

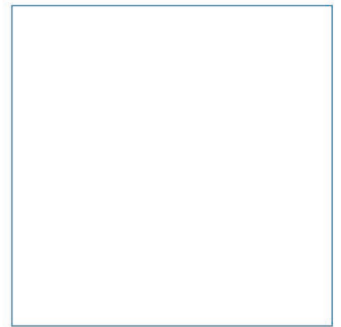
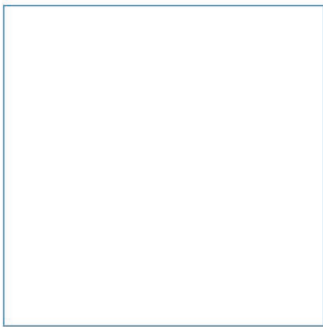
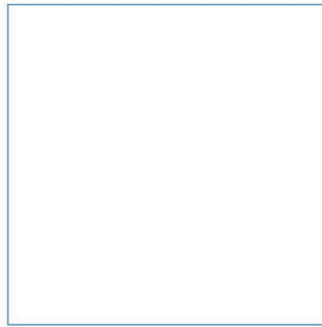
Associated British Ports

Immingham Eastern Ro-Ro Terminal

Preliminary Environmental Information

Chapter 12: Ground Conditions, Including Land Quality

January 2022



Innovative Thinking - Sustainable Solutions

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12 Ground Conditions, Including Land Quality

12.1 Introduction

12.1.1 This chapter provides a preliminary assessment of the ground conditions aspect of the proposed Immingham Eastern Ro-Ro Terminal (IERRT), including on geology, soils and contaminated land. This chapter has been prepared by AECOM Limited.

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

- Human health;
- An ecological system, or organism within such system, within a location that has been identified for protection under various European, national and local designations (including Site of Special Scientific Interest (SSSI), Special Protection Area (SPA), Special Area of Conservation (SAC), National Nature Reserve (NNR));
- Geology: artificial ground, superficial deposits and bedrock;
- Property in the form of buildings and services; and
- Controlled waters (surface water courses and groundwater).

12.1.3 A number of figures support the description of the existing environment (baseline) and are provided in Volume 2 of this Preliminary Environmental Information Report (PEIR) document. 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 and Figure 1.3 shows the layout of the proposed land side works at the site. Figures 12.1, 12.2a, 12.2b and 12.3 show the study area, site geology, and groundwater abstractions, respectively.

12.1.4 This chapter describes the impacts and effects that are anticipated as a result of the proposed IERRT, and outlines proposed design and other measures to help mitigate the potential effects. This chapter references the requirement for the development of and adherence to the following:

- A Construction Environmental Management Plan (CEMP) in order to mitigate the magnitude and significance of potential effects during construction;
- An Earthworks Strategy and/or Remediation Strategy to set out how the earthworks stage of construction would be undertaken; and
- A Materials Management Plan (MMP) and an Asbestos Management Plan (AMP) in order to develop a set of suitable controls for the re-use of materials such as soils and crushed concrete.

12.2 Definition of the study area

- 12.2.1 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.
- 12.2.2 The direct effects on ground conditions are those that may arise through accidental release of contaminants during construction and/or operation.
- 12.2.3 The indirect effects involve disturbing the ground in such a way that contaminant linkages (source-pathway-receptor) are created, for example, introducing a new pathway for the migration of a pollution plume within the Made Ground into aquifers or by allowing potentially contaminated dusts, during construction, to migrate offsite to nearby residential and/or commercial properties.
- 12.2.4 The study area for the ground conditions topic is considered to be the entirety of the ground within the site boundary, along with a buffer extending 250 m around the site in order to identify potential off-site sources of contamination and land stability issues to inform the baseline condition within and adjacent to the Site. This includes the artificial land adjacent to the development site and within the Port. geological deposits underlying artificial ground and any natural ground underlying surface water bodies within the area of the proposed development site. For assessment of effects to controlled waters including groundwater abstractions and groundwater source protection zones a buffer extending 1 km from the site boundary is considered appropriate. The extent of the study area is shown on Figure 12.1.
- 12.2.5 These are considered to be appropriate study areas for the assessment of geotechnical and geochemical aspects in accordance with the methodology set out in Design Manual for Roads and Bridges (DMRB) LA 109 Geology and Soils (Highways England, 2019). A study zone of 250 m radius for off-site sources of potential contamination and land stability issues are considered appropriate; and a 1 km radius for the assessment to controlled waters, extends a far enough distance from the proposed development options to be able to consider contamination migration risks, the location of potential contaminants and the location and nature of on-site and offsite potential receptors (as noted in LA 109 Geology and Soils). This is based on professional judgement by competent experts with relevant and appropriate experience of assessing land contamination and contamination dispersion.
- 12.2.6 Factors that affect the extent of the study area will be dependent on the proposed intrusive works including but not limited to excavation, dredging, infill and piling. These activities have the potential to disturb the underlying geology and existence of Made Ground. Any localised contamination present has the potential to migrate, and the use of piled foundations has the potential to create new pathways for contaminant migration to underlying aquifers.

12.3 Assessment methodology

Data and information sources

12.3.1 Current baseline conditions have been determined by a desk-based review of available information supplemented by a walk-over of Sub Plots 1 and 3; Sub Plot 2 and 4 were not accessed. Site walk-overs of Sub Plot 2 and 4 will be conducted to inform the Environmental Statement (ES). The south east corner of Sub Plot 1 was not accessed as this area is leased to a tenant. A Phase 1 Desk study was prepared by AECOM dated November 2021 and should be read in conjunction with this chapter. The desk study is included at Appendix 12.1 in Volume 3 of this PEIR.

12.3.2 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 <https://www.google.co.uk/maps>;
- British Geological Survey (BGS) GeolIndex Online <http://www.bgs.ac.uk/GeolIndex/>;
- Coal Authority Interactive Map Viewer <http://mapapps2.bgs.ac.uk/coalauthority/home.html>;
- BGS GeoRecords Plus interactive map <http://mapapps.bgs.ac.uk/GeoRecords/GeoRecords.html> ;
- MAGIC website <http://magic.defra.gov.uk/>;
- BGS Solid and Drift for Partington (Sheet 81 (and including parts of Sheet 82 and 90) 1:50,000;
- Public Health England website <https://www.gov.uk/government/organisations/public-health-england>;
- UK Radon website <https://www.ukradon.org/>; and
- Soil Survey of England and Wales (1983). 1:250,000 scale Soil Map of Northern England.

12.3.3 The baseline characterisation provided by the desktop survey within the Phase 1 Desk Study (AECOM, 2021) (provided at Appendix 12.1) report is considered sufficient to inform the assessment.

12.3.4 That said, intrusive investigations will be undertaken to support the assessment to be included as part of the ES and will also be used to inform the detailed design, the scope of which will be agreed with the relevant authorities prior to the completion of the NSIP Examination.

Determining significance of effects

12.3.5 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.

- 12.3.6 Assessment of receptor value (sensitivity) for Geology, Soils and Contamination follows the procedure described in Table 3.11 of the Highways England DMRB Sustainability & Environmental Appraisal, LA 109 Geology and Soils (Highways England, 2019).
- 12.3.7 Assessment of receptor value (importance) for groundwater resources follows the procedure described in Table 3.70 of the Highways England DMRB Sustainability & Environmental Appraisal LA 113, Road drainage and the water environment (Highways England, 2020a).
- 12.3.8 The value (sensitivity or importance) of a resource ranges from Very High to Negligible (or Low for groundwater) and is dependent on the assessment area or features of importance and conservation value. The criteria for determining the value of a resource and typical examples for geology, soils, contamination and groundwater are given in Table 12.1 to Table 12.4.
- 12.3.9 Resources assessed to have a value (sensitivity) of Medium or higher are assessed against likely Impacts, Effects and Mitigation Measures in Section 12.8 and 12.9.

Table 12.1 Sensitivity (value) of geology and soil receptors, and water environment attributes

Level of Sensitivity	Example of definitions of sensitivity for different receptors	
	Receptors susceptible to land contamination	Soil and geological receptors
Very high	<ul style="list-style-type: none"> • Human health: very high sensitivity land use such as residential or allotments. • Surface water: Watercourse having a Water Framework Directive (WFD) classification shown in a River Basin Management Plan (RBMP) and $Q95 \geq 1.0 \text{ m}^3/\text{s}$. Site protected/designated under EC or UK legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site, salmonid water)/Species protected by EC legislation LA 108 [Highways England, 2020c]. • Groundwater: Principal aquifer providing a regionally important resource and/or supporting a site protected under EC and UK legislation LA 108 [Highways 	<ul style="list-style-type: none"> • Geology: very rare and of international importance with no potential for replacement (e.g. UNESCO World Heritage Sites, UNESCO Global Geoparks, SSSIs and Geological Conservation Review (GCR) where citations indicate features on international importance). Geology meeting international designation citation criteria which is not designated as such. • Soils directly supporting an EU designated site (e.g. SAC, SPA, Ramsar site).

Level of Sensitivity	Example of definitions of sensitivity for different receptors	
	Receptors susceptible to land contamination	Soil and geological receptors
	England, 2020c]. Groundwater locally supports Groundwater Dependant Terrestrial Ecosystems (GWDTE) SPZ1	
High	<ul style="list-style-type: none"> • Human health: high sensitivity land use such as public open space. • Surface water: Watercourse having a WFD classification shown in a RBMP and Q95 • Groundwater: Principal aquifer providing locally important resource or supporting a river ecosystem. The groundwater is within a Source Protection Zone (SPZ) 2 which is defined by the Environment Agency as a “400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken”. 	<ul style="list-style-type: none"> • Geology: rare and of national importance with little potential for replacement (e.g. geological SSSI, ASSI (area of special scientific interest), National Nature Reserves (NNR)). Geology meeting national designation citation criteria which is not designated as such. • Soils directly supporting a UK designated site (e.g. SSSI).
Medium	<ul style="list-style-type: none"> • Human health: medium sensitivity land use such as commercial or industrial. • Surface water: Watercourses not having a WFD classification shown in a RBMP and Q9 5 >0.001 m³/s • Groundwater: Aquifer providing water for agricultural or industrial use with limited connection to surface water. This is within a SPZ3 which is defined by the Environment Agency as the “area around a supply source within which all groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point”. 	<ul style="list-style-type: none"> • Geology: of regional importance with limited potential for replacement e.g. Regionally Important Geological Sites (RIGS). Geology meeting regional designation citation criteria which is not designated as such. • Soils supporting non-statutory designated sites (e.g. Local Nature Reserve (LNR), Local Geological Sites (LGSs), Sites of Nature Conservation Importance (SNCIs)).

Level of Sensitivity	Example of definitions of sensitivity for different receptors	
	Receptors susceptible to land contamination	Soil and geological receptors
Low	<ul style="list-style-type: none"> • Human health: low sensitivity land use such as highways and rail. • Surface water: Watercourses not having a WFD classification shown in a RBMP and Q95 $\leq 0.001 \text{ m}^3/\text{s}$ • Groundwater: Unproductive strata 	<ul style="list-style-type: none"> • Geology: of local importance/ interest with potential replacement (e.g. non designated geological exposures, former quarries/ mining sites). • Soils supporting non-designated notable or priority habitats.
Negligible	<ul style="list-style-type: none"> • Human health: undeveloped surplus land/ no sensitive land use proposed. • Surface water: Receptor is resistant to change and is of little or no environmental value. • Groundwater: Receptor is resistant to change and is of little or no environmental value. 	<ul style="list-style-type: none"> • Geology: no geological exposures, little/ no local interest. • Soils: previously developed land formerly in 'hard uses' with little potential to return to agriculture.

Source: Adapted from DMRB LA 109 Table 3.11 (Highways England, 2019) and DMRB LA 113 Table 3.70 (Highways England, 2020a) therein

Magnitude of Impacts

12.3.10 The magnitude of potential impact upon geology and soils receptors considers 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).

12.3.11 The magnitude of impact on a receptor (Geology, Soils and Human Health) ranges from Major to No Change, with additional Magnitude descriptions of Minor beneficial, Moderate beneficial and Major beneficial prescribed to Groundwater receptors. The criteria for determining the magnitude of impact on a receptor are given in Table 12.2. 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 12.3.

Table 12.2 Magnitude of impact - geology and soils (adapted from DMRB LA 109 Table 3.12 and Table E/2.1 (Highways England, 2019) therein)

Magnitude of Impact	Example of adverse magnitudes	
	Receptors susceptible to land contamination	Soil and geological receptors
Major	<ul style="list-style-type: none"> • Human health: significant contamination identified. Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels - SP1010 (Contaminated Land: Applications in Real Environments (CL:AIRE, 2014))). Potential for significant harm to human health. Contamination heavily restricts future use of land. • Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). • Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). 	<ul style="list-style-type: none"> • Geology: loss of geological feature/ designation and/ or quality and integrity, severe damage to key characteristics, features or elements. • Soils: physical removal or permanent sealing of soil resource or agricultural land.
Moderate	<ul style="list-style-type: none"> • Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g., category 4 screening levels SP1010). Significant contamination can be present. Control/ remediation measures are required to reduce risks to human health/ make land suitable for intended use. • Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). • Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). 	<ul style="list-style-type: none"> • Geology: partial loss of geological feature/ designation, potentially adversely affecting the integrity; partial loss of/ damage to key characteristics, features or elements. • Soils: permanent loss/ reduction of one or more soil function(s) and restriction to current or approved future use (e.g., through degradation, compaction, erosion of soil resource.)
Minor	<ul style="list-style-type: none"> • Human health: contaminant concentrations are below relevant screening criteria (e.g., category 4 screening levels SP1010). Significant 	<ul style="list-style-type: none"> • Geology: minor measurable change in geological feature/ designation attributes, quality or vulnerability; minor loss of, or alteration to, one (may be

Magnitude of Impact	Example of adverse magnitudes	
	Receptors susceptible to land contamination	Soil and geological receptors
	<p>contamination is unlikely with a low risk to human health. Best practice measures can be required to minimise risks to human health.</p> <ul style="list-style-type: none"> • Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). • Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). 	<p>more) key characteristics, features or elements.</p> <ul style="list-style-type: none"> • Soils: Temporary loss/ reduction of one or more soil function(s) and restriction to current or approved future use (e.g., through degradation, compaction, erosion of soil resource).
Negligible	<ul style="list-style-type: none"> • Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g., category 4 screening levels SP1010). No requirement for control measures to reduce risks to human health/ make land suitable for intended use. • Surface water: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). • Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). 	<ul style="list-style-type: none"> • Geology: very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature/ designation. Overall integrity of resource not affected. • Soils: no discernible loss/ reduction of soil function(s) that restrict current or approved future use.
No Change	<ul style="list-style-type: none"> • Human health: reported contaminant concentrations below background levels. • Surface water; use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). • Groundwater: use sensitivity criteria in DMRB LA 113 (Highways England, 2020a). 	<ul style="list-style-type: none"> • Geology: no temporary or permanent loss/ disturbance of characteristics features or elements. • Soils: no loss/ reduction of soil function(s) that restrict current or approved future use.

Significance of Effects

12.3.12 Once the value (Significance) of each resource and the Magnitude of the potential Impact upon it are established, the significance (effect) matrix from 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 of that document. These have been reproduced and are presented as Table 12.3 and Table 12.4, respectively.

Table 12.3 Significance (Effect) Matrix

Receptor Value	No Change	Magnitude of Impact (degree of 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 (Highways England, 2020b)

Table 12.4 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).

12.3.13 The methodology described above has been used to assess the significance for the three principal stages of the project, namely:

- Construction;
- Operation; and
- Cumulative effects.

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

12.4 Consultation

- 12.4.1 Responses as part of Scoping Opinion process have informed the question as to whether there are any geology or contamination effects likely to arise as a result of the construction and operation of the Project.
- 12.4.2 Those responses, received from the Environment Agency, the Coal Authority, Historic England, Marine Management Organisation, Natural England and the Planning Inspectorate (PINS) have been taken into account in this chapter of the PEIR and are summarised in Table 12.5.

Table 12.5 Summary of the Scoping Opinion responses

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
Environment Agency	Scoping Opinion, October 2021 Appendix 2 Environment Agency response	The Environment Agency are satisfied that sufficient measures have been scoped in for the assessment of the risk posed to controlled waters from potential contamination.	Accepted.
The Coal Authority	Scoping Opinion, October 2021 Appendix 2 The Coal Authority response	The Coal Authority have confirmed the site is located outside the defined Development High Risk Area, therefore, there is no requirement to consider the coal mining legacy or to consult with the Coal Authority on subsequent planning.	Accepted.
Historic England	Scoping Opinion, October 2021 Appendix 2 Historic England response	Historic England have acknowledged the use of existing geotechnical, geophysical and geoarchaeological data, however, it is stated that specifically acquired survey data should be conducted. Historic England have also stated the need for clarification as to whether further geotechnical data will be obtained, and if any	Comments will be discussed and used to inform this chapter. A ground investigation (GI) will be undertaken to obtain geotechnical and geo-environmental data and used to inform the ground conditions ES chapter.

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
		geophysical data will be commissioned for use in the Environmental Statement.	
Natural England	Scoping Opinion, October 2021 Appendix 2 Natural England response	<p>Natural England have stated the need to consider impacts on geological sites and therefore include an assessment of the likely impacts on the geodiversity interests.</p> <p>Natural England have stated the Environmental Statement (ES) should include information on sediment quality and the potential for effects on water quality through suspension of contaminated sediments. The ES should also consider if there will be an increase in the pollution risk to water as a result of construction or operation of the development.</p>	<p>Comments will be discussed and used to inform this chapter. There are no recorded RIGS or Locally important Geological Sites within the proposed development boundary.</p> <p>Chapter 8 Water and Sediment Quality will address comments related to sediment quality.</p>
Planning Inspectorate (PINS)	Scoping Opinion, October 2021 Paragraph 3.3.9	The PINS state that specific reference should be made to soil and subsoil pollution produced during the construction and operation phases.	A specific consideration to soil and subsoil pollution pathways and mitigation is presented in Section 12.9 alongside the potential impacts to other identified receptors.
PINS	Scoping Opinion, October 2021 Table ID 4.1.5	It is also advised that the ES explains how the baseline data (existing geotechnical and GI data) is derived. If no further GIs occur, the use of the baseline data should be justified as to why it is adequate for	A GI will be undertaken to obtain geotechnical and geo-environmental data and used to inform the ground conditions ES chapter.

Consultee	Reference, Date	Summary of Response	How comments have been addressed in this chapter
		the assessment of effects from the Proposed Development.	
PINS	Scoping Opinion, October 2021 Table ID 4.7.1	The PINS agrees with the justification for best and most versatile agricultural soils and recognises that the Proposed Development will be on previously developed land.	Accepted.
PINS	Scoping Opinion, October 2021 Table ID 4.7.2	The PINS has acknowledged that ground contamination assessments were desk-based, however, they state that if the desk study indicates that a GI is required, this needs to be undertaken to give confidence to the Examining Authority in a robust assessment with adequate mitigation measures.	A GI will be undertaken to obtain geotechnical and geo-environmental data and used to inform the ground conditions ES chapter.

12.5 Implications of policy legislation and guidance

12.5.1 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 geology, soils and controlled waters. It builds upon the overarching chapter covering Legislative and Consenting Framework (Chapter 5). This will be kept under review and updated throughout the development of the ES.

EU legislation

12.5.2 The United Kingdom left the EU on 31 January 2020. The legislation discussed in this section has been adopted by the UK and remains applicable to the assessments in this PEIR.

The Water Framework Directive (2000/60/EC)

12.5.3 The framework for community action in the field of water policy. The principal objective of the framework is for all groundwater, surface water and coastal water bodies to achieve 'good' status by 2015 and maintain this status. It includes broader ecological objectives as well as aims to prevent

deterioration of all water bodies. The framework aims to develop sustainable water use and reduce and eliminate the presence of hazardous substances within water bodies. It must be considered in any scheme that has the potential to have an impact on any part of the water environment. This is incorporated in The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Groundwater Daughter Directive (2006/118/EC)

12.5.4 This Directive classifies groundwater bodies, establishes pollutant threshold values, and identifies trends and starting points for their reversal. Specific measures to control groundwater pollution are described, including good groundwater chemical status criteria and provisions to control groundwater pollutant inputs. The Directive provides further details on groundwater pollution control that are outlined within the Water Framework Directive (2000/60/EC). This is incorporated in The Groundwater (Water Framework Directive) (England) Direction 2016 and The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

The Environmental Liability Directive (2004/35/EC)

12.5.5 This Directive relates to the prevention and remedying of environmental damage. The Directive refers to environmental damage to habitats and protected species, water damage (chemical and ecological) and land damage caused by land contamination. In this instance, damage is defined as *“a measurable adverse change in a natural resource or measurable impairment of a natural resource service which may occur directly or indirectly”*. It also establishes a framework based on the ‘polluter pays’ principle to prevent and remedy environmental damage. Operators are therefore liable to the cost of prevention measures and remediation strategies. This is incorporated in The Environmental Damage (Prevention and Remediation) (England) (Amendment) Regulations 2019.

Dangerous Substances Directive (2006/11/EC) as amended

12.5.6 This Directive sets out the measures of pollution caused by certain dangerous substances discharged into the aquatic environment (inland surface water, territorial waters and internal coastal waters). As part of this Directive, List I and List II substances are described, whereby List I substances should be eradicated and List II substances should be reduced. This is incorporated in The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

UK legislation

Environmental Protection Act 1990 and Part 2A (the contaminated Land Regime)

12.5.7 Part 2A of the Environmental Protection Act 1990 provides a means of dealing with unacceptable risks posed by land contamination to human

health and the environment. Enforcing authorities are required to identify and deal with such land.

The Environment Act 1995

12.5.8 The Act established the Environment Agency and Scottish Environment Protection Agency corporate bodies. This makes provision with respect to contaminated land and abandoned mines. Further provisions are provided for National Parks, pollution controls, natural resource conservation and environment conservation/enhancement.

The Environment Act 2021

12.5.9 The Act provides a legal framework for environmental governance and for specific improvement of the environment, including measures on waste and resource efficiency, air quality and environmental recall, water, nature and biodiversity, and nature conservation covenants.

The Water Act 2003

12.5.10 The Act provides measures with regards to holding and issuing licences for water abstractions. The four broad aims of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation. The Act also considers controlled waters pollution and coal mine water discharge, and describes provisions for land drainage and flood defence. This was issued to amend the 1991 Water Resources Act and Water Industry Act.

The Water Act 2014

12.5.11 The aim of the Act 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. The Act describes provisions for the following: abstraction water licence modifications, waterworks records, flood insurance for households, internal drainage boards, regulations for the water environment and Regional Flood and Coastal Committees.

The Water Resources Act 1991

12.5.12 The Act gives the Environment Agency powers and duties to prevent or remedy the pollution of controlled waters. Previously under the Act and now under the Environmental Permitting (England and Wales) Regulations 2016 (as amended) it is a criminal offence for a person to cause or knowingly permit pollution of controlled waters. Sections within the Act refer to water resources management, pollution of water resources, flood defences, fishery controls, financial provisions, land and works powers and information provisions.

Anti-Pollution Works Regulations (as amended) 1999

12.5.13 These Regulations empower the Environment Agency to serve a notice to remediate or mitigate on "*any person who has caused or knowingly permitted poisonous, noxious or polluting matter or any solid waste to be present in controlled waters*". The notice will either describe a potential incident and the risk to associated controlled waters, or for a pollution incident that has already occurred, the notice will describe the pollution event. Furthermore, the notice will describe the necessary operations or works which should be carried out.

The Environmental Permitting (England and Wales) Regulations 2016 (as amended)

12.5.14 The Regulations set out the measures for those carrying out activities that may cause imminent threats of, or actual 'environmental damage', which require a permit. These Regulations also outline the authorities responsible for enforcing the Regulations. Such Regulations cover environmental permits, discharge into regulated facilities, enforcement and offences, public registers and powers/functions of the regulator and authority.

The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (as amended)

12.5.15 The Regulations describes the legal framework for the prevention of environmental damage and requirements for remediation of damage when it occurs. It sets out the UK Government views on how they should be applied and how particular terms should be interpreted.

The Contaminated Land (England) Regulations 2012

12.5.16 The Regulations set out the processes of risk assessment and identification/evaluation of remediation options. This is an amendment of the 2006 Contaminated Land (England) Regulations.

The Waste (England and Wales) Regulations 2011 (as amended)

12.5.17 The Regulations set out the measures required for the prevention of, production and management of waste. This describes the purpose of waste prevention programmes with waste prevention measures and makes reference to monitoring by appropriate authorities using qualitative or quantitative benchmarks.

National policy

National Policy Statement for Ports (NPSfP), 2012

12.5.18 The NPSfP is a framework to address proposals for port development in the UK and associated development (rail and road). This describes the Government's conclusions on new port infrastructure in the context of future demand and needs and the current economy. This project is considered to

be a Nationally Significant Infrastructure Project (NSIP) within the ports industry.

12.5.19 This Policy Statement contains the following relevant policies:

12.5.20 Section 4.7 describes the requirements for an Environmental Impact Assessment if projects “*are subject to the European Environmental Impact Assessment Directive*”.

12.5.21 Section 4.11 concerns pollution control and environmental regulations that need to be considered. This describes the requirement for pollution control measures and recommends consultation and contact with the Environment Agency to determine potential effects, environmental permits and other consents.

12.5.22 Section 4.16 refers to the impact of ports on human health, with direct reference to polluting water and hazardous waste. Paragraph 4.16.2 suggests health impacts should be identified.

12.5.23 Section 5.1 refers to the impacts on biodiversity and geological conservation. As part of this, paragraph 5.13 describes the adverse impacts including spillages or leakages from cargo handling and storage that could result in water pollution and contamination,

12.5.24 Section 5.6 refers to water quality and resources. In particular, paragraph 5.6.2 refers to the risk of pollutants entering the water due to spills and leaks from the development.

12.5.25 Section 5.13 refers to land use and in particular, paragraph 5.13.8 describes how the risks associated with land contamination should be considered when land has previously been developed.

National Planning Policy Framework (NPPF), 2021

12.5.26 The NPPF sets out the government’s planning policies for England and how these are expected to be applied. This Framework contains policies relevant to the geology and soils assessment.

12.5.27 Paragraph 120 c) describes how “*Planning policies and decisions should] give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*”.

12.5.28 Paragraph 174b relates to contributing to and enhancing the local environment through recognising the benefits of natural capital, ecosystem services, agricultural land, trees and woodland.

12.5.29 Paragraphs 183 – 188 form part of a section called ‘Ground conditions and pollution’.

12.5.30 Paragraph 183 details requirements of planning policies in the context of proposed development on a site including adequate site investigation,

suitability in the context of ground conditions, land instability and contamination and proposals for mitigation. This requires that land cannot be classified as contaminated post remediation as defined under the Environmental Protection Act 1990 Part IIA.

12.5.31 Paragraph 184 relates to the responsibility of developers and/or landowners for safe development.

12.5.32 Paragraph 185 refers to minimising the effects of pollution and adverse impacts from the proposed development.

Planning Practice Guidance (PPG), 2019

12.5.33 The guidance was published to provide more in-depth guidance to the NPPF. The PPG of relevance to the geology and soils assessment is Land Affected by Contamination and Land Stability (MHCLG, 2019). The PPG aims to provide guiding principles on how planning can deal with land affected by contamination.

Local policy

North East Lincolnshire Local Plan 2013 - 2032

12.5.34 The following policies of the North East Lincolnshire Local Plan are relevant to the ground conditions and land quality assessment:

- Policy 34: Water management. This policy outlines the requirements of development proposals in relation potential impacts to surface and groundwater. Such requirements include sustainable and adequate water supplies on site, efficient water use, adequate foul water treatment and appropriate sewerage systems. The Humber River Basin Management Plan should be considered. The Policy also refers to the importance of protecting groundwater within Source Protection Zones during construction and operational phase
- Policy 40: Developing a green infrastructure network This Policy outlines the importance of green spaces and infrastructure within developments, as well as biodiversity, climate change mitigation and sustainable water management. As part of this Policy, open areas between Immingham and the northern industrial development will be given specific protection;
- Policy 41: Biodiversity and Geodiversity. This Policy aims to retain, protect and restore biodiversity value and the ecological network. The protection and enhancement of biological and geological sites are also described within this Policy. Specific reference is made to the Estuary Employment Zone which requires management to protect the biodiversity;.
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- Policy 46: Restoration and Aftercare (minerals). This Policy refers to mineral development applications which should minimise disturbance and restore land as early as possible; and
- Policy 49: Restoration and Aftercare (waste). This Policy refers to proposals for additional landfill that should minimise disturbance and restore the land as early as possible.
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12.5.35 The following local guidance document will also be referred to:

- Yorkshire and Lincolnshire Pollution Advisory Group (2019) Development on Land Affected by Contamination Technical Guidance for Developers, Landowners and Consultants. This document provides guidance for the redevelopment of land that may be contaminated and outlines the required documentation for the Local Planning Authority. The guidance outlines the process for land affected by contamination including Phase 1 Preliminary Risk Assessment, Phase 2 Site Investigation, Phase 3 Remediation and Phase 4 Verification, all of which should be submitted to the Local Planning Authority.

12.6 Preliminary description of the existing environment

12.6.1 The baseline conditions established for this preliminary assessment are based on a review of a wide range of data and information from published material from sources outlined in Section 12.3.

12.6.2 A full description of baseline conditions is provided in Section 2 to 5 of the Phase 1 Desk Study (AECOM, 2021). The desk study (AECOM, 2021) also contains a desk-based assessment of the geological and hydrogeological conditions across the site. It includes a Preliminary Risk Assessment, a Conceptual Site Model (CSM) and an initial assessment of risk to human health and controlled waters. That report is attached as Appendix 12.1 in Volume 3 to this PEIR. The baseline conditions for the site are summarised in the following sections of this chapter for the purposes of assessment of potential impacts, effects and mitigation measures related to the proposed development.

12.6.3 At the time of writing, site specific ground investigations (GI), laboratory testing and contamination assessment has not been undertaken. The baseline description will be updated in the ES in light of the findings of the GI works. which will be undertaken to inform the ES assessment. The objective of the GI will be to obtain sufficient chemical and geotechnical data (via site and laboratory testing) from across the site to be able to build a comprehensive CSM to ensure that there is adequate good quality data available for undertaking human health, controlled waters and ground gas risk assessments.

Statutory and Non-Statutory Designated Sites

12.6.4 The Humber Estuary is designated as a SSSI of 'mixed' interest including geological interest, SAC, SPA, and Ramsar site. The proposed development site also falls within a nitrate vulnerable zone.

Soils – Agricultural Land Classification

12.6.5 The proposed development site is identified as Urban on the Provisional Agricultural Land Classification Grade map on the MAGIC Map Application (Natural England, 2021) and indeed forms part of the operational port estate.

Geology

12.6.6 The geology beneath the proposed development site is shown on BGS 1:50,000 Sheet 81 (and including parts of Sheets 82 and 90) (Patrington). It is also shown on the BGS Geology of Britain Viewer.

12.6.7 A detailed description of the geology of the proposed development site is provided in Section 3 of the Phase 1 desk study (AECOM 2021). A summary of this information is provided in Table 12.6. The site geology is also displayed in Figures 12.2a and 12.2b.

Table 12.6 Geology

Stratum		Expected Location	Description (BGS Lexicon)
Artificial	Made Ground	Entire site. There are also some small areas of infilled ground indicated on mapping. This is congruent with the development history of the site.	Variable composition.
Superficial	Tidal Flat Deposits - Clay and Silt	The majority of the site, apart from the bank of the Humber estuary.	Tidal flat deposits consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit, which is normally a consolidated soft silty clay, with layers of sand, gravel and peat.
	Beach and Tidal Flat Deposits (Undifferentiated) - Clay, Silt and Sand	Along the bank of the Humber estuary.	Composite of 'Beach deposits' and 'Tidal Flat Deposits'. Beach deposits comprise shingle, sand, silt and clay, which may be bedded or chaotic. Beach deposits may be in the form of dunes, sheets or banks. The Tidal Flat deposits are commonly silt and clay with sand and gravel layers, possible peat layers from the tidal zone.
	Devensian Till (Glacial Till)	Entire site, underlying the Beach and Tidal Flat deposits	No description given. Likely comprising a mixture of clay, sand, gravel, and boulders.

Stratum		Expected Location	Description (BGS Lexicon)
Bedrock	Burnham Chalk Formation	The north west arm of the site	White, thinly bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams.
	Flamborough Chalk Formation – Chalk	The majority of the site, apart from the north west arm of the site	White, well-bedded, flint-free chalk with common marl seams (typically one per metre). Common stylolitic surfaces and pyrite nodules.

Geological Features and Minerals

12.6.8 There are no geological faults noted within the Immingham dock site or within the immediate vicinity of the proposed development site. There are also no recorded RIGS or Locally Important Geological Sites within the proposed development boundary.

Hydrogeology

12.6.9 A detailed description of the hydrogeology, including definitions provided by the Environment Agency to describe the characteristics of aquifer designations, is provided in Section 4.7 of the Phase 1 Desk Study (AECOM 2021). This is included as Appendix 12.1 in Volume 3 to this PEIR.

12.6.10 Hydrogeological conditions for the proposed development are summarised in Table 12.7.

Table 12.7 Hydrogeology

Strata	Relevant Feature	Aquifer Designation
Tidal Flat Deposits and Glacial Till	Superficial Aquifer Designation	Unproductive
	Groundwater vulnerability	Low
	Source protection zones	None
Beach and Tidal Flat Deposits (undifferentiated)	Superficial Aquifer Designation	Secondary Undifferentiated Aquifer
	Groundwater vulnerability	Low
	Source protection zones	None
Burnham Chalk Formation	Bedrock Aquifer Designation	Principal Aquifer
	Groundwater vulnerability	High
	Source protection zones	None
Flamborough Chalk Formation	Bedrock Aquifer Designation	Principal Aquifer
	Groundwater vulnerability	High
	Source protection zones	SPZ 1, 2 & 3

- 12.6.11 There are no groundwater or surface water abstractions located within the proposed development site boundary.
- 12.6.12 There are no surface water abstractions within 1 km of the proposed development site boundary.
- 12.6.13 In the wider area, there are eight (8) groundwater abstractions listed within 1 km of the proposed development site. Two (2) of the abstractions are listed as active while six (6) are listed as historical. These are depicted in Figure 12.3.
- 12.6.14 The groundwater abstraction located approximately 63 m south east of the proposed development site is associated with a source protection zone (SPZ). The SPZ 1, 2 and 3 Zones cover the south east of the proposed development site. The SPZ are depicted in Figure 12.3.

Surface Waters

- 12.6.15 The proposed development site is located within the North Beck Drain river body water catchment (ID: GB104029067575), as shown on the Environment Agency Catchment Explorer (Environment Agency, 2021a). The Harborough Marsh drain is located to the southern and eastern perimeters of the port and forms part of the North Beck Drain catchment. The extensive use for coastal protection, flood protection and navigation use results in the heavily modified water body (HMWB) designation. The chemical status of the water body is designated as 'fail' due to Polybrominated Diphenyl Ethers (PBDE) and Mercury and its compounds. The 'ecological' potential is designated as 'moderate' and the overall status of the waterbody is designated as 'moderate'. The proposed development site is also located adjacent to the Humber Estuary.

Historical Development

- 12.6.16 The proposed development site has been subject to extensive industrial development as seen on Ordnance Survey Mapping with potential contaminative uses present to the present day.
- 12.6.17 The historical development of the proposed development site is discussed in detail within Section 5.1 of the Phase 1 Desk Study (AECOM 2021) which should be read in conjunction with this chapter. This is included as Appendix 12.1 in Volume 3 to this PEIR. Contaminative uses include railways, chemical works, oil storage, landfill sites, and unspecified buildings, tanks and heaps.

Environmental Risk Assessment

- 12.6.18 A CSM was produced for the site within the Phase 1 Desk Study (AECOM 2021), an evaluation of the risks posed by the identified pollutant linkages at the proposed development site has been prepared and is presented in Chapter 8 of the Phase 1 Desk Study (AECOM, 2021) (Appendix 12.1 in

Volume 3 to this PEIR). A summary of the CSM produced for the Phase 1 Desk Study is provided here:

- Sources identified are as follows: Made Ground, natural strata, soil leachate, groundwater, ground gas and off-site sources associated with migration from adjacent railway lines and historical and contemporary industries;
- Receptors identified are as follows: future site visitors, on-site workers, off-site human health receptors, controlled waters (Humber Estuary, unnamed surface water courses and principal bedrock aquifer of the Flambrough Chalk and Burnham Chalk Formations), development infrastructure, flora, fauna and constructions workers;
- Pathways identified for soil sources are via dermal contact, direct contact, ingestion, inhalation and plant uptake;
- Pathways identified for groundwater sources are via rainfall infiltration and vertical/lateral migration via permeable strata and service conduits;
- Pathways identified for surface water are via surface run-off and surface water drainage; and
- Pathways for gas sources are via vertical/lateral migration through permeable strata.

12.6.19 A summary of the associated risks of the pollutant linkages identified in the Phase 1 Desk Study is as follows:

- The risk to future site visitors is considered *Very Low* to *Low* for all contaminant linkages;
- The risk to on-site workers in future buildings is considered to be *Moderate/Low* for all contaminant linkages;
- The risk to on-site workers outdoor is considered to be *Very Low* to *Low* for all contaminant linkages;
- The risk to offsite human health receptors is considered to be *Very Low*;
- The risk to surface waters is considered to be *Moderate/Low* to *Moderate*;
- The risk to groundwater is considered to be *Low* to *Moderate/Low*;
- The risk to development infrastructure is considered to be *Moderate/Low* to *High* for all contaminant linkages;
- The risk to construction workers is considered to be *Moderate/Low* to *Moderate*; and
- The risk to flora and fauna is considered to be *Low*.

Geotechnical Risks

12.6.20 A preliminary Engineering Assessment and a Summary of Geotechnical Risks are described within Section 10 of the Phase 1 Desk Study (AECOM 2021).

12.6.21 The geotechnical and engineering risks identified have been reviewed in the Section 12.8 on the preliminary consideration of likely impacts and effects.

12.7 Future baseline environment

12.7.1 The site of the proposed development forms part of the operational Port of Immingham and has been in active use as a port since 1912. The site will continue to be utilised for port activity, irrespective of the development proposal for the IERRT project.

12.8 Preliminary Consideration of Likely Impacts and Effects

12.8.1 This section identifies the potential likely effects on the human health, geology and controlled water receptors as a result of the construction and subsequent operation of the IERRT project which have been identified at this preliminary stage. Further detail is provided in Section 12.11 whereby Table 12.9 provides a summary of potential impacts, mitigation measures and residual impacts.

12.8.2 A GI is to be carried out as part of future phases of ground conditions assessment and design and will be used to inform the ground conditions chapter of the ES. The GI will be specified in accordance with the UK Specification for GI (Site Investigation Steering Group, 2012) and carried out in accordance with BS EN 1997-2:2007 Eurocode 7 (British Standards Institute (BSI), 2007), BS5930:2015+A1:2020 Code of practice for GIs (BSI, 2020) and BS10175:2011+A1:2017 Investigation of potentially contaminated sites. Code of Practice (BSI, 2017). Detailed GI requirements for environmental purposes will be agreed with North East Lincolnshire Council.

12.8.3 Further assessment of any existing contamination within the ES will be risk-based and will develop upon the initial CSM that is produced. This will also involve further assessment of the contamination sources, receptors and plausible pollutant linkages at the site, in accordance with government guidance and the UK framework for the assessment of risk arising from contaminated land. The assessment will take into account principles adopted by the Environment Agency in Land Contamination: Risk Management (2021b). The significance of impacts will take into account the principles of assessment identified in CIRIA Report C552, (CIRIA, 2011) and Environment Agency's guiding principles for land contamination in assessing risks to controlled waters (Environment Agency, 2010). The detailed scope and content of the ES will be agreed with relevant contaminated land officers at North East Lincolnshire Council, in consultation with the Environment Agency if required.

12.8.4 Cumulative impacts on geology, controlled water and human health which 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, the approach to which is explained further in Chapter 20 of this PEIR.

Summary of Resource/Receptor Value

12.8.5 This assessment considers the following resources/receptors:

- Human health;
- An ecological system, or organism within such system, within a location that has been identified for protection under various European, national and local designations (including SSSI, SPA, SAC, NNR);
- Geology: artificial ground, superficial deposits and bedrock;
- Hydrogeological aquifer designations;
- Contamination to soils and groundwater
- Property in the form of buildings and services; and
- Controlled Waters (surface waters including the Humber Estuary, North Beck Drain catchment and Harborough Marsh drain and groundwater).

12.8.6 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 assessment are summarised in Table 12.8.

Table 12.8 Resources Value (Sensitivity)

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
Human Health				
Human Health	Workers and site visitors	Onsite	Medium	The on-site workers and visitors will be the most at risk human health receptors due to the proximity to their potentially contaminated soils/ vapours/ dust and groundwater. However, due to the proposed sites commercial/ industrial land use, human health is of a medium sensitivity.
Human Health	Workers and site visitors	Offsite	Medium	The wider Immingham Dock site surrounding the proposed development is of a commercial/ industrial land use with offsite workers adjacent to the proposed site being at particular risk to migrated vapour/ dust and groundwater. Due to the wider Immingham sites commercial/ industrial land use, human health is of a medium sensitivity.
Ecological Systems	Humber Estuary	Partially on the site	High	The number of environment designations, including SSSI, SAC, SPA and a Ramsar site suggests this is high sensitivity.
Geology - Bedrock				
Geology Bedrock	Burnham Chalk Formation	North west arm of the site	Negligible	No geological exposures, little/ no local interest. Bedrock is overlain by thick superficial deposits in most areas and Made Ground.
Geology Bedrock	Flamborough Chalk Formation	The majority of the site, apart from the north west arm of the site.	Negligible	No geological exposures, little/ no local interest. Bedrock is overlain by thick superficial deposits in most areas and Made Ground.

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
Geology - Superficial				
Geology Superficial	Tidal Flat Deposits	The majority of the site, apart from the bank of the Humber estuary.	Negligible	No geological exposures, little/ no local interest. These soils are overlain by Artificial Ground/ Made Ground.
Geology Superficial	Beach and Tidal Flat Deposits (Undifferentiated)	Along the bank of the Humber estuary.	Negligible	No geological exposures, little/ no local interest.
Groundwater – Bedrock Aquifer				
Groundwater (Bedrock)	Principal Aquifer - Burnham Chalk Formation	North west arm of the site.	High	Principal Aquifer is of high sensitivity. The aquifer is potentially of a lower sensitivity where it is overlain by a thick cover of low permeability unproductive superficial deposits. However, as the superficial deposits are described to contain sand and gravel layers the bedrock aquifer may still be susceptible.
Groundwater (Bedrock)	Principal Aquifer - Flamborough Chalk Formation	The majority of the site, apart from the north west arm of the site	High	Principal Aquifer is of high sensitivity. The aquifer is potentially of a lower sensitivity where it is overlain by a thick cover of low permeability unproductive superficial deposits. However, as the superficial deposits are described to contain sand and gravel layers the bedrock aquifer may still be susceptible.
Groundwater – Superficial Aquifer				
Groundwater (Superficial)	Secondary Undifferentiated – Beach and Tidal Flat Deposits	Along the bank of the Humber estuary.	Low - Medium	Secondary undifferentiated productive aquifer combined with the underlying productive principal bedrock aquifer give a combined high sensitivity.

Aspect / Criteria	Resource / Receptor	Location	Sensitivity	Justification
Groundwater (Superficial)	Unproductive – Tidal Flat Deposits	The majority of the site, apart from the bank of the Humber estuary.	Low	Unproductive strata.
Surface Waters				
Controlled Waters	Humber Estuary	Partially on site	High	The estuary is classified as an SSSI, SAC, SPA and a Ramsar site.
Controlled Waters	North Beck Drain catchment	409 m south	High	The status of the North Beck Drain was classified as Moderate by the Environment Agency in 2019 (Environment Agency 2021), therefore the sensitivity is high.
Controlled Waters	Harborough Marsh Drain	Southern and eastern perimeters of the port estate.	High	The Harborough Marsh Drain is part of the North Beck Drain catchment which was given a Moderate classification by the Environment Agency in 2019 (Environment Agency, 2021).
Property – Buildings and Services				
Property	Buildings	Onsite in future	High	Potential for degradation of foundations if design of concrete does not account for aggressive ground conditions identified at the site. Potential for accumulation of ground gases
Property	Services	Onsite in future	Medium	Potential for degradation of service pipes if design does not account for aggressive ground conditions identified at the site.

Construction phase

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

12.8.8 The following impact pathways have been assessed:

- Direct contact with contamination;
- Inhalation of dust and/ or soil derived vapours;
- Migration of ground gas; and
- Lateral and vertical migration of contamination through groundwater or surface run-off.

12.8.9 Construction phase activities that may result in potential impacts to human health, geology, groundwater and surface water at the proposed development site (without mitigation) include the following.

Direct contact with contamination and inhalation of dust and/ or soil derived vapours

12.8.10 Site visitors and on-site workers are considered the main potential human health receptors likely to be affected by the construction phase works. Adverse effects to human health are described in the following paragraphs.

12.8.11 Activities relating to foundation construction, earthworks and excavations and associated movement of ground materials have the potential to cause exposure of on-site workers and/ or site visitors and off-site workers and visitors to potentially contaminated dust.

12.8.12 Disturbances and/ or removal of the ground materials and groundwater which could potentially remove, relocate or mobilise existing potential contaminants (e.g. during foundation construction, earthworks and excavations).

12.8.13 Potential temporary impacts to human health may result from the accidental leak of fuels and oils from vehicular plant or from stored liquids. Other temporary impacts may also result from the use of materials and substances with polluting potential (e.g. concrete, fuel, oils and soil) which have the potential to be mobilised to ground or controlled waters. However, these risks will be mitigated by implementing a development specific CEMP.

12.8.14 According to publicly available mapping there are no bedrock exposures present within the site boundary of the proposed development. Potential impacts on the underlying geology are primarily related to the potential risk of creating new Source-Pathway-Receptor linkages.

12.8.15 With regard to existing geological and soils resources, construction has the potential to result in the following adverse impacts:

- Degradation of soil resources from the compaction of soil due to heavy construction vehicle movement, changes in topography, exacerbation of erosion through the handling and storage of soils, or ground stability impacts; and
- The generation of waste soils that cannot be reused elsewhere on the proposed development, requiring off-site disposal as waste.

12.8.16 Some, albeit limited, potential exists for construction to result in beneficial impacts through the following:

- Removal or treatment of contaminated soil, with the effect that existing adverse effects on receptors are removed; and
- A reduction in soil erosion through improved drainage.

Migration and accumulation of ground gas

12.8.17 Ground gas may accumulate within temporary structures erected on site during construction. There is the potential for ground gas to be sourced from the Made Ground materials and organic rich soils around and underlying the site. However, it is recommended that entry into excavations or any other enclosed space on a construction site should comply with confined space legislation and be assessed prior to entry.

Lateral and vertical migration of contamination through groundwater or surface run-off

12.8.18 Potential effects to controlled waters could arise from contamination of the Principal Aquifers, Secondary Undifferentiated Aquifer or the Humber Estuary.

12.8.19 Excavations and foundations have the potential to disrupt shallow groundwater. Temporary groundwater controls such as dewatering or physical cut-offs may be required to prevent the excavations filling with water, which would likely result in the lowering of groundwater levels in the immediate area of the excavation. Service trenches can also provide preferential flow pathways for groundwater. Dewatering of excavations could result in an adverse risk to groundwater and could also draw contaminated groundwater on site, should any be present.

12.8.20 Accidental leaks of fuels and oils from vehicular plant equipment, stored liquids, and other polluting materials have the potential to be mobilised to groundwaters and surface water via vertical and lateral migration or surface run-off. However, these risks will be mitigated by implementing a development specific CEMP and compliance with relevant environmental permit requirements during operation.

12.8.21 Disturbance and / or removal of ground materials and groundwater which could potentially remove, relocate or mobilise potential contaminants, e.g. during foundation construction, earthworks and excavations.

- 12.8.22 Creation of new Source-Pathway-Receptor linkages (e.g. pile foundation construction through existing Made Ground into underlying natural soils or bedrock) into an aquifer (comprised of coarse or sandy soils (superficial deposits) or chalk (bedrock)).
- 12.8.23 Creation of new potential contaminant linkages or mobilisation of existing contaminants may result from exposure of soils/ increases in rainwater infiltration through changes in ground cover/ in excavations or bulk earthworks.
- 12.8.24 Changes to the hydrogeological regime and potential mobilisation of contamination into groundwater during construction and potential effects on groundwater aquifers, e.g. from temporary dewatering activity required as part of construction.
- 12.8.25 Dredging operations associated with the proposed development have the potential to mobilise sediment bound contaminants of concern with the potential to impact water quality through sediment disturbance. Impacts relating to the water environment and sediment are discussed in detail within Chapter 8 Water and Sediment Quality.

Operational phase

- 12.8.26 This section contains an assessment of the potential impacts to geology, hydrogeology, development infrastructure and human health as a result of the operational phase of the IERRT project. The following impact pathways have been assessed:
- Direct contact with contamination;
 - Inhalation of dust and/ or soil derived vapours;
 - Migration and accumulation of ground gas; and
 - Lateral and vertical migration of contamination through groundwater and surface run-off.

Direct Contact with contamination and inhalation of dust and/ or soil derived vapours

- 12.8.27 Direct contact or inhalation of contamination is unlikely as the site will be covered in hardstanding and the majority of human health receptors will be transient in nature. Receptors may change from the assumed baseline conditions and may include site workers, commercial users and visitors.

Migration and accumulation of ground gas

- 12.8.28 There is the potential for ground gas migration and accumulation within structures built as part of the proposed development. The gassing potential of the site will be assessed within a GI prior to the development of the ES and appropriate remediation and/or ventilation will be agreed upon and implemented. The agreed mitigation measures, derived from interpretation and risk assessments of the data obtained during the GI, will be also be covered within a CEMP.

Lateral and vertical migration of contamination through groundwater and surface run-off

12.8.29 Impacts to groundwater and surface water could potentially occur during operation as a result of accidental spills from the handling or leakage of fuels, lubricants, stored chemicals and process liquids. Standard industry practices will be adopted to mitigate these potential impacts.

12.9 Mitigation measures

12.9.1 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 12.9..

Construction phase mitigation

12.9.2 Construction phase mitigation measures that are proposed to be implemented in relation to the geological and hydrogeological environment are as follows:

- Prior to the development of the ES, a GI will be undertaken to provide site specific geotechnical and geo-environmental data to inform land contamination risk assessments and to assess ground conditions and derive geotechnical parameters. The findings will feed into the detailed design process and an Outline Construction Environmental Management Plan (OEMP) would be prepared prior to the DCO application outlining measures to avoid, minimise or mitigate any construction effects on the environment. Once the detailed design is finalised the OEMP can be developed into a final CEMP and implemented to mitigate the magnitude and significance (effect) of potential impacts of the proposed development during construction. This will be prepared as part of the ES. No part of the authorised development is to commence until a CEMP, substantially in accordance with the OEMP, has been approved in writing by the relevant consultees;
- To support the DCO application an outline of the Remediation Strategy and/or Earthworks Strategy would be prepared in parallel to the ES. A final Remediation Strategy and/or Earthworks Strategy in accordance with the outline strategy would be prepared as part of the CEMP and submitted to the relevant consultees for approval. The Remediation Strategy would set out the measures required to mitigate any significant/unacceptable contamination risks and how the earthworks stage of construction would be undertaken during the landside works. Where necessary, the strategy would consider what materials, if any, can be reused and what materials are surplus and require either disposal or onward management to ensure appropriate re-use. The strategy would also define whether any treatment may be required, prior to reuse or disposal, as well as establishing risk-based compliance criteria for soils to be screened against. The strategy would cover site clearance and the works required to prepare the area for development;

- Should the assessments of the data from the GI indicate the need for piling or other deep foundation or a form of ground improvement to take place, the construction methodology will be assessed to reduce the risk of development of preferential pathways (e.g. groundwater flow) between the Made Ground present and the underlying Secondary superficial aquifers and Principal bedrock aquifers;
- A MMP, following the guidance in CL:AIRE (2011) Definition of Waste: Development Industry Code of Practice, will be prepared and implemented to provide suitable controls to facilitate the re-use of materials such as soils and crushed concrete. This will be prepared as part of the CEMP and an outline of the report will be prepared as part of the OEMP and DCO application. The MMP would detail the procedures and measures that would be taken to classify, track, store, dispose of and potentially re-use all excavated materials that are expected to be encountered during the development works;
- An AMP will be prepared and implemented should Asbestos or asbestos containing materials be encountered during the GI and its identification confirmed and quantified during chemical screening. This will be prepared as part of the ES and CEMP and an outline of the report will be prepared as part of the OEMP and DCO application;
- The suitability of excavated materials for re-use will be assessed as part of the proposed GI works. All earthworks operations will need to be undertaken in accordance with BS1997:2004 Eurocode 7, BS16907-1 to 7:2018 Earthworks; BS6031:2009 Code of Practice for earthworks (BSI, 2009) and National Highways (NH) guidelines including DMRB Series 600 'Earthworks' (Highways England, 2016). Best practice will be adopted during construction to prevent or minimise spillage risk and spillage impacts by adhering to the CEMP. The CEMP will address the management of concrete batching, concrete usage and accidental spillage relating to foundation and building construction;
- Where soil materials are deemed to be surplus to the requirements of the development, such materials, will require classification as waste under the Waste Framework Directive (WFD) (2009/98/EC) as either hazardous (17-05-03) or non-hazardous (17-05-04) soils. Classification would be undertaken using a proprietary assessment tool such as "HazWasteOnline™". Waste deemed to be hazardous, will require testing using the Waste Acceptance Criteria (WAC) prior to disposal to landfill;
- Stockpiled excavated material will be in a designated area of the site located away from watercourses to prevent run-off from the stockpile from entering surface water bodies;
- All areas of stockpiled material may be reseeded or otherwise covered temporarily if they are not to be used within 3 months. All areas of unused and exposed soil following reinstatement of the proposed development

will be reseeded or otherwise covered as soon as possible. Erosion protection matting may also be used to minimise sediment being entrained by water flow or becoming entrained by the wind if allowed to dry out; and

- Washing out of vehicles or equipment will only take place in controlled areas. Suitable locations will be agreed upon through consultation with the Environment Agency and identified within the CEMP.

Operational phase mitigation

- 12.9.3 At this stage no additional mitigation measures are considered necessary during the operational stage as the risks identified previously identified will have been mitigated during the construction stage.
- 12.9.4 Operational impacts are considered to be unlikely, as the proposed development will be operated in accordance and comply with relevant regulations and legislation. Operations would be limited to any maintenance works, which could include the accidental spillage of polluting materials.
- 12.9.5 Potential risks posed to maintenance workers would be mitigated through adherence to appropriate site and task specific health and safety documentation, required for legal compliance. Maintenance workers that are required to undertake excavations during the operational life of the proposed development would be provided with sufficient information on the nature of each sub-area at the site, upon which to base site and task specific risk assessments. Such work would also include measures as detailed in the Environmental Management Plan (EMP) to minimise the effects of the work on human health.

12.10 Limitations

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

- The assessment undertaken during the PEIR has been based on the collation and evaluation of available information obtained from the Environment Agency, BGS, Groundsure Report and other sources made available;
- Site specific GI information is not yet available for the proposed development;
- Prior to the development of the ES, a GI will be undertaken, based on the findings of the desk study, to assess the presence of contamination on site and determine the impacts this may have on site users and the environment. The findings will feed into the identification of mitigation measures, which may include remediation, the detailed design process and CEMP of the proposed development so that appropriate measures are taken.

- 12.10.2 The information presented in this chapter is based on the information available at the time of writing the report 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 EIA and consultation processes.
- 12.10.3 If, during development, any previously unidentified contamination is encountered, an appropriate investigation to allow sampling and testing of materials and risk assessment will be undertaken. Any actions resulting from the risk assessment will be agreed with the local planning authority along with any remedial measures in consultation with the Environment Agency, where risks to controlled waters are identified. Any remedial measures will be outlined within a Remediation Strategy developed in parallel with the ES, OEMP and CEMP which will be submitted for DCO examination.
- 12.10.4 The implications of these findings will be re-evaluated and presented within the ES.

12.11 Preliminary Conclusions on Residual Effects

- 12.11.1 A summary of the impact pathways that have been assessed, the identified residual impacts and level of confidence is presented in Table 12.9. The majority of the effects (inclusive of embedded mitigation) are shown to be Neutral, Neutral/ Slight or Slight.
- 12.11.2 Mitigation measures would be adopted during the construction and operational phases as described above. Potential impacts arising from the construction phase would be expected to be localised and short term. Therefore, the magnitude of any impacts caused by the disturbance and mobilisation of any previously unidentified contamination would be considered neutral to slight. There may also be a Slight beneficial effect if any previously unidentified contamination is identified and remediated.
- 12.11.3 There is the potential for earthworks to mobilise ground contamination impacting human health and/ or create preferential pathways to groundwater. The implementation of appropriate mitigation measures will reduce the significance of these pathways

Table 12.9 Summary of potential impact, mitigation measures and residual impacts

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Construction Phase					
Human Health (Contamination) <ul style="list-style-type: none"> • Onsite workers • Site visitors 	Exposure to vapour, dust, and contaminated groundwater. Direct contact with contaminated soils.	Moderate/ Large Adverse	Construction works would be carried out in accordance with the CEMP and environmental good practice on site.	Slight Adverse	High
Human Health (Contamination) <ul style="list-style-type: none"> • Off-site workers 	Exposure to vapour, dust, and migrated contaminated groundwater.	Moderate/ Large Adverse	Construction works would be carried out in accordance with the CEMP and environmental good practice on site.	Slight Adverse	High
Geology <ul style="list-style-type: none"> • Beach and Tidal Deposits (Undifferentiated) • Tidal Flat Deposits • Burnham Chalk Formation • Flamborough Chalk Formation 	Piling foundations	Neutral/ Slight Adverse	Construction works would be carried out in accordance with the CEMP. Location specific Piling Risk Assessments and environmental good practice on site.	Neutral Adverse	High
Soils <ul style="list-style-type: none"> • Beach and Tidal Deposits (Undifferentiated) • Tidal Flat deposits 	Spoil resulting from excavations and earthworks.	Neutral/ Slight Adverse	<p>A GI will be undertaken to confirm baseline assumptions prior to the development of the ES.</p> <p>All earthworks operations will need to be undertaken in accordance with BS6031:2009</p>	Neutral Adverse	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
			<p>'Code of Practice for Earthworks', BS16907-1 to 7:2018 Earthworks and HE guidelines including DMRB Series 600 'Earthworks'. Development will actively work towards achieving an earthworks balance.</p>		
<p>Groundwater (Bedrock Contamination)</p> <ul style="list-style-type: none"> • Burnham Chalk Formation Principal Aquifer • Flamborough Chalk Formation Principal Aquifer 	<p>Changes to Hydrogeological Regime.</p> <p>Mobilisation of contaminants during construction.</p> <p>Vertical migration of spills and leakages.</p> <p>Formation of new preferential pathways.</p>	<p>Moderate/ Large Adverse</p>	<p>A GI considering groundwater level and quality will be undertaken to confirm baseline assumptions prior to the development of the ES.</p> <p>Construction works would be carried out in accordance with the CEMP.</p> <p>Piling works would be planned in accordance with best practice guidance (Environment Agency, 2001). Piling operations would be subject to foundation works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements.</p>	<p>Neutral/ Slight Adverse</p>	<p>High</p>

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
<p>Groundwater (Superficial Contamination)</p> <ul style="list-style-type: none"> • Beach and Tidal Deposits (Undifferentiated) Secondary Undifferentiated Aquifer 	<p>Potential mobilisation of existing contaminants during construction.</p> <p>New contaminant pathways or mobilisation of existing contaminants may result from exposure of soils, increases in rainwater infiltration through changes in ground cover, in excavations.</p> <p>Vertical migration of spills and leakages.</p>	Slight Adverse	<p>A GI considering groundwater level and quality will be undertaken to confirm baseline assumptions prior to the development of the ES.</p> <p>Piling works would be planned in accordance with best practice guidance (Environment Agency, 2001). Piling operations would be subject to foundation works risk assessment and any potential to cause pollution to the aquifer would be covered by measures to be detailed in piling method statements.</p> <p>Construction works would be carried out in accordance with the CEMP.</p>	Neutral/Slight Adverse	High
<p>Surface Water (Contamination)</p> <p>Humber Estuary</p>	<p>Spills and leakages from vehicles or stored materials into the Humber Estuary.</p> <p>Run-off from exposed ground and material stockpiles.</p> <p>Direct disturbance of the riverbed or bank.</p>	Moderate Adverse	<p>All marine development will need to be undertaken in accordance with relevant pollution prevention guidance.</p> <p>Specific guidance relating to the control of water pollution from construction sites is discussed within Chapter 8 Water and Sediment Quality.</p>	Neutral/Slight Adverse	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Surface Water (Contamination) North Beck Drain Catchment and associated Harborough Marsh Drain	Spills and leakages from vehicles or stored materials into the Harborough Marsh Drain on the perimeter of the site and into the North Beck Drain Catchment. Run-off from exposed ground and material stockpiles.	Moderate Adverse	Specific guidance relating to the control of water pollution from construction sites is discussed within Chapter 8 Water and Sediment Quality.	Neutral/ Slight Adverse	High
Operational Phase					
Human Health (Contamination) • Future on-site workers	Exposure to contaminants, vapour, dust, and contaminated groundwater.	Moderate Adverse	Maintenance workers will be required to adopt safe working practices under relevant health and safety legislation. Therefore, the significant effects are unlikely to arise.	Neutral/ Slight Adverse	High
Human Health (Contamination) • Future site visitors • Off-site workers	Exposure to contaminants, vapour, dust, and contaminated groundwater.	Moderate Adverse	No mitigation measures are required as operation of the development is not likely to cause significant effect on offsite receptors with regards to geology and soils	Neutral/ Slight Adverse	High
Soils (Contamination)	Impacts on soil quality could potentially occur during operation caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids.	Neutral/ Slight Adverse	The development will be operated in accordance with an Environmental Permit.	Neutral/ Slight Adverse	High

Receptor	Impact pathway	Impact Significance	Mitigation measure	Residual Impact	Confidence
Controlled Waters (Contamination)	Impacts on groundwater and watercourses could potentially occur during operation caused by accidental spills resulting from handling or leakage of fuels, lubricants, stored chemicals and processed liquids.	Neutral/ Slight Adverse	The development will be operated in accordance with an Environmental Permit and will have a managed surface drainage system.	Neutral/ Slight Adverse	High
Property • Building and Services	Exposure to contaminants in soil, leachate, groundwater and accumulation of ground gas	Moderate Adverse	Buildings and services risks will be mitigated by using concrete and service pipes appropriate for any aggressive ground conditions. Ground gas protection measures will be implemented into design and build of structures.	Neutral/ Slight Adverse	High

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12.13 Abbreviations/Acronyms

Acronym	Definition
AA	Appropriate Assessment
ABP	Associated British Ports
AMP	Asbestos Management Plan
ASSI	Area of Special Scientific Interest
BGS	British Geological Society
BMV	Best and Most Versatile
BS	British Standard
BSI	British Standards Institute
CEMP	Construction Environmental Management Plan
CL:AIRE	Contaminated Land: Applications in Real Environments
CSM	Conceptual Site Model
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	European Marine Site
EPA	Environmental Protection Act
EPUK	Environmental Protection UK
EQS	Environmental Quality Standards
ES	Environmental Statement
EU	European Union
GCR	Geological Conservation Review
GI	Ground Investigation
GWDTE	Groundwater Dependant Terrestrial Ecosystems
HMWB	Heavily Modified Water Body
HSE	Health and Safety Executive
LGS	Local Geological Site
LNR	Local Nature Reserve
MMP	Materials Management Plan
NH	National Highways
NPPF	National Planning Policy Framework
NPSfP	National Policy Statement for Ports

NNR	National Nature Reserve
NSIP	Nationally Significant Infrastructure Project
OEMP	Operational Environmental Management Plan
PBDE	Polybrominated Diphenyl Ethers
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPG	Planning Practice Guidance
RBMP	River Basin Management Plan
RIGS	Regionally Important Geological Site
SAC	Special Area of Conservation
SNCI	Site of Nature Conservation Importance
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

12.14 Glossary

Term	Definition
Anthropogenic pollution	Pollution as a result of human activities
Aquifer	An aquifer is a geological formation which can contain or transmit groundwater. The type of aquifer indicates how permeable it is, its capability to store/yield significant quantities of water and also whether its quality is suitable for potable water supply
Baseline conditions	Existing conditions and past trends associated with the environment in which a proposed activity may take place
Best Practical Environmental Option	Procedures adopted with the goal of managing waste and other environmental concerns which emphasise the protection and conservation of the environment across land, air and water

Conceptual Site Model	A representation of the characteristics of the site and indicates potential source areas of contamination, pathways and receptors (including human health, groundwater, surface water, ecology and buildings / infrastructure). It is used to identify potentially complete source-pathway-receptor (S-P-R) contaminant linkages
Cumulative effects	Combined effects of multiple developments or the combined effect of individual impacts (e.g. where different project elements in different locations have a cumulative impact on a particular feature)
Dangerous substance	A substance which presents flammable, toxic or explosive hazards to people, or which is dangerous to the environment
Geotechnical data	Properties of soil and/or rock which are used in engineering design
Glacial Till	Unsorted and unstratified material deposited by glacial ice
Glaciofluvial	Relating to or coming from streams deriving much or all of their water from the melting of a glacier
Greenhouse gas emissions	Total mass of greenhouse gases, which absorb and emit radiant energy causing warming, released to the atmosphere over a specific period of time.
Groundwater	Water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations
Hazard	A substance, operation or piece of equipment which has the potential to cause harm to people or the environment
Made Ground	Disturbed soils which include man-made or artificial materials
Nitrate Vulnerable Zone	Areas designated as being at risk from agricultural nitrate pollution
Quantified risk assessment	A numerical assessment of the risks to people based on an assessment of the consequences/severity and likelihood of major accidents
Ramsar	Wetlands of international importance designated under the Ramsar Convention
Risk	The likelihood of a specified level of harm occurring within a specified period of time
Special Area of Conservation	A designated area protecting one or more habitats or species listed in the Habitats Directive

Site of Special Scientific Interest	An area of land which is of special interest for its flora, fauna, geological, geomorphological or physiographical features
Tidal Flat Deposits	Soil deposits formed from mud flats in the intertidal zone
Topography	The arrangement of the natural and artificial physical features of an area
Unproductive Strata	Soil and/or rock layers with low permeability that have negligible significance for water supply or base flow for rivers

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