot of 5.52 m AOD.

11.6.6 Lock gates are used to control levels within the dock. Both lock structures are protected by an external flood gate. Following the tidal storm surge in December 2013 the standard of protection afforded by the external lock gate to the docks was improved via the installation of new outer lock gates with reverse head restraint capability and a crest height of 6.5 m AOD.

11.6.7 To the east of Habrough Marsh Drain, the existing Environment Agency flood defences consist of an earth embankment topped by a concrete wave return wall comprising a smooth concrete or asphalt seaward face.

11.6.8 ABP is responsible for the flood defences along the frontage of Immingham Docks. The flood defences along the wider Humber Estuary south bank frontage are maintained by the Environment Agency. However, the Environment Agency are responsible for inspecting the condition of all of the flood defences and have confirmed that the condition of the flood defences adjacent to the site are classed as 'fair' (Condition Grade 3). The Environment Agency inspects these defences regularly to ensure that any potential defects are identified early.

11.6.9 In relation to the flood defences located within the Site (Compartment IT3 Immingham and North Killingholme), the North East Lincolnshire Council SFRA states:

> *"ignoring freeboard, these defences will protect the area behind against events with a 0.2 % annual probability of occurring or better. The standard will remain above the 0.5 % annual probability requirement set out in PPS25 for the next 50 years, taking the effect of sea level rise into account".*

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

11.6.11 The majority of port infrastructure, including the site, is located within Flood Area 24 'containing major industrial and commercial facilities, including wharves, storage areas, petro-chemical and power plant'. The area also contains important road and rail links and high voltage powerlines, while most undeveloped land is used for agriculture. Along with the industrial development, the defences are protecting over 11,500 properties (at risk in Area 24). The proposed management approach policy for this frontage is for continued protection and improve the defences that protect existing development.

11.6.12 The Environment Agency have confirmed there are currently no ongoing capital projects to reduce or sustain the current flood risk to the IERRT site.

Flood Risk

11.6.13 A preliminary FRA has been undertaken to ascertain if the proposed development site is at risk of flooding or if the proposed development of the site would cause an increase in offsite flood risk. The FRA has been prepared in accordance with the NPPF and supporting Technical Guidance. For further information on flood risk, the preliminary FRA (AECOM, 2021) should be consulted (see Appendix 11.1 PEIR Volume 3), although the sections below provide selected flooding details.

Historical Flooding

11.6.14 The Port of Immingham has a history of flooding from tidal surges, notably in 1953 and in 2013.

11.6.15 The December 2013 surge event inundated the port on 5 December with a maximum flood water level of approximately 5.22 m AOD, equivalent to a 1 in 750 year event.

11.6.16 The flooding resulted primarily from inundation of the quayside as water levels rose above the lock/dock cope levels and filled the enclosed dock basin via the lockpit. In addition, tidal water also overtopped a section of gabion baskets along the frontage on the western part of the port, approximately 3 km away from the project area (this area has now been repaired), with further slight ingress (backflow) through the drainage system where flap valves failed to close properly. Maximum flood depths of up to 0.5 – 1 m were identified at locations across the port centred around the enclosed dock basin which was the primary source of flooding due to the older, lower outer lock gates allowing water to enter the lockpit and enclosed dock. These outer gates have now been replaced with gates that have a higher crest height and are capable of being held in position against a reverse head of water (reverse head restraint system) . Subsequent surveys undertaken by ABP post flood event indicate the application area did not flood.

Tidal Flooding

11.6.17 The main risk of flooding for the IERRT project will typically be associated with a storm surge event. Storm surges result from low pressure weather systems, high winds and tidal conditions which change the sea level. Storm surges can lead to extensive flooding over a wide area and are dangerous to people in coastal areas.

11.6.18 The site lies within tidal Flood Zone 3a, defined by the 'Planning Practice Guidance: Flood Risk and Coastal Change', as having a high probability of flooding. Flood zone 3a is classified as land having a 1 in 100 or greater annual probability of river flooding, or land having a 1 in 200 or greater annual probability of sea flooding.

11.6.19 The Environment Agency Flood Map for Planning (FMfP) showing the extent of Flood Zone 3, assuming no defences exist, is provided in Image 11.1 below.

11.6.20 Although not indicated on Image 11.1, the proposed development site is protected from flooding associated with tidal sources up to and including a 0.5 % AEP flood event due to the presence of tidal flood defences along the south bank of the estuary (see Coastal Protection subsection above). However, areas behind the defences are still considered to be at residual risk of flooding through overtopping or failure of the defences although the likelihood of either occurring is low.

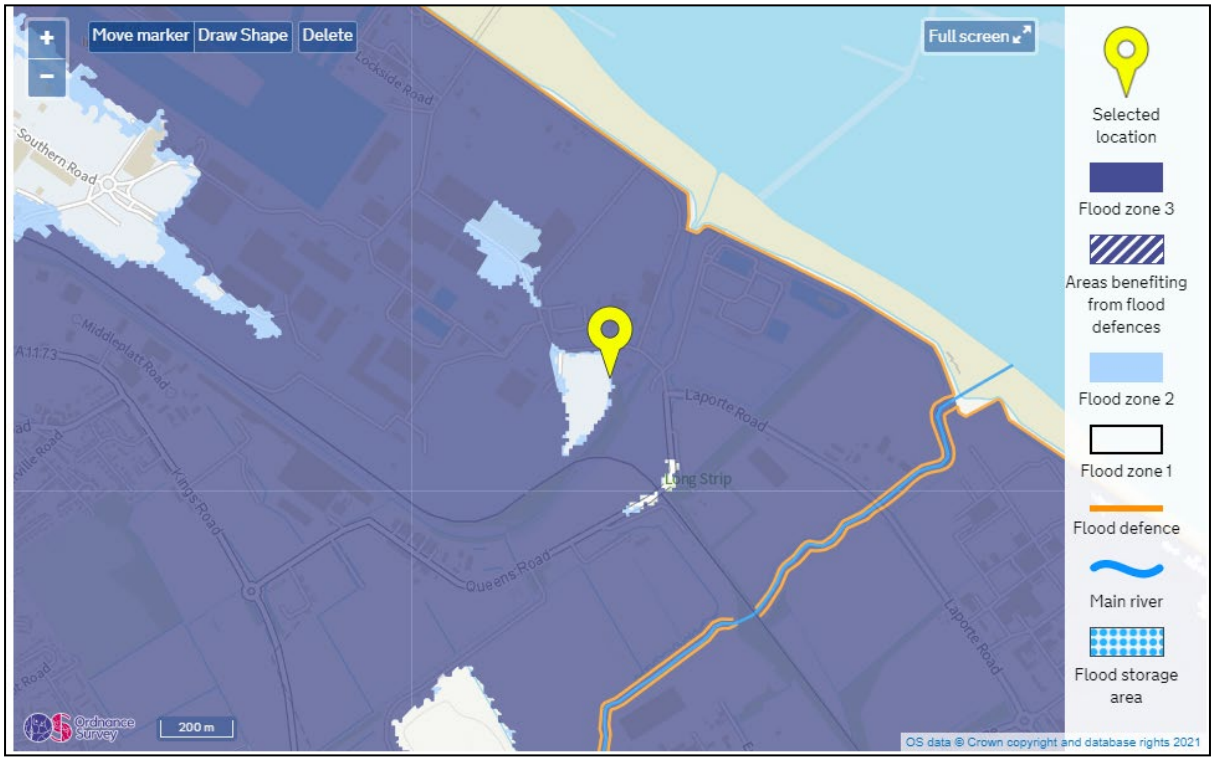

Image 11.1. Environment Agency Flood Map for the Immingham Eastern Ro-Ro Terminal project

Extreme Water Levels

11.6.21 Current extreme predictions determined by the Environment Agency for the Port of Immingham are considered to be the most up-to-date and appropriate for this review (Environment Agency, 2018). These are provided in Table 11.6 for a baseline year of 2017.

Table 11.6. Summary of consultation to date

Return Period (Years)	Annual Exceedance Probability (AEP) (%)	Extreme Water Level (mODN)
1	100	4.15
2	50	4.25
5	20	4.40
10	10	4.51
20	5	4.62
25	4	4.66
50	2	4.77
75	1.3	4.85
100	1	4.90
150	0.67	4.97
200	0.5	5.03
250	0.4	5.06
300	0.33	5.10
500	0.2	5.20
1,000	0.1	5.34
10,000	0.01	5.85

Source: Environment Agency, 2018

11.6.22 Based on the information in Table 11.6 the following extreme still water level for the Port of Immingham is 5.03 m AOD for a 0.5 % (1 in 200 year) AEP event and 5.34 m AOD for a 0.1 % (1 in 1000 year) AEP event.

11.6.23 The maximum water level currently recorded at Immingham occurred on 5 December 2013 at 19:00 hours with a level of 5.216 m AOD (equivalent to a 1 in 750 year event) compared to the prediction of 3.689 m AOD, therefore, the meteorological surge effect was 1.527 m.

11.6.24 The proposed development site is protected from flooding associated with tidal sources up to and including a 0.5 % AEP flood event due to the presence of tidal flood defences along the south bank of the estuary (see Coastal Protection subsection above)

11.6.25 Areas located behind the defences are however, still considered to be at residual risk of tidal flooding through overtopping or failure of the defences, although the likelihood of either occurring is low.

Breach of Defences

11.6.26 The Environment Agency has provided breach location and associated breach flood extent maps from the Northern Area Tidal Breach Mapping Study (presented in Annex 1 of Appendix 11.1 FRA , PEIR Volume 3). The

Northern Area Tidal Breach Hazard Mapping project involved a modelled representation of tidal breaches along the east coast and the south bank of the Humber Estuary, with breaches in the hard defences set at 20 m wide with the defences assumed to breach down to the ground level behind the defence. The defences were raised within the model to create reservoir cells, ensuring that the most precautionary volumes of water were driven through the breach opening.

11.6.27 The breach modelling is based on the Still Water Tidal Levels from the Northern Area Tidal Model Analysis 2006 including a 100 % (1 in 1) AEP wave height allowance (current year 2006 and 2115).

11.6.28 The Breach Hazard Mapping shows the following:

- For a current day (2006) 0.5 % and 0.1 % AEP breach event the west and southern areas of the site are not located within the breach flood extent;
- The southern parcel of land (to the south of Habrough Marsh Drain, is located in a 'Danger to All' hazard area with a maximum water depth of 1.8+m and a maximum water velocity of 0.3-1 m/s for both the 0.5 % and 0.1 % AEP events; and
- the south east of the site, directly adjacent to the Humber Estuary is located in a hazard area classified as 'Danger to Most' with a maximum water velocity of 0-0.3 m/s for both the 0.5 % and 0.1 % AEP flood events. Maximum water depth increases from 0.25-0.5 m (0.5 % AEP flood event) to a depth of 1-1.8 m (0.1 % AEP flood event).

11.6.29 Although a breach of the flood defences would represent a significant to extreme hazard, the likelihood of a breach is low.

Overtopping of Defences

11.6.30 The Environment Agency has provided flood extent maps from the Northern Area Tidal Overtopping Hazard Mapping Study for the 0.5 % AEP (1 in 200) and the 0.1 % AEP (1 in 1,000) overtopping scenarios (presented in Annex 1 of Appendix 11.1 FRA , PEIR Volume 3) . The modelling is based on the Still Water Tidal Levels from the Northern Area Tidal Model Analysis 2006 including a 100 % AEP (1 in 1) wave height allowance (current year 2006 and 2115).

11.6.31 The flood hazard maps indicate that for the 2006 0.5 % AEP breach event:

- the west and south of the site are located outside of a hazard area;
- the southern parcel of land (to the south of Habrough Marsh Drain, is in an area of 'Low Hazard' with a maximum water depth of 0-0.25 and a maximum water velocity of 0.3 – 1 m/s; and
- the south east of the site, directly adjacent to the Humber Estuary is located in a hazard area classified as 'Danger to Most' with a maximum water depth of 1-1.8 m and a maximum water velocity of 0-0.3 m/s.

11.6.32 During a 0.1 % AEP overtopping event the entire IERRT project site is located in an area classified as 'Danger for All', with a maximum water depth of 1 to 1.8+ m and a maximum water velocity of approximately 1 to 1.5 m/s.

11.6.33 Although overtopping of the flood defences would represent a significant hazard, the likelihood of overtopping is low.

Fluvial Flooding

11.6.34 The Stallingborough North Beck is located approximately 400 m to the south east of the IERRT project site and is designated as an Environment Agency 'Main River'. The Drain is an embanked upland river which receives pumped surface water runoff from south, central, and east Immingham as well as land drainage run off from West Lindsey. The North Beck discharges by gravity, via a sluice gate, into the Humber Estuary.

11.6.35 The Habrough Marsh drain is designated as an 'Ordinary Watercourse' and falls under the jurisdiction of the North East Lincolnshire IDB. The watercourse largely skirts the southern and western perimeters of the port estate flowing between the northern and southern parcels of land and discharges partly to the estuary and partly to the Stallingborough North Beck through the Immingham Pumping Station.

11.6.36 In addition, there are numerous drains and small watercourses beyond the port estate that form part of the North East Lindsey Internal Drainage Board (NELIDB) land drainage system for the low- lying coastal area.

11.6.37 The Flood Map for Planning (shown in Image 11.1) illustrates that the proposed development site is located predominantly within Flood Zone 3 (high risk) defined as land having a >1 %/ 0.5 % AEP (greater than a 1 in 100/ 1 in 200 chance in any year) of river or sea flooding. However, this map does not differentiate between the tidal and fluvial sources of risk and the tidal defences are not taken into account.

11.6.38 Mapping in Section 2.4 of the North East Lincolnshire Preliminary Flood Risk Assessment (PFRA) gives some indication of fluvial flood zones and suggests that the IERRT project site is located in Flood Zone 1.

11.6.39 The SFRA notes that hydraulic modelling of the Stallingborough North Beck was undertaken in 2009. The results indicate that the water level having a 1.0 % annual probability of occurring varies from 3.37 m AOD at the outfall to 4.40 m AOD at the upstream end of the model located at the B1210 road bridge crossing approximately 3 km upstream (Paragraph H.49, SFRA).

11.6.40 Further data provided by the Environment Agency on fluvial flooding is provided in Appendix 11.1: FRA (PEIR Volume 3).

11.6.41 Based on the available information it has been determined that the proposed development site is at a 'low' risk of flooding from fluvial sources.

Groundwater Flooding

11.6.42 Groundwater flooding occurs when water levels in the ground rise above surface elevations. It is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

11.6.43 The North East Lincolnshire Council PFRA states *"Generally the risk of flooding from groundwater is in the coastal areas from Immingham to Humberston, i.e. the lower lying parts of the Borough. This is caused by artesian spring flows from confined chalk where high groundwater pressures force an upward flow path through the confining clay*" (Page 26).

11.6.44 Groundwater levels tend to get re-charged during the winter and high groundwater levels can cause flooding as the water table rises. This rise in water table levels can be very slow, dependent on rainfall patterns. There is no reference to groundwater flooding events in in the North East Lincolnshire SFRA for the Eastern Coastal Area where the IERRT project is located.

11.6.45 There are no historical flood records for groundwater flooding within the site boundary or the wider Port of Immingham area.

11.6.46 The IERRT Phase 1 Geoenvironmental and Geotechnical Desk Study includes historical boreholes records in proximity to the site, however although these logs show the geology encountered, groundwater strikes were not recorded.

11.6.47 Given the limited information on groundwater and potential for groundwater flooding in the area, the preliminary assessment for the risk of flooding from groundwater sources is assessed as a medium risk.

Surface Water Flooding

11.6.48 Surface water flooding is caused by overland flow that results from rainfall that fails to drain into the ground through infiltration, instead travelling over the ground surface. This can be exacerbated where the permeability of the ground is low due to the type of soil (such as clayey soils) and geology or land use including urban developments with impermeable surfaces.

11.6.49 The Environment Agency 'Risk of Flooding from Surface Water' mapping indicates areas at risk from surface water flooding when rainwater does not drain away through the normal drainage systems or soak into the ground, but instead lies on or flows over the ground. The mapping indicates that the proposed development site is generally not at risk from surface water flooding, classifying the majority of the land to be at 'very low' risk of flooding from surface water.

11.6.50 There are small, isolated areas of the site shown to be at low, medium, and high risk of surface water flooding predominantly to the southern corner of the proposed development site and to the west in the area most recently

used as a storage area/car park for newly imported vehicles. However, it is considered that these areas shown to be at risk are reflective of areas of low topography where water sits and pools during higher return period storm events.

11.6.51 The risk of flooding from surface water is considered to be low.

Flooding from existing drainage infrastructure and sewers

11.6.52 Drainage infrastructure present within the proposed development site and the area in proximity to the site boundary is outlined in the Drainage Section below.

11.6.53 There is limited information on the existing drainage network. Large paved areas comprising either roller compacted concrete, pavement quality concrete or asphalt appear to have very little surface water drainage. Gulleys within the proposed development site have been identified, however these systems appear blocked and therefore considered un-useable.

11.6.54 There appears to be a small amount of drainage infrastructure that discharges to the existing pumping station, which is pumped to the Humber Estuary, along with treated foul effluent via a 600 mm pumped main which is likely to be retained.

11.6.55 When tidal levels are high, discharge from drainage infrastructure can become tide locked which can cause surcharging of the system and flooding. This can be further exacerbated if higher sea levels inundate the discharge outlets of the drains along the Immingham frontage, thus delaying or preventing the drainage of floodwater.

11.6.56 Given the limited presence of drainage infrastructure within the proposed development site boundary and the localised nature of drainage infrastructure within the wider Port of Immingham, the risk of flooding from drainage infrastructure and sewers is considered to be low.

11.6.57 Further data is provided in the Preliminary FRA at Appendix 11.1 (PEIR Volume 3) and an outline drainage strategy will be undertaken as part of the full ES.

Flooding from Artificial Sources

11.6.58 The Environment Agency Long-term Flood Risk maps indicate the proposed development site is not considered at risk from reservoir flooding.

11.6.59 There are no canals, lakes, or other artificial water sources in proximity to the proposed development site.

11.6.60 The risk of flooding to the proposed development site from all artificial waterbodies is therefore considered to be low.

Drainage

11.6.61 Anglian Water asset mapping shows there is no surface water drainage infrastructure for which Anglian Water have responsibility located within the proposed development site boundary. Drainage of surface water within both the site and the wider Port of Immingham is privately owned.

11.6.62 A 600 mm diameter Anglian Water foul sewer main runs parallel with right bank of Habrough Marsh Drain.

11.6.63 Foul and surface water management infrastructure at the Port of Immingham is comprehensive and comprises the following:

- Numerous drainage outfalls (flap gate culverts) provide drainage to the Humber Estuary directly, via Immingham Lock or through adjacent drainage channels;
- Pumping pits across the port estate allow drainage water in low elevated areas to be pumped from drainage points into the Humber (either directly or indirectly via Immingham Dock);
- Drain interceptors across the port estate prevent contaminants from entering the drainage systems;
- Sewage treatment plants provide treatment of effluent on-site before being discharged to the Humber; and
- An extensive network of drainage pipes, channels, and manholes.

11.6.64 For the IERRT project site there is at present limited available information on the existing drainage network. Large paved areas comprising either roller compacted concrete, pavement quality concrete or asphalt appear to have very little surface water drainage. Initial drainage investigations undertaken in 2019 have noted some gullies have been identified but appear blocked and have been deemed unusable.

11.6.65 There appears to be a small amount of drainage infrastructure that discharges to the existing pumping station in the area near the proposed terminal building. The pumping station receives surface water drainage and process water from the Port of Immingham to the west of the site and this gets pumped out into the Humber Estuary, along with treated foul effluent via a 600 mm pumped main.

11.6.66 There are four discharge outfalls along Habrough Marsh Drain within the site boundary. In addition, there is a discharge to the Humber Estuary at the northern corner of the site, adjacent to the location of the proposed jetty.

11.6.67 There are seven cesspits located within, or in proximity to, the site boundary with the majority located in the eastern section of the proposed development site clustered near the location of the proposed overbridge, and two pumping pits, one near the proposed overbridge location and the second, to the south, within the proposed parking/storage area.

11.7 Future baseline environment

11.7.1 In the absence of the IERRT project the existing coastal defence and drainage structures within the port estate would be maintained and hydrodynamic and sedimentary processes will continue to be influenced by natural and human-induced variability, ongoing cyclic patterns, and trends (e.g. ongoing maintenance dredging and disposal).

11.7.2 The future baseline will also be influenced by climate change. The primary way in which climate change may interact with the proposed development site is through:

- Changes in storminess/storm surges, wave heights, and sea levels, posing an increased risk of coastal damage and tidal flooding.
- Changes in rainfall intensity increasing peak river flows, posing an increased risk of fluvial flooding and property damage; and
- Changes in rainfall intensity increasing surface water runoff (overland flow), posing an increased risk of pluvial and drainage/sewer flooding.

11.7.3 Published in November 2018 (Met Office, 2018), the UK Climate Projections 2018 (UKCP18) is the official source of information on how the climate of the UK may change over the rest of this century. The UKCP18 projections replace the UKCP09 projections.

11.7.4 In coastal locations, where developments are sensitive to flood risk and/or have a lifetime of at least 100 years, it is recommended that both the current allowance in 'Flood risk assessments: climate change allowances' and the 95th percentile of UKCP18 'Representative Concentration Pathway (RCP) 8.5' scenario (high emissions scenario) standard are used to assess the impact of climate change over the lifetime of a proposed development. Both data sets have been used to inform this preliminary assessment.

11.8 Preliminary Consideration of Likely Impacts and Effects

11.8.1 This section identifies the potential likely effects on the coastal protection, flood risk and drainage receptors as a result of the construction and subsequent operation of the IERRT project which have been identified at this preliminary stage.

11.8.2 Cumulative impacts on coastal defence, flood risk and drainage could arise as a result of other coastal and marine developments and activities in the Humber Estuary will be considered as necessary as part of the cumulative impacts and in-combination effects assessment, as set out in Chapter 20 of this PEIR.

Summary of Resource/Receptor Value

11.8.3 This assessment considers the following resources/receptors:

- Human Health;
- Flood Defences;
- Surface Waterbodies;
- Existing and Proposed Development; and
- Surface Water Drainage Infrastructure.

11.8.4 Resources/receptors assessed to have a value (sensitivity) of Medium or higher are assessed against likely impacts, effects, and mitigation measures. The results of this preliminary assessment are summarised in Table 11.7.

Table 11.7. Resource/Receptor Value (Sensitivity)

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Human Health	Public and Visitors to Site	On-site	High	Public and visitors on-site will be the most at risk as human health receptors due to the proximity to flood risk sources and lack of knowledge on site processes should flooding occur.
	Construction Crew and operatives with prior knowledge of site conditions	On-site	Medium	Construction workers and operatives on-site are at risk as human health receptors due to the proximity to flood risk sources. However, given prior knowledge of site conditions there is an increased awareness of flood risk issues and evacuation procedures.
Flood Defences	Flood defence walls	On-site (along the site boundary frontage)	High	Floodplain or defence protecting between 10 and 100 residential properties or industrial premises from flooding.
		Off-site (along the	Very High	Floodplain or defence protecting more than

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
		wider Port of Immingham frontage)		100 residential and industrial properties from flooding.
Existing/Proposed Development	Built development	On-site	Medium	Development on site is predominantly storage/ commercial use classed as Less Vulnerable development.
		Off-site	Medium	Development within the wider Port of Immingham is predominantly port/storage/commercial/ industrial use based classified as Less Vulnerable development
Surface Water Drainage Infrastructure	Piped drainage network	On-Site	Low	There are no discharges to the regional Anglian Water sewer system from the site. Effluent generated on-site within the Port of Immingham is treated by the on-site sewage treatment plants before being discharged to the Humber Estuary. Surface water drainage infrastructure on site is limited.
	Habrough Marsh Drain	Off-site	High	Habrough Marsh Drain forms part of the locally pumped IDB drainage network managing surface water across low-lying land.

Construction phase

11.8.5 This section contains an assessment of the potential impacts as a result of the construction phase of the IERRT project.

11.8.6 The following impact pathways have been assessed:

- Exposure to floodwater;
- Changes in tidal regime;
- Floodplain inundation from flood sources;
- Changes to flow regimes and/or water levels; and
- Changes to surface water run-off rates and volumes.

Exposure to floodwater

11.8.7 The location of the IERRT project (immediately adjacent to the Humber Estuary) presents risks to site workers during construction. The risks associated with working close to water during flood or storm events include risk of drowning, risk of injury, risk of swallowing contaminated water and risk of hyperthermia.

11.8.8 It is difficult to estimate the likely severity of any flood events or storms which may occur during construction as events cannot be forecast so far into the future. For the purposes of the assessment it is conservatively assumed as a worst case scenario that a major flood would occur during the construction period.

11.8.9 As flooding presents a risk to human health, mitigation measures should include preparation and implementation of a flood response plan within the CEMP for the construction phase. More details are provided in Section 11.9.

Changes to tidal regime

11.8.10 Dredging operations associated with the marine element of the proposed development will change seabed levels and has the potential to change wave heights, tidal water levels and the rates of erosion or accretion on the foreshore in proximity to the flood defences during the construction phase. Impacts relating to the proposed development and changes to the tidal hydrodynamic regime are discussed in detail within Chapter 7 Physical Processes.

11.8.11 In summary, for the construction phase of the proposed development Chapter 7 Physical Processes concludes that the local hydrodynamics, the existing (background) suspended sediment concentration (SSC) levels within the estuary and the proposed dredge and disposal works have all been considered and conditions during the construction phase are likely to remain the same as that which already occurs in the baseline scenario.

11.8.12 As the local hydrodynamics will remain comparable to the baseline scenario it is considered that there will be no change to wave heights, tidal water levels and the rates of erosion or accretion on the foreshore (above natural

variations) both on-site (along the frontage of the proposed development site) and off-site (along the frontage of the wider Port of Immingham.

Floodplain inundation from flooding sources

11.8.13 During periods of inclement weather there is the potential that flooding to the proposed development site could occur from tidal, fluvial, surface water and drainage sources.

11.8.14 The proposed development site is afforded protection by flood defences up to and including the 0.5 % AEP flood event and is therefore considered to be at low risk of tidal flooding. However, the residual risk of site inundation remains should the defences overtop (during a storm surge) or breaching of the defences occur. The site of the proposed approach jetty and the southern parcel of land are located in a hazard area designated as 'Danger to Most'. Flooding from tidal sources would impact human receptors (site workers and construction crew), cause damage to existing development and construction equipment and disrupt site operations, both within the site boundary and wider Port of Immingham.

11.8.15 The proposed development site is considered to be at low risk of flooding from surface water and drainage infrastructure sources.

11.8.16 Section 11.9 outlines mitigation for the construction phase of the proposed development, including flood resilience and resistance measures, a flood response plan, subscription to the Environment Agency Flood Warning Service and temporary drainage infrastructure. These measures will ensure the development remains safe over its operational lifetime.

Changes to flow regimes and/or water levels

11.8.17 The tidal/fluvial baseline risk could be exacerbated during construction works from an increase in impermeable areas such as compacted soils, and the presence of stockpiled materials and equipment temporarily stored on the floodplain.

11.8.18 The baseline flood risk from Habrough Marsh Drain could be exacerbated during construction works by in-channel works associated with the new drainage outfalls that may temporarily constrict or alter the flow within the channel. Sediment, construction materials and equipment may also be washed downstream where it may block the channel and lead to or increase the risk of flooding.

11.8.19 However, with the implementation of standard construction methods and mitigation as will be detailed in the draft CEMP, this risk can be effectively managed (for example by monitoring weather forecasts and Environment Agency flood warnings, by undertaking works close to watercourses during periods of dry weather, by ensuring an adequate temporary drainage system is in place and maintained throughout the construction phase and avoiding stockpiling material on floodplains).

Changes to surface water run-off rates

11.8.20 During the construction phase of the scheme, the impermeable area within the Site may increase. This has the potential to result in a short-term increase in surface water runoff from the proposed development site.

11.8.21 The tidal/fluvial baseline risk could be exacerbated during construction works by the temporary increase in the rate and volume of surface water runoff from an increase in impermeable areas such as compacted soils.

11.8.22 Any construction works on the floodplain have the potential to increase the rate and volume of surface water run-off

Operational phase

11.8.23 This section contains an assessment of the potential impacts as a result of the operational phase of the IERRT project. The following impact pathways have been assessed:

- Exposure to floodwater;
- Changes in tidal regime;
- Floodplain inundation from flood sources;
- Changes to flow regimes and/or water levels; and
- Changes to surface water run-off rates and volumes.

Exposure to floodwater

11.8.24 Given the location of the proposed development site exposure to flood water to human receptors over the lifetime of the development remains, although the majority of human receptors will be transient in nature. Receptors may change from the assumed baseline conditions and may include site workers, commercial users, and visitors.

11.8.25 Although the severity of any flood events or storms which may occur is difficult to estimate it is likely that the risk of flooding from a storm surge or extreme storm event will increase as a consequence of climate change over the lifetime of the development. The depth of tidal flooding, flood water velocity and flood hazard will increase both on-site and across the wider Port of Immingham area.

11.8.26 As the risk to human health as a consequence of flooding remains a risk, mitigation measures should include preparation and implementation of an updated flood response plan (detailing access and egress routes, evacuation plans, and the location/use of safe refuge), site inductions, weather monitoring and monitoring flood warnings issued by the Environment Agency.

Changes to tidal regime

11.8.27 The marine development and associated maintenance dredging operations will change sea bed levels and, in addition to the predicted increases in

wave height, peak water level associated with climate change, has the potential to change wave heights, tidal water levels and increase the rates of erosion and/ or accretion on the foreshore in proximity to the flood defences over the operational lifetime of the development. Impacts relating to the marine development and changes to the tidal regime for the operational phase are discussed in detail within Chapter 7 Physical Processes.

11.8.28 In summary, for the operational lifetime of the proposed development Chapter 7 Physical Processes concludes:

- Marginal changes to hydrodynamics (local flow speed) are likely to result from the IERRT within, and adjacent to, the proposed berth pocket. Slight changes in flow speed are predicted to extend up-estuary to Immingham Outer Humber (IOH) and down-estuary past the Immingham Oil Terminal (IOT) jetty. The largest predicted magnitude of change is anticipated within the berth pocket itself (particularly towards the landward edge, as a result of the larger proposed dredge depths);
- Marginal changes to significant wave height are likely to result from the IERRT within, and adjacent to, the proposed berth pocket. For the various wave events assessed, slight changes in wave height (typically less than ±5 % of baseline values) are predicted to extend up-estuary as far as the Immingham west jetty (for a wave event approaching from the southeast). The largest predicted magnitude of change is anticipated in close proximity to the berth pocket itself; and
- Future maintenance dredging will result in smaller changes in SSC and sedimentation (within the dredge plumes and at the disposal site) compared to the (construction) capital dredge. Furthermore, the predicted impacts from future maintenance dredging will be similar to that which already arises from the ongoing maintenance of the existing Immingham berths.

11.8.29 Based on the above information there is potential for the current hydrodynamic processes to change over the lifetime of the proposed development. It is possible that flow speeds and wave heights might increase, albeit it a marginal increase in the area between the berth pocket and the proposed development site frontage as well as along the wider Port of Immingham frontage. Any change is, however, predicted to be negligible and unlikely to affect the integrity of the flood defences in these areas. It is unlikely that changes to tidal water levels and the rates of erosion or accretion on the foreshore (above natural variations) both on-site (along the frontage of the proposed development site) and off-site (along the frontage of the wider Port of Immingham will increase above that which would currently occur when climate change is taken into account.

Floodplain inundation

11.8.30 With rainfall intensity, peak water levels, sea water level and wave heights set to increase, as a consequence of climate change, over the lifetime of the development, the likelihood of flooding occurring to the proposed development site and the wider Port of Immingham from all sources will

increase. This potential increase in flood risk will result in damage to the development and disruption of site and port operations.

11.8.31 In line with SMP 3 and FRMP 'Hold the Line' management policy it is assumed that the crest height of the defences will be raised to maintain the 0.5 % AEP standard of protection afforded by the flood defences over the lifetime of the development. However, the residual risk of flooding from overtopping and breach events will still remain. By the year 2115, should a breach event occur, the site will be located in a 'Danger to All' (landward side of the approach jetty and southern parcel of land) or 'Danger to Most' (land to the north west and west) hazard area. For an overtopping event, the entire site, and the Port of Immingham, is located in a 'Danger for All' hazard area with maximum flood depths exceeding 1.8 m in places.

11.8.32 Section 11.9 outlines embedded mitigation for the operational phase of the development, including flood resilience and resistance measures, subscription to the Environment Agency Flood Warning Service and drainage infrastructure designed in line with the Drainage Strategy and good practice to attenuate surface water run-off. These measures will ensure the development remains safe for the duration of its operational lifetime.

Changes to flow regimes and/or water levels

11.8.33 New drainage outfalls to the Habrough Marsh Drain are proposed as part of the surface water drainage network to manage surface water run-off on-site.

11.8.34 Surface water will be discharged to the watercourse at a restricted run-off rate that provides betterment over the baseline scenario. Correspondence with North East Lindsey IDB indicates a 70 % decrease from current surface water run-off rates will be required potentially freeing up capacity within the watercourse.

11.8.35 Drainage infrastructure will be designed to attenuate surface water flows and reduce discharge rates to provide a betterment over present day surface water run-off rates and ensure that the risk of surface water flooding does not increase over the duration of the proposed developments lifetime. A Drainage Strategy will be produced as part of the full ES.

Changes to surface water run-off rates

11.8.36 An increase in rainfall intensity over the lifetime of the development will increase surface water runoff rates and volumes from impermeable surfaces on site with potential for the increased risk of flooding from surface water and drainage infrastructure sources.

11.8.37 Drainage infrastructure will be designed to attenuate surface water flows and reduce discharge rates to provide a betterment over present day surface water run-off rates. A Drainage Strategy will be produced as part of the full ES.

11.9 Mitigation measures

11.9.1 Where the Effect (Significance) is determined to be Moderate or higher mitigation measures are required. Mitigation measures are summarised in the next section and presented in Table 11.8.

Construction phase mitigation

11.9.2 Construction phase mitigation measures that are proposed to be implemented in relation to coastal protection, flood risk and drainage are summarised below.

11.9.3 For the purposes of this assessment, it is assumed that the measures set out below would be required of any contractors undertaking construction work in relation to the proposed development.

Management of Flood Risk

11.9.4 ABP are subscribed to the Environment Agency's Flood Warning Direct Service and therefore will receive flood warnings for the Port of Immingham area should risk of a flood event occur.

11.9.5 Preparation and implementation of a flood response plan for the construction phase of the development. This will inform and assist the site occupants on the protocols and procedures required to overcome the risk of flooding and emergency evacuation in the event of a flood occurring from the Humber Estuary.

11.9.6 All construction workers will undergo site induction training prior to being allowed access. This will include instructions on what to do in the event of emergency incidents such as flooding, access and egress routes and the location of safe refuge, if required.

11.9.7 As a precaution, flood resilience measures can be incorporated into the proposed development to minimise the amount of damage and reduce recovery time in the unlikely case of the site becoming inundated. It is recommended that during construction the opportunity be taken to adopt flood resilient design techniques for the terrestrial elements of the proposed development. The following resilient construction measures have been identified as possible options for inclusion for the project during the construction phase and will remain for the operational phase:

- Finished floor level raising;
- Use of flood resistant building materials;
- Use of water-resistant coatings;
- Use of galvanised and stainless-steel fixings;
- Raising electrical sockets and switches; and
- Safe refuge is provided (at a level above the 0.5 % AEP climate change breach water level).

11.9.8 If water is encountered during below ground construction, suitable de-watering methods will be used to prevent a temporary increase in the risk of groundwater flooding. Any significant groundwater dewatering required will be undertaken in line with the requirements of the appropriate statutory authority.

11.9.9 Safe egress and exits are to be maintained at all times when working in excavations. When working in excavations a banksman is to be present at all times.

11.9.10 Further details regarding the management of flood risk are available within Appendix 11.1: Preliminary FRA (PEIR Volume 3).

Temporary Drainage

11.9.11 Temporary drainage facilities will be provided during the construction phase, where necessary, to ensure controlled discharge of surface water run-off.

11.9.12 Where a new outfall requires construction, consent will be required from the Environment Agency and/or North East Lindsey IDB to allow outfall construction, whilst suitable method statements will need to be prepared.

11.9.13 Measures that should be considered for temporary drainage include installation of measures such as swales, silt fences, and appropriately sized settlement tanks/ponds to reduce sediment load and thus prevent blockages.

Operational phase mitigation

11.9.14 A number of embedded mitigation features are being incorporated into the design of the proposed development in order to avoid, minimise and reduce potential adverse impacts on coastal protection, flood risk and drainage, and these are described in the following sections.

Flood Risk during Operation

11.9.15 Mitigation measures to manage the current and future flood risk during operation are described in detail in the FRA (11.1 PEIR Volume 3). It includes:

- Production and implementation of a flood response plan;
- Resilient / resistant building design;
- Placement of buildings in the areas of lowest flood hazard (towards the west and northwest of the site), where possible, within the site boundary.

11.9.16 These mitigation measures will minimise the potential for building damage and impacts on human health as much as possible.

11.9.17 It is assumed that the standard of protection afforded by the existing flood defences along the both the site frontage and the wider Port of Immingham will be kept under consideration and reviewed as appropriate to account for

climate change in line with 'Hold the line' management policies in the FRMP and SMP 3.

11.9.18 In order to protect against the residual risk of breach and the future risk from defence overtopping and breach, the critical equipment and infrastructure will be raised above the predicted 0.5 % AEP + climate event breach water levels on site.

Surface Water Drainage

11.9.19 A suitable surface water drainage network and management system will be provided for the proposed development that will provide appropriate interception, conveyance, treatment, and attenuation of surface water runoff. A Drainage Strategy will be produced as part of the full ES.

11.9.20 Detailed information on the proposed management of surface water run-off will be provided as part of the full ES , however this section outlines general drainage principles proposed for the site and are also included in Appendix 11.1 FRA (PEIR Volume 3).

11.9.21 North East Lindsey IDB has stated in their consultation response (see Table 11.5) that an acceptable discharge rate for surface water from the operational site would be a 70 % reduction in pre-development surface water run-off rates for a direct discharge to the Habrough Marsh Drain.

11.9.22 The maintenance required for SuDS and drainage networks will be based on standard guidance and practice. As the drainage system for the site will remain a private system the responsibility for management and maintenance will be undertaken by ABP. Management of the Habrough Marsh Drain will remain under the jurisdiction of the North East Lindsey IDB.

11.9.23 Although the detailed drainage design has not been completed, surface water drainage will follow the existing sites drainage catchments utilising existing routes and outfalls to surface watercourses. New outfalls will be included in the design, where required. The overall drainage system will be designed to not increase flood risk.

11.10 Limitations

11.10.1 The assessment has been undertaken based on the following assumptions:

- The information presented in this chapter is based on the information available at the time of writing this chapter and based on an emerging design. The findings reported in this PEIR chapter may be subject to change as the design of the proposed development is developed and refined through the Environmental Impact Assessment (EIA) and consultation processes; and.
- The implications of on any change in design will be re-evaluated and presented within the ES.

11.11 Preliminary Conclusions on Residual Effects

11.11.1 A summary of the impact pathways that have been assessed, the residual impacts identified once mitigation is in place and level of confidence are presented in Table 11.8.

11.11.2 Following the implementation of the mitigation methods described within this chapter, it is anticipated that all identified construction effects will be reduced to either Slight adverse or Neutral residual effects which would be expected to be predominantly localised and short term. No likely significant effects to coastal protection, flood risk and drainage have been identified at this preliminary assessment stage as a result of construction activities associated with the Immingham Eastern Ro-Ro-Terminal development.

11.11.3 It is anticipated that, following the implementation of mitigation measures, the identified operational effects of the Immingham Eastern Ro-Ro-Terminal development will be reduced predominantly to Slight Adverse. The inclusion of a new surface water drainage system on-site, including surface water attenuation, has a slight beneficial (not significant effect) to moderate beneficial effect (significant effect) on Habrough Marsh Drain and drainage infrastructure respectively.

Table 11.8. Summary of potential impact, mitigation measures and residual impacts

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Construction Phase					
Human Health Public and visitors to the site	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping or breach of defences.	Moderate/Large adverse	Site induction, including evacuation routes, safe refuge, access, and egress. Registration of site with the Environment Agency Flood Warnings Direct Service. No visitors or access during periods of inclement weather.	Slight adverse	High
Human Health Construction workers and operatives	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping or breach of defences.	Moderate adverse	Construction works would be carried out in accordance with the CEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Registration of the site with the Environment Agency Flood Warnings Direct Service. No work onsite during a flood warning period.	Slight adverse	High
Flood Defences On-site around the site frontage	Changes in tidal regime e.g. wave heights, water levels, erosion/ deposition due to dredging/ construction activities.	Neutral	No mitigation measures are proposed beyond the ongoing inspection and maintenance programme undertaken by the Environment Agency.	Neutral	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Flood Defences Off-site around wider Port of Immingham frontage	Changes in tidal regime e.g. wave heights, water levels, erosion/deposition due to dredging/ construction activities.	Neutral	No mitigation measures are proposed beyond the ongoing inspection and maintenance programme undertaken by the Environment Agency.	Neutral	High
Existing Development On-site	Floodplain inundation from tidal flooding, overland flow from fluvial/surface water sources	Slight adverse	Flood Resilience and resistant measures embedded in design. Overland flow paths maintained and temporary drainage to control surface water discharge.	Neutral or Slight adverse	High
Existing Development Off-site	Floodplain inundation from tidal flooding, impedance of overland flow routes, from fluvial/surface water sources	Neutral/Slight adverse	Overland flow paths maintained and temporary drainage to control surface water discharge.	Neutral	High
Surface Waterbodies Habrough Marsh Drain	Changes in flow regime/water level due to surface water discharge	Slight/Moderate adverse	Temporary drainage facilities (swales etc) provided during the construction phase to control discharge of surface water run-off.	Neutral	High
Drainage Infrastructure	Increased rate and volume of surface water runoff due to impermeable surfacing/ compaction	Slight adverse	Temporary drainage facilities (swales etc) provided during the construction phase to control discharge of surface water run-off.	Neutral	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Operational Phase					
Human Health Public and visitors to the site	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping or breach of defences.	Moderate/Large adverse	Site induction, including evacuation routes, safe refuge, access, and egress. Site registered with the Environment Agency Flood Warnings Direct Service. No visitors or access during periods of inclement weather.	Slight adverse	High
Human Health Site operatives and future workforce	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping or breach of defences.	Moderate adverse	Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Registration of the site with the Environment Agency Flood Warnings Direct Service. No work onsite during a flood warning period.	Slight adverse	High
Flood Defences On-site around the site frontage	Changes in tidal regime e.g. wave heights, water levels, erosion/deposition due to dredging/ construction activities.	Slight adverse	No mitigation measures are proposed beyond the continuation of the current inspection and maintenance regime undertaken by the Environment Agency.	Slight adverse	High
Flood Defences Off-site around wider Port of Immingham frontage	Changes in tidal regime e.g. wave heights, water levels, erosion/deposition due to dredging and off-shore development.	Slight adverse	No mitigation measures are proposed beyond the continuation of the current inspection and maintenance regime undertaken by the Environment Agency.	Slight adverse	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Existing Development On-site	Floodplain inundation from tidal flooding, new overland flow routes and from fluvial/surface water sources	Moderate/Large adverse	Standard of protection provided by the flood defences will be improved in line with 'hold the line' management policies. Flood Resilience and resistant measures embedded in design.	Slight adverse	Medium
Existing Development Off-site	Floodplain inundation from tidal flooding, new overland flow routes, flooding from fluvial/surface water sources	Moderate/Large adverse	Standard of protection provided by the flood defences will be improved within the lifetime of the proposed development in line with 'hold the line' management policies.	Slight adverse	Medium
Surface Waterbodies Habrough Marsh Drain	Changes in flow regime/water level due to increases in surface water discharge over the lifetime of the development	Slight/Moderate adverse	Drainage infrastructure designed in line with the Drainage Strategy would include a 70 % reduction in surface water run-off rates/volumes from the site compared to pre-development scenario, including attenuation storage to manage climate change over the lifetime of the development	Slight beneficial	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Drainage Infrastructure	Increased rate and volume of surface water runoff from impermeable surfaces over the lifetime of the development.	Slight adverse	Drainage infrastructure designed in line with the Drainage Strategy would include a 70 % reduction in surface water run-off rates/volumes from the site compared to pre-development scenario, including attenuation storage to manage climate change over the lifetime of the development	Moderate beneficial	High

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11.13 Abbreviations/Acronyms

Acronym	Definition
ABP	Associated British Ports
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGS	British Geological Society
CEMP	Construction Environmental Management Plan
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EC	European Commission
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
FMfP	Flood Map for Planning
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FRMS	Flood Risk Management Strategy
FWMA	Flood and Water Management Act
HM	Her Majesty's
HTL	Hold The Line
IDB	Internal Drainage Board
IERRT	Immingham Eastern Ro-Ro Terminal
IOH	Immingham Outer Harbour
IOT	Immingham Oil Terminal
LA	Lifecyle Appraisal
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
MAGIC	Map and Geographic Information Centre
MPS	Marine Policy Statement
MR	Managed Realignment
NELIDB	North East Lindsey Internal Drainage Board
NPPF	National Planning Policy Framework
NPSfP	National Policy Statement for Ports
NSIP	Nationally Significant Infrastructure Project
ODN	Ordnance Datum
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment
PINS	Planning Inspectorate
PPG	Planning Policy Guidance
RCP	Representative Concentration Pathway
SFRA	Strategic Flood Risk Assessment

SoP	Standard of Protection
SMP	Shoreline Management Plan
SSC	Suspended Sediment Concentration
SuDS	Sustainable Drainage Systems
TAG	Transport Analysis Guidance
UKCP18	UK Climate Projections 2018
WRA	Water Resources Act

11.14 Glossary

Term	Definition
Advance the Line	New defences are built further out in the sea in an attempt to reduce the stress on current defences and possibly extend the coastline slightly
Hold the Line	Where existing coastal defences are maintained but no new defences are set up
No Active Intervention	A policy decision not to invest in the provision or maintenance of any defences

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