KEEPING BRITAIN TRADING

IMMINGHAM EASTERN RO-RO TERMINAL

Habitats Regulations Assessment
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Immingham Eastern Ro-Ro Terminal

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1 Introduction

1.1 Overview

1.1.1 This Shadow Habitats Regulations Assessment (HRA) has been prepared to support Associated British Ports' (ABP) application for a Development Consent Order (DCO) which, if approved, will authorise the construction and consequent operation of a new roll-on/roll-off (Ro-Ro) facility within the Port of Immingham. This proposed development will be known as the Immingham Eastern Ro-Ro Terminal (IERRT).

1.1.2 The site for the proposed IERRT lies within the eastern sector of the Port which is situated on the southern bank of the Humber Estuary between North Killingholme and Grimsby. The boundary of the proposed development is shown in Figure 1.

1.2 Project background

1.2.1 ABP, the owner and operator of the Port of Immingham, is proposing to construct a new Ro-Ro facility within the Port. The proposed new facility is designed to service the embarkation and disembarkation of principally commercial cargo carried either by accompanied trailer (where the Heavy Goods Vehicle (HGV) tractor unit and driver travel on the vessel with the trailer) or unaccompanied trailers which are delivered to the port of embarkation and then collected at the port of disembarkation by different HGV tractor units and drivers. It should be noted that in addition to wheeled or Ro- Ro cargo, the Ro-Ro vessels using the new facility will also be able to carry, on occasion, a small and limited number of passengers travelling by vehicle. This will only be possible, however, when the demands of the Ro-Ro cargo operation permit in terms of space/capacity for passengers becoming available.

1.2.2 The proposed IERRT development will consist of marine works within the Humber Estuary and landside works within the existing port estate. The following paragraphs summarise the principal elements of the project in the context of both the marine and landside infrastructure. Full details are provided in Chapters 2 and 3 in Volume 1 of the Environmental Statement (ES) (Application Document Reference number 8.2.2 and 8.2.3 respectively).

1.2.3 **Marine infrastructure works** – The marine works will comprise a number of distinct components. In brief, these include:

- An approach jetty from the shore;
- A linkspan with bankseat to provide a solid foundation;
- Two secured floating pontoons linked by another linkspan bridge;
- Two finger piers to provide three berths (one on either side of the northern-most outer finger pier furthest from the shore, and one on the northern side of the southern-most inner finger pier) thereby enabling the

vessels to berth alongside with their stern ramps resting on a floating pontoon which will match the rising and falling of the tide;

- A capital dredge of the new berth pocket; and
- Disposal of dredged material at sea on the basis that no beneficial alternative use for the material has been identified (see Waste Hierarchy Assessment in Appendix 2.1 in Volume 3 of this Environmental Statement (ES) (Application Document Reference number 8.4.2(a));
- Possible inclusion of vessel impact protection measures to provide protection in the unlikely event of an errant vessel contacting the Immingham Oil Terminal (IOT) jetty and finger pier. ABP does not believe that such measures will actually be required, but it has been decided to make provision for them in the DCO application so as to ensure that the infrastructure is consented as part of the IERRT DCO should it be determined at some future date that they are required.

1.2.4 **Landside infrastructure works** – In summary, the landside works consist of the following:

- The demolition of ~~four~~ existing commercial buildings ~~(and a 'lean-to' on one of the buildings)~~. Two of the buildings to be demolished which are used by Malcolm West Forklifts, will be replaced within the existing site boundary but their relocation will facilitate the construction of the internal bridge (see below);
- The improvement of the surface of the development site so to enable it to accommodate the cargo which is either awaiting embarkation on to one of the Ro-Ro vessels or awaiting collection after disembarkation - together with a small vehicular passenger waiting area. These works will include resurfacing and the provision of new pavements and associated infrastructure across the site;
- The construction of a new terminal building and a small welfare building to provide facilities for terminal operational and administration staff, lorry drivers and passengers, together with a small workshop;
- The construction of a UK Border Force ~~building~~buildings and facilities with check in area;
- The provision of necessary infrastructure such as substations and frequency converters;
- An internal vehicle access bridge linking the North and Central Storage Areas which will cross over Robinson Road (an existing port road) ~~and ABP controlled railway track~~;
- Improvements to the internal road layout within the Port together with improvements to East Gate comprising the widening of the existing entrance; and
- Off-site environmental enhancements involving the improvement of an existing area of woodland ~~and the provision of intertidal habitat~~.

1.2.5 **Construction programme** – This is set out in Chapter 3 of the ES (Application Document Reference number 8.2.3), specifically paragraphs 3.1.16 to 3.1.65. ~~Capital dredging~~Marine works ~~will~~may be undertaken 24 hours a day, 7 days a week, ~~and~~subject to the adherence to environmental restrictions during certain months. It is estimated that capital dredging will take around 80 days. It is estimated that piling works would be undertaken for approximately 24 weeks in total.

1.2.6 With a sequenced construction programme, construction of the northern finger pier would commence first. The intended timescale being that the northern finger pier and approach jetty will become operational around ~~mid~~late-2025. Following this, the innermost southern finger pier (accommodating the third berth) would be constructed. The capital dredging works outlined above will be undertaken in a single stage in the case of either construction scenario. With a sequential construction, piling works for the northern finger pier, approach jetty, and pontoons would be scheduled to be carried out for an approximate 24-week period, with an approximate 13-week period for the southern finger pier.

1.2.7 In any case, the assessment has been based on the precautionary assumption that the works could occur at any time of year as a worst case.

1.2.8 **Decommissioning** – As noted in paragraphs 3.2.2 to 2.2.3, and 3.2.19 *et seq.* of Chapter 3 of the ES (Application Document Reference number 8.2.3) the IERRT DCO does not make provision for the decommissioning or demolition of the proposed IERRT development. This is because the IERRT infrastructure will, once constructed, become part of the fabric of the Port of Immingham and will continue to be maintained so that it can be used for port related activities to meet long-term commercial needs. In the unlikely event that the IERRT should one day require decommissioning and demolition, the relevant statutory process at that time, including HRA as appropriate, would be followed. As a consequence, decommissioning or demolition of the IERRT is not assessed further in this HRA.

1.2.9 **The consenting route** – As the IERRT development comprises the - “alteration of harbour facilities” and the effect of that alteration “is expected to be to increase by at least the relevant quantity per year the quantity of material the embarkation or disembarkation of which the facilities are capable of handling” – the “relevant quantity” in the case of IERRT being 250,000 units per year, (Planning Act 2008, section 24(2)) - the proposed development will be taken forward as a Nationally Significant Infrastructure Project (NSIP). In light of this, ABP has submitted to the Secretary of State for Transport an application for a DCO for authority to construct and then operate the proposed development. Additional consents and approvals that are required for the construction and operation of the proposed development will, with the agreement of the appropriate consenting bodies, be incorporated within the final DCO.

1.2.10 ABPmer has been commissioned to undertake an HRA of the IERRT project. The information within this HRA will assist the Competent Authority (in this case the Secretary of State for Transport) when undertaking an Appropriate Assessment, in accordance with the provisions of Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) (commonly referred to as the ‘Habitats Regulations’).[1]

1.2.11 This HRA has been informed by the outcomes of the nature conservation and marine ecology assessment (Chapter 9 of Volume 1 of the ES – Application Document Reference number 8.2.9). A description of the proposed development is included in Chapter 2 of the ES (Application Document Reference number 8.2.2) and further details of the construction and operational methodology on which this assessment is based on is included in Chapter 3 of the ES (Application Document Reference number 8.2.3).

1.1.1 [1] Following the UK leaving the EU, these have been modified by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

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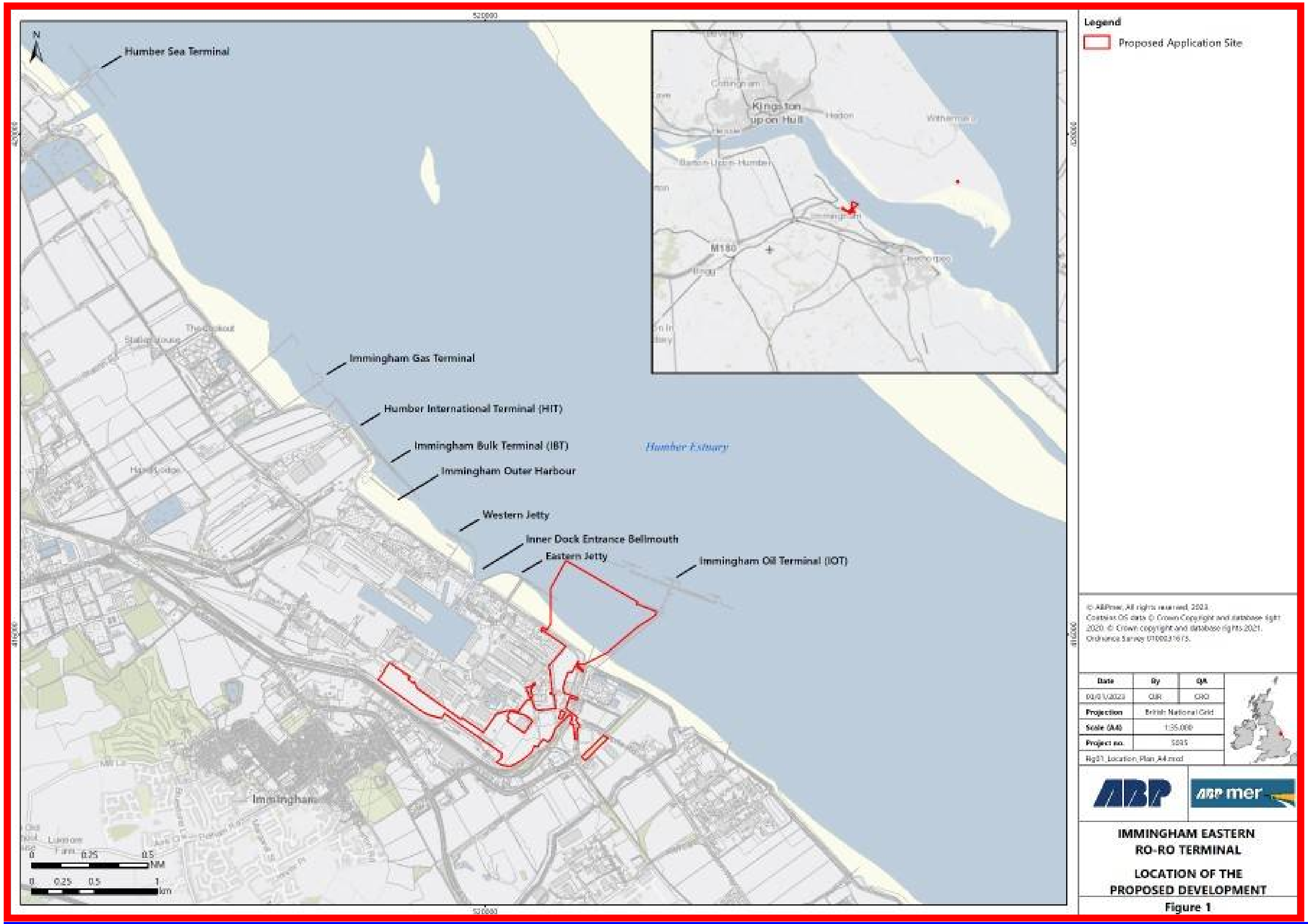


Figure 1. Location of the proposed development

1.3 Need for a Habitats Regulations Assessment

1.3.1 The requirements of Council Directive 92/43/EEC (as amended) on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') and Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive') have been transposed into UK legislation through, most recently, the Habitats Regulations.

1.3.2 The Habitats Regulations provide for the protection of European designated sites including Special Areas of Conservation (SACs), Sites of Community Importance (SCIs), candidate SACs (cSACs) and Special Protection Areas (SPAs). According to Paragraph 181 of the National Planning Policy Framework (NPFF), in England these regulations also apply to Ramsar sites (designated under the 1971 Ramsar Convention for their internationally important wetlands), possible SACs (pSAC), potential Special Protection Areas (pSPA), and proposed Ramsar sites and any sites identified, or required, as compensatory measures for adverse effects on any of the aforementioned sites. Collectively, these sites are referred to as European/Ramsar sites in this HRA (unless they are referring specifically only to European sites and/or Ramsar sites alone).

1.3.3 As Competent Authority, the Secretary of State for Transport is required to take account of the Habitats Regulations and produce an AA for any plans or projects that have the potential to directly and/or indirectly affect European/Ramsar sites. As summarised above, Regulation 63(1) of the Habitats Regulations states that:

> *"A competent authority, before deciding to undertake, or give any consent, permission, or other authorisation for a plan or project which:*
>
> *a) is likely to have a significant effect on a European site or a European offshore marine site (either alone or in -combination with other plans or projects); and*
> *b) is not directly connected with or necessary to the management of the site*
>
> *must make an appropriate assessment of the implications for the site in view of that site's conservation objectives".*

1.3.4 The decision as to whether an AA is required is based on an assessment of likely significant effect (LSE). LSE is recognised as being an objective judgement or a statement that the anticipated effects of the proposal will be more than trivial (i.e., that the anticipated changes resulting from a proposal have the potential to impact on an interest feature of a European/Ramsar site). If a project (or plan) could have an LSE on a European/Ramsar site, it does not automatically follow that an impact will occur. The decision of LSE is purely an indication of the need for an AA.

1.3.5 In an AA, it is necessary to determine whether the project or plan would result in an adverse effect on the integrity (AEOI) of the European/Ramsar site(s) in view of the site's conservation objectives. The integrity of a site has been defined as the "coherence of its ecological structure and function, across its whole area that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated" (HM Government, 2019).

1.3.6 Where it cannot be demonstrated that a project will not have an AEOI, or there is insufficient certainty of an avoidance of an adverse effect, the activities can only proceed under a derogation. In this case it must be demonstrated that there are no more suitable (less damaging) alternatives, that there are Imperative Reasons of Overriding Public Interest (IROPI) sufficient to justify the proposed project and that suitable compensatory measures have been identified to ensure that adequate compensation, usually in the form of replacement habitat, has been provided to protect the overall coherence of the Natura 2000 network (i.e., European/Ramsar sites) (PINS, 2022).

1.3.7 The decision as to whether the integrity of the site is adversely affected will be made by the Secretary of State for Transport as Competent Authority, in consultation with Natural England.

1.3.8 The HRA process for NSIPs comprises a three stages process, as detailed in the PINS Advice Note 10 (PINS, 2022):

- **Stage 1. Screening** – check if the proposal is likely to have a significant effect on the European site(s)'s conservation objectives, both alone or in- combination with other plans or projects. At this stage, and in light of the decision of the Court in the case of (People Over Wind and Sweetman v Coillte Teoranta (Case C-323/17)), mitigation measures proposed for the purpose of avoiding or minimising risk to a European site should not be taken into account. If a conclusion of no LSE is reached for all/the European site(s), their qualifying features having been fully taken into account, it is not necessary to proceed to the next stage of HRA.
- **Stage 2. Appropriate assessment (AA)** – assess the implications of the proposal for the qualifying features of the European site(s), in view of the site(s)' conservation objectives and identify ways to avoid or minimise any effects.
- **Stage 3. Derogation** – consider if proposals that would have an AEOI of a European site(s) qualify for an exemption. There are three tests to this stage to be followed in order: are there alternative solutions? ; is the proposal IROPI? ; and have satisfactory compensatory measures been secured? Each test must be passed in sequence for a derogation to be granted.

1.4 Report structure

1.4.1 This report has been structured as follows:

- **Section 1: Introduction** provides a brief description of the IERRT project and an overview of the need for an HRA;
- **Section 2: Consultation** presents the outcome of the consultation that has been undertaken to date, along with how it has influenced the HRA;

- **Section 3: Stage 1 - Screening** reviews the location of the proposed development in relation to European/Ramsar sites and the potential for it to result in an LSE on the interest features of these sites;
- **Section 4: Stage 2 – Appropriate Assessment** reviews the potential for the proposed development to result in an AEOI on the interest features of European/ Ramsar sites, including in-combination effects;
- **Section 5: Conclusions** presents a brief summary of the findings of this report.

2 Consultation

2.1.1 Consultation as to the assessment of effects on European/Ramsar sites and interest features as a result of the construction and operation of the IERRT project has been undertaken with the Environment Agency, Natural England and the Marine Management Organisation (MMO). Pre-application consultation meetings have been held as follows:

- Meetings with Natural England on 7 February 2022, 16 March 2022, 28 April 2022, 28 July 2022;
- Meetings with the MMO on 24 February 2022, 7 April 2022, 3 October 2022 (also with Cefas); and
- Meeting with the Environment Agency on 29 November 2021, 20 May 2022.

2.1.2 These meetings together with the outcomes of the formal scoping process, as well as any feedback received in response to the publication of the Preliminary Environmental Information Report (PEIR) (see Appendix 4.2 Supplementary Consultation (Application Document Reference number 8.4.4 (b)), have also been taken into account and provide part of the evidence base which has been used to inform the HRA. Furthermore, on 19 October 2023, ABP submitted a Change Notification to the Examining Authority (ExA) [AS- 026 – AS-032] (Change Notification). The Change Notification set out the ABP's intention to make a change request and detailed its consultation proposals. Feedback received in response to the non-statutory consultation and the publication of the Changes Notification has also been taken into account to inform this HRA.

2.1.3 The outcome of ~~the~~these consultation ~~exercise~~exercises that has been undertaken to date relating to the HRA, along with how it has influenced the HRA, is presented in Table 1. Other topic-specific comments are included in the individual ES chapters (e.g., Chapter 9: Nature Conservation and Marine Ecology (Application Document Reference number 8.2.9)).

Table 1. Summary of consultation responses relating to HRA.

Consultee	Reference, Date	Summary of Response	How Comments Have been Addressed in this HRA
PINS	Scoping Opinion, October 2021 Table ID 4.3.2	The ES should include an assessment of indirect changes to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes caused by the presence of piled structures which could affect all marine ecological receptors or information demonstrating agreement with the relevant consultation bodies and the absence of a Likely Significant Effect (LSE).	This has been considered in the Stage 1 – Screening included in Section 3.1 of the HRA. Piling alone has only localised effects on physical processes. Modelling has been completed based on all aspects of the marine works and these results have informed the assessment of changes to qualifying habitats and species as a result of changes to hydrodynamic and sedimentary processes (see Section 4.5).
PINS Natural England	Scoping Opinion, October 2021 Table ID 4.3.3 Appendix 2 Natural England response	The ES should include an assessment of changes in water and sediment quality during piling which could affect all marine ecological receptors or information demonstrating agreement with the relevant consultation bodies and the absence of an LSE.	This has been considered in the Stage 1 – Screening included in Section 3.1 of the HRA. Piling alone would have very limited localised effects on water and sediment quality. The potential effects on qualifying habitats and species from non-toxic (suspended sediment) and toxic contamination is considered in the AA in Sections 4.8 and 4.9 respectively.
PINS	Scoping Opinion, October 2021 Table ID 4.3.6	The ES should include an assessment of water quality impacts during dredging/dredge disposal and operational berth vessel movements on marine mammals or information demonstrating agreement with the relevant consultation bodies and the absence of an LSE.	This has been considered in the Stage 1 – Screening included in Section 3.1 of the HRA. The potential effects on qualifying habitats and species from non-toxic (suspended sediment) and toxic contamination is considered in the AA in Sections 4.8 and 4.9 respectively.
PINS	Scoping Opinion, October 2021	The Applicant's attention is drawn to the comments from Natural England, where they highlight the potential for	Potential effects on the Greater Wash SPA have been considered in the Stage 1 – Screening included in Section 3.1 of the

		effects on	HRA.
Natural England	Table ID 4.3.8 Appendix 2 Natural England response	North Killingholme Haven Pits Site of Special Scientific Interest (SSSI), The Lagoons SSSI and the Greater Wash Special Protection Area (SPA). The ES should clearly present and justify the zones of influence of the Proposed Development. Evidence should be presented of agreement wherever possible with relevant stakeholders, particularly Natural England.	In summary, it is considered highly unlikely that interest features of the Greater Wash SPA will overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to the vicinity of the Port of Immingham. Effects on SSSIs are discussed in Chapter 9 of the ES (Application Document Reference number 8.2.9).
PINS Natural England	Scoping Opinion, October 2021 Table ID 4.3.9 Appendix 2 Natural England response	Natural England has identified the potential for the new piers to lead to changes in foraging and roosting habitat which could affect the ecological function of the mudflats. The ES should either include an assessment of these effects or a justification (supported by evidence) that no LSE would arise as a result of this effect pathway.	This has been considered in the Stage 1 – Screening and Stage 2 – Appropriate Assessment included in Sections 3.1 and 4.10 of the HRA respectively.
PINS Natural England	Scoping Opinion, October 2021 Table ID 4.3.10 Appendix 2 Natural England response	Natural England has identified the potential for direct changes to benthic habitats and species beneath the pier structures to affect the ecological function of the mudflats. The ES should either include an assessment of these effects or a justification (supported by evidence) that no LSE would arise as a result of this effect pathway.	This has been considered in the Stage 1 – Screening and Stage 2 – Appropriate Assessment included in Sections 3.1 and 4.6 of the HRA respectively.
Environment Agency	Scoping Opinion, October 2021 Appendix 2	We note the capital dredge location overlaps with the intertidal habitat, which will result in a loss of intertidal habitat in this location - we would expect the loss to	The loss of habitat has been considered in the Stage 1 – Screening and Stage 2 – Appropriate Assessment included in Sections

	Environment Agency response Pre-application meeting, 29 November 2021	be compensated for.	3.1 and 4.3 of the HRA respectively. The loss of intertidal habitat as a result of the IERRT project is considered *de minimis* (i.e., negligible and ecologically inconsequential) in extent (0.012 ha direct loss and 0.01 ha indirect loss) following a change to the scheme design in order to reduce the loss and consequently is not considered to result in an AEOI on a European/Ramsar site. On this basis, compensatory habitat is not required.
Natural England	Scoping Opinion, October 2021 Appendix 2 Natural England response	Under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) an appropriate assessment (AA) needs to be undertaken. Should a Likely Significant Effect on a European/Internationally designated site be identified or be uncertain, the competent authority may need to prepare an AA, in addition to consideration of impacts through the EIA process.	An HRA has been undertaken (this report).
Natural England	Scoping Opinion, October 2021 Appendix 2 Natural England response	The Environmental Statement (ES) should include a full assessment of the direct and indirect effects of the development on the designated sites' features of special interest and should identify such mitigation measures as may be required in order to	This has been considered in the Stage 1 – Screening and Stage 2 – Appropriate Assessment included in Sections 3 and 4 of the HRA respectively.
		avoid, minimise or reduce any adverse significant effects.	
North Lincolnshire Council	North Lincolnshire Council scoping response, 28	For the in-combination assessment within the HRA, it is advised the applicant makes use of the Humber Nature Partnership In-	The database has been reviewed for the in-combination assessment included in Section 4.14 of the HRA.

Natural Environment Policy Specialist	October 2021	combination Database.	
North East Lincolnshire Council Ecologist	North East Lincolnshire Council scoping response, 23 November 2021	I can confirm that I'm happy with [the approach set out in the Scoping Report]. Interest will lie in the HRA, but protected species and habitats outside of the qualifying features of the Humber Estuary designation have been dealt with here.	An HRA has been undertaken (this report).
Natural England (PI40)	Statutory Consultation 19/01/22 - 23/02/22	*Internationally and nationally designated sites:* The consultation documents do not include a Habitats Regulations Assessment (HRA). It is Natural England's advice that the proposal is not directly connected with or necessary for the management of the European site. You should therefore determine whether the proposal is likely to have a significant effect on any European site, proceeding to the Appropriate Assessment stage where significant effects cannot be ruled out.	An HRA has been undertaken (this report).
Natural England	Statutory Consultation 19/01/22 - 23/02/22	Based on our current understanding of the nature and scale of the development, and the information provided within the	More detailed information on potential effects during the operation phase is provided in the
		consultation, Natural England broadly agrees with the scope of the assessment set out in Table 9.17 and Table 9.19, within Chapter 9 of the PEIR. However, further justification is needed where impact pathways have been scoped out of further assessment for the operation phase, while the same impact pathway	ES (Chapter 9) (Application Document Reference number 8.2.9). An HRA has been undertaken (this report).

		has been scoped in for the construction phase. This is discussed in more detail in the sections below. We recommend you consider potential likely significant effects on international designated sites arising from the impact pathways identified in Table 9.17 and Table 9.19, in addition to any other potential impact pathways identified within this consultation response and during your assessment.	
Natural England	Statutory Consultation 19/01/22 - 23/02/22	*Assessment of loss of intertidal and subtidal habitat:* Natural England notes that the proposed development will result in a loss of 1.65 ha of intertidal habitat as a result of the proposed capital dredge and jetty. In addition, it is assumed that there will be a loss of subtidal habitat as a result of piling associated with the proposed floating pontoons and finger pier structures. The potential for loss of	An HRA has been undertaken (this report). Both the ES and HRA have considered intertidal and subtidal loss including effects on designated features. The loss of intertidal habitat as a result of the proposed development is considered *de minimis* (i.e., negligible and ecologically inconsequential) in extent (0.012 ha direct loss and 0.01 ha indirect loss). This is following optimisation of the scheme design in order to reduce the loss
		subtidal habitat has not been considered in the PEIR. Natural England advises that the HRA considers the potential for likely significant effects as a result of loss of both intertidal and subtidal habitat. This should include loss of SAC habitat (i.e., Estuaries and Mudflats and sandflats not covered by seawater at low tide) as well as the loss of supporting habitat for SPA bird species.	and consequently is not considered to result in an AEOI on a European/Ramsar site (see Section 4.3).
Natural Englan	Statutory Consultation	*Assessment of loss of intertidal and subtidal habitat:* Natural England	The HRA (this report) has assessed the potential for an AEOI on a European/Ramsar

d	19/01/22 - 23/02/22	considers that any credible risk of a measurable loss of marine or terrestrial habitat, no matter how small, from within a European site is a 'likely significant effect' and the full significance of its impact on site integrity should be screened-in and further tested by an Appropriate Assessment. It is Natural England's advice that a lasting and irreparable loss of European Site habitat will prevent a conclusion of no adverse effect on site integrity being reached, unless an Appropriate Assessment can clearly ascertain otherwise.	site integrity as a result of the proposed development. The loss of intertidal habitat as a result of the proposed development is considered *de minimis* (i.e., negligible and ecologically inconsequential) in extent (following a change to the scheme design in order to reduce the loss) and consequently is not considered to result in an AEOI on a European/Ramsar site (see Section 4.3).
Natural England	Statutory Consultation 19/01/22 -23/02/22	*Assessment of loss of intertidal and subtidal habitat:* We note that section 9.8.172 states that, in the context of the Humber Estuary SPA, the loss of 1.65 ha	The HRA (this report) has assessed the potential for an AEOI on a European/Ramsar site as a result of the proposed development.
		of intertidal habitat as a result of the proposed development is considered negligible. Natural England advises that further assessment is required within an Appropriate Assessment.	The loss of intertidal habitat as a result of the proposed development is considered *de minimis* (i.e., negligible and ecologically inconsequential) in extent (following a refinement to the scheme design) and consequently is not considered to result in AEOI on a European/Ramsar site (see Section 4.3).
Natural England	Statutory Consultation 19/01/22 - 23/02/22	*Appropriate Assessment:* An appropriate assessment should be made in view of the European sites' conservation objectives, which provides a list of attributes contributing to site integrity that can provide a checklist for the assessment process, the detailed supplementary advice and advice on	An HRA has been undertaken (this report) in view of the European sites' conservation objectives (see Table 6) and with the supplementary advice and advice on operations used to inform the assessment.

		operations should also inform the conclusion.	
Natural England	Statutory Consultation 19/01/22 - 23/02/22	*Assessment of impacts on fish:* At this time, Natural England have not fully considered the potential impacts on fish species due to lack of expertise availability. We will provide detailed comments on the ES. We note however that the assessment has correctly identified fish species included in the Humber Estuary SAC designation; namely sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis*. When assessing the likely significant	An HRA has been undertaken alongside the ES (this report). This considers the impact on lamprey at different life stages.
		effect on the SAC, Natural England advises you have consideration for the potential impacts on lamprey species at the different life stages.	
Natural England	Statutory Consultation 19/01/22-23/02/22	*Assessment of impacts on fish:* Section 9.8.130 states that works will take place between 7 am and 7 pm, therefore reducing the risk to migratory fish. This has not been included as mitigation in section 9.9. It is our advice that night time working is beneficial to lamprey species and therefore should be considered mitigation.	River lamprey migrate at night (Environment Agency, 2013) and so it is assumed that the Natural England statement 'It is our advice that night time working is beneficial to lamprey species and therefore should be considered mitigation' is an error. Restricting piling at night is proposed as a mitigation measure (see Table 32 of this HRA).
Natural England	Statutory Consultation 19/01/22 - 23/02/22	*Assessment of impacts on coastal waterbirds:* Table 9.16 indicates that SPA qualifying species have been highlighted in bold. It is not clear why some species are not highlighted; curlew, grey plover, mallard and teal are all important	Species listed as SPA assemblage species within the citation have been highlighted with the symbol † in Appendix A of this HRA and the ES (Chapter 9, Table 9.19) (Application Document Reference number 8.2.9).

		component species of the Humber Estuary SPA waterbird assemblage feature. Impacts to all the SPA bird species, whether they are individually qualifying features or as part of the waterbird assemblage should be assessed within the HRA. As a guideline, impacts on all SPA bird species which are present on the project site in numbers over 1 per cent of the estuary population (not just over 10 per cent) have the potential to undermine	The HRA (this report) considers all SPA bird species which are present on the project site in numbers over 1% of the estuary population. However, for SPA species where only one single bird observation represents > 1% of the estuary population (based on the data for Sector B presented in Table 9.19 in Chapter 9 of the ES (Application Document Reference number 8.2.9)), such as Greenshank, they are not considered further in the assessment.
		the conservation objectives and should therefore be subject to further assessment in the HRA.	
Natural England	Statutory Consultation 19/01/22 - 23/02/22	*Assessment of impacts on coastal waterbirds:* Natural England agrees with the scope of assessment of potential impacts to coastal waterbirds during construction and advises that the potential impact pathways included in Table 9.17 should be considered in the HRA.	These pathways are considered in the HRA (this report) in Section 4.
Natural England	Statutory Consultation 19/01/22-23/02/22	*Assessment of impacts on coastal waterbirds:* Section 9.8.228 discusses the potential for operational disturbance to coastal birds using the nearby intertidal mudflat as a result of vessel movements and people around the berthing infrastructure. Natural England advises that the assessment should also consider the potential for disturbance as a result of wheeled cargo moving from the berthing infrastructure to the terminal	This pathway is considered in the HRA (this report) in Section 4.

		areas, which are expected to occur directly above and adjacent to the intertidal mudflat.	
Natural Englan d	Statutory Consultation 19/01/22 -23/02/22	*Assessment of impacts on coastal waterbirds:* We welcome the proposed avoidance/mitigation measures set out in section 9.9. The specifics of these measures should be detailed in the Code of Construction Practice (CoCP) and Ecological Management Plan (EMP) which	Mitigation measures are detailed within the Construction Environmental Management Plan (CEMP) (Application Document Reference number 9.2) and are referred to in the HRA (this report) in Section 4.
		will need to be agreed with Natural England.	
Natural Englan d	Statutory Consultation 19/01/22 - 23/02/22	*Assessment of impacts on coastal waterbirds:* Section 9.9.6 identifies mitigation measures to reduce disturbance to coastal waterbirds during construction, namely soft start piling and cold weather restrictions. Please note that these mitigation measures rely on availability of alternative intertidal areas for feeding and roosting birds. This should be considered in more detail within the Appropriate Assessment.	The availability of alternative intertidal areas for feeding and roosting birds is considered in Section 9.8 of Chapter 9 of the ES (Application Document Reference number 8.2.9) and in Section 4.10 of this HRA.
Natural Englan d	Statutory Consultation 19/01/22 -23/02/22	*Assessment of impacts on coastal waterbirds:* Section 9.9.8 proposes an adaptive monitoring and management strategy to address disturbance of waterbirds during the operational phase. Whilst it would be interesting to see the results of a programme of monitoring of disturbance related to port operations, Natural England does not recommend reliance on a 'monitor and manage'	The application of an adaptive monitoring and management strategy has not been included in the HRA given Natural England's concerns relating to the implementation of such a strategy. Instead, screens will be used to reduce potential disturbance on a precautionary basis during operation (see Section 4.9 of this HRA). If mitigation was deemed necessary as part of an adaptive approach, it is likely that this would have

		approach which we have found can be very difficult to implement. There are a number of issues such as the setting of appropriate targets when additional mitigation measures would be required and separating out the disturbance effects of this development from current port	involved the implementation of screens.
		activity. The surveys are proposed to take place twice per month, so provide a 'snap shot' of port activity, which may miss a very disturbing event, which would trigger additional mitigation measures. This aspect should be considered in more detail within the Appropriate Assessment and additional mitigation measures proposed, if it cannot be shown that there will not be an adverse effect on the integrity of the designated site.	
Natural England (PI40)	Statutory Consultation 19/01/22 -23/02/22	Construction Phase: The potential for air quality impacts to the Humber Estuary SPA, SAC and Ramsar from construction dust and site plant emissions should be assessed in the HRA.	Consideration was given to the impacts of construction dust and emissions at Stage 1 - Screening and given the scale and nature of the works the potential for LSE was excluded. Further information on this pathway is presented in Chapter 9 of the ES (Application Document Reference number 8.2.9).
Natural England (PI40)	Statutory Consultation 19/01/22 -23/02/22	Operational Phase: Natural England recommends that the ES and HRA consider whether there is likelihood of the operational traffic acting in -combination with other plans or projects.	The HRA has considered the potential for in-combination effects with other reasonably foreseeable development in the area in relation to operational road traffic emissions (see Section 4.14).

Natural England (PI40)	Statutory Consultation 19/01/22 -23/02/22	Operational Phase: It is not clear whether vessels will pass within 200m of sensitive habitats when moving through the estuary. This should be clarified in the ES and HRA.	The HRA has considered the potential for in-combination effects with other reasonably foreseeable development in the area in relation to operational vessel emissions (see Section 4.14).
			Vessels will be required to route to and from the IERRT project using the Humber Estuary Main Navigational Fairway. At no point on this route will vessels associated with the operation of the IERRT pass within 200 m of an air quality sensitive habitat.
Natural England (PI40)	Statutory Consultation 19/01/22 -23/02/22	We therefore advise that ammonia from traffic and marine vessels should be included for assessment in the HRA.	The HRA has considered the potential for in-combination effects with other reasonably foreseeable development in the area in relation to operational vessel emissions (see Section 4.14). Ammonia emissions have been included in the assessment for appropriate sources on habitats reported in the HRA (this report) (see Section 4.7).
Natural England (PI40)	Statutory Consultation 19/01/22 -23/02/22	Natural England's guidance accepts the use of the significance threshold of 1000 Annual Average Daily Traffic (or the levels of emissions being <1 per cent of the critical level/ load), however, this does not exclude the requirement for an assessment of the potential impacts in-combination with other plans or projects. Therefore, Natural England recommends that the ES and HRA consider whether there is likelihood of the operational traffic	The HRA has considered the potential for in-combination effects with other reasonably foreseeable development in the area in relation to operational vessel and traffic emissions (see Section 4.14).

		acting in -combination with other plans or projects.	
Natural England	Pre-application meeting, 7 February 2022.	The meeting provided an overview of the IERRT project, the marine ecology assessment approach, the site-specific surveys and a discussion on potential impacts relating to habitat loss/change and bird disturbance. As part of the meeting ABP highlighted that they will continue to optimise the marine design (dredge berth pocket) and layout of marine infrastructure with a view to avoiding or at least minimising any loss of intertidal habitat. Natural England suggested that potential mitigation for bird disturbance could involve opportunities for reducing activities that are causing disturbance elsewhere on the Humber as this could potentially make other areas of the estuary more attractive to birds.	The HRA (this report) – has been completed taking on board consultee comments from the meeting. Mitigation has been incorporated where relevant, for example in relation to disturbance of coastal waterbirds in Section 4.10.
Natural England	Pre-application meeting, 16 March 2022.	The meeting provided an update of the IERRT project, a summary of the future site-specific surveys and a discussion on potential impacts relating to habitat loss/change and bird disturbance. Proposed mitigation measures in construction and operation for potential bird disturbance were also discussed.	The HRA (this report) has been completed taking on board consultee comments from the meeting. Mitigation has been incorporated where relevant, for example in relation to disturbance of coastal waterbirds in Section 4.10.
Natural England	Pre-application meeting, 28 April 2022	The meeting provided a further update of the IERRT project as well as a discussion on potential impacts relating to habitat loss/change and bird disturbance.	Chapter 9 of the ES (Application Document Reference number 8.2.9) and the HRA (this report) have been completed taking on board consultee comments from the meeting.
Natural Englan	Natural England response to pre-	Natural England provided comments following the meeting held on 28 July 2022	The HRA has been completed taking on board comments raised in Natural England's

d	application meeting minutes (28 July 2022), 3 October 2022	and the meeting minutes.	response.
Environment Agency (PI34)	Statutory Consultation 19/01/22 - 23/02/22	We have considered this Chapter of the preliminary assessment for elements of marine ecology, which fall under the Environment Agency's remit. We agree with the scoped in elements of Table 9.17, which are being taken forward in the assessment. We note that there will be a loss of 1.64 ha of intertidal habitat, which has been identified as high to moderate vulnerability, and acknowledged for its importance to supporting coastal birds. The Environment Agency strongly encourages compensation for this loss.	The HRA (this report) has assessed the potential for an adverse effect on site integrity as a result of the proposed development. The loss of intertidal habitat as a result of the proposed development is considered *de minimis* (i.e., negligible and ecologically inconsequential) in extent (0.012 ha direct loss and 0.01 ha indirect loss) following optimisation of the scheme design in order to reduce the loss and consequently is not considered to result in AEOI on a European/Ramsar site (see Section 4.3). On this basis, compensatory habitat is not required.
DFDS (P17, P122, P139).	Statutory Consultation 19/01/22 - 23/02/22	The project would be built into the Humber Estuary Ramsar/SAC/SPA and will therefore almost certainly have an adverse effect on the integrity of the site. Chapter 4 of the PEIR does not adequately demonstrate need for the project, rather setting out predicted demand for Ro-Ro traffic without examining whether existing capacity could meet it.	The HRA (this report) has assessed the potential for an adverse effect on site integrity as a result of the proposed development. The loss of intertidal habitat as a result of the proposed development is considered *de minimis* (i.e., negligible and ecologically inconsequential) in extent (following refinements to the scheme) and consequently
		If the project is to go ahead in a Natura 2000 site, ABP must demonstrate there	is not considered to result in AEOI on a European/Ramsar site (see Section 4.3). On this basis, it is not necessary to demonstrate

		are imperative reasons of overriding public importance that it does so, and that compensatory land is provided. At present, none of these have been demonstrated to a satisfactory degree. In particular there are other installations on the Humber that could accommodate these works with less harm to the Natura 2000 site.	IROPI and compensatory habitat is not required.
North Lincolnshire Council (P138)	Statutory Consultation 19/01/22 - 23/02/22	The Natural Environment Policy Specialist has advised that, in terms of landscape and terrestrial ecology, the proposal is not likely to have any significant effects of relevance to North Lincolnshire. Furthermore, the approach proposed for the EIA and the Habitat Regulations Assessment (HRA) is supported, as amended by the advice of Natural England. For the in-combination assessment within the HRA, it is advised that the applicant makes use of the Humber Partnership In-combination Database.	Humber Partnership In-combination Database has been used to inform the HRA In-combination Assessment (Section 4.13).
Natural England (PI 22)	Supplementary Statutory Consultation – 28 Oct – 27 Nov 2022	It is Natural England's advice that the proposal is not directly connected with or necessary for the management of the European site. You should therefore determine whether the proposal is likely to have a significant effect on any European site, proceeding to the Appropriate Assessment stage where significant effects cannot be ruled out.	It has been determined that the IERRT project is likely to have a significant effect on the Humber Estuary EMS, and a HRA has been undertaken (this report).
Natural England (PI	Supplementary Statutory	Natural England advises that the HRA should consider the potential for likely	The HRA (this report) has considered the potential for loss (both direct and indirect)

22)	Consultation – 28 Oct – 27 Nov 2022	significant effects as a result of loss and change in both intertidal and subtidal habitat. This should include loss of SAC habitat (i.e., Estuaries and Mudflats and sandflats not covered by seawater at low tide) as well as the loss of supporting habitat for SPA bird species. If it is considered necessary to include in the final application the additional impact protection measures, then this should also be included in the Habitats Regulations Assessment.	and change to intertidal and subtidal habitats and has been assessed in the context of SAC features ('Estuaries' and 'Mudflats and sandflats not covered by seawater at low tide') as well as the loss of supporting habitat for SPA bird species. The HRA (this report) has considered the additional impact protection measures.
Natural England (PI 22)	Supplementary Statutory Consultation – 28 Oct – 27 Nov 2022	Natural England considers that any credible risk of a measurable loss of marine or terrestrial habitat, no matter how small, from within a European site is a 'likely significant effect' and the full significance of its impact on site integrity	All predicted loss (both direct and indirect) and change to intertidal and subtidal habitats has been screened into the AA stage.
		should be screened-in and further tested by an Appropriate Assessment. It is Natural England's advice that a lasting and irreparable loss of European Site habitat will prevent a conclusion of no adverse effect on site integrity being reached, unless an Appropriate Assessment can clearly ascertain otherwise.	
Natural England (PI 22)	Supplementary Statutory Consultation – 28 Oct – 27 Nov 2022	Natural England advises that further assessment is required within an Appropriate Assessment and we will give our statutory advice at that stage.	Noted.
Natural England (PI 22)	Supplementary Statutory Consultation – 28	The appropriate assessment should be made in view of the European sites' conservation objectives, which provides a	The AA has been made in in view of the European sites' conservation objectives and also has been informed by the

	Oct – 27 Nov 2022	list of attributes contributing to site integrity that can provide a checklist for the assessment process, the detailed supplementary advice and advice on operations should also inform the conclusion.	supplementary advice and advice on operations.
Natural England (PI 22)	Supplementary Statutory Consultation – 28 Oct – 27 Nov 2022	Plans or projects that should be considered in the in-combination assessment include the following: The incomplete or non-implemented parts of plans or projects that have already commenced; Plans or projects given consent or given effect but not yet started;	The specified types of projects are considered in the cumulative and in-combination effects assessment. Immingham Green Energy Terminal has been included in the list of projects to assess. The assessment is provided in Section 4.14 of the HRA (this report).
		Plans or projects currently subject to an application for consent or proposed to be given effect; Projects that are the subject of an outstanding appeal; Ongoing plans or projects that are the subject of regular review; Any draft plans being prepared by any public body; Any proposed plans or projects published for consultation prior to application. Chapter 20 of the PEIR provides a list of projects that would be included in an assessment of the potential in-combination effects, if deemed necessary. Natural England broadly agrees with the selection criterion. When assessing the effects on designated sites, Natural England recommends that the search radius be measured from the nearest point on the designated site to the proposal being assessed, or the nearest	

		area of sensitive habitat, if known. This would likely identify those proposals which are likely to affect overlapping geographic extents within the designated site in question. Natural England notes that the Immingham Green Energy Terminal has	
		not been included in table 20.4 in the PEIR.	
Natural England (PI 22)	Supplementary Statutory Consultation – 28 Oct – 27 Nov 2022	Natural England have advised previously that the applicant also refer to Natural England's guidance on the assessment of road traffic emissions under the Habitats Regulations. To re-iterate: Construction phase The potential for air quality impacts to the Humber Estuary SPA, SAC and Ramsar from construction dust and site plant emissions should be assessed in the HRA. Operational phase Refer to Natural England's previous response dated 23rd February 2022.	Noted. Consideration was given to the impacts of construction dust and emissions at Stage 1 - Screening and given the scale and nature of the works the potential for LSE was excluded. Further information on this pathways is presented in Chapter 9 of the ES (Application Document Reference number 8.2.9).
MMO (CA 32)	Change Application Consultation 17.11.23	The MMO does not have any concerns regarding the proposed changes with regards to benthic ecology. The impact of the proposed development on benthic ecology receptors following the proposed changes will be approximately equivalent to what was originally assessed in the ES, and therefore the MMO has no further	The MMO's comments are noted.

		comments to make on this topic.	
		The MMO does not have any concerns relating to fisheries from the proposed changes to the project. We are content that the significance of impacts arising from direct loss or changes to fish populations, loss of habitat, and changes in water and sediment quality as a result of dredging and dredge disposal will remain broadly the same as those assessed in the ES.	The MMO's comments are noted.
		Concerning the impacts to fish from underwater noise and vibration during piling, the MMO notes that the number of piles to be installed has changed, with a decrease in the number required for the approach jetty, but an increase in the number of piles required for the dolphins, plus a change in pile diameter is required in some instances. Overall, the MMO considers the changes are not of concern, however, the MMO, in consultation with Cefas fisheries and underwater noise advisors, are in consultation with the Applicant regarding appropriate mitigation measures for underwater noise impacts to fish. A meeting between the MMO, Cefas and the Applicant was held on 7 November 2023 and a separate consultation is expected to be held regarding this shortly.	The MMO's comments are noted. Discussions between the Applicant and the MMO are ongoing regarding appropriate mitigation measures for underwater noise impacts to fish. However, as noted by the MMO, underwater noise effects on migratory fish and the mitigation measures for underwater noise are not affected by the Proposed Changes.
		The MMO has no concerns relating to shellfisheries caused by the proposed changed to the project and therefore has	The MMO's comments are noted.

		no further comments to make regarding this.	
		The MMO does not have any major concerns regarding the proposed changes with regards to underwater noise. Given that the additional piling (if approved) will be undertaken with the original footprint of the project, the MMO believes that the conclusions of the original underwater noise assessment are valid.	The MMO's comments are noted.
		The MMO presumes 180 minutes of impact piling and 20 minutes of vibro-piling each working day is also applicable to the additional piling that is required as a result of the proposed changes, but it would be helpful if this could please be confirmed.	The MMO's presumption is correct.
Natural England (CA 34)	Change Application Consultation 17.11.23	With regard to the Proposed Change 1 (realignment of the approach jetty and related works) and Proposed Change 2 (realignment of the internal link bridge and consequential works), Natural England confirms that these elements will not result in a change to the assessment of impact significance compared to the documents originally submitted into Examination. As regards to Proposed Change 3 (realignment of the UKBF facilities) and Proposed Change 4 (enhanced management controls and options for the potential provision of additional impact protection measures), Natural England has no comment to	Natural England's comments are noted. The Applicant's dialogue with Natural England continues regarding matters related to the application.

		make.	

3 Stage 1 - Screening

3.1 Identification of sites and features screened into the assessment

3.1.1 In accordance with PINS Advice Note 10 (PINS, 2022), the first stage of the HRA involves considering if the plan or project is likely to have a significant effect on interest features of a European/Ramsar site either alone or in- combination with other plans or projects.

3.1.2 The entire Humber Estuary is designated as a SAC and a SPA under the Habitats and Birds Directives. It is also classified as a 'Ramsar site' under the Ramsar Convention due to the presence of internationally important wetlands. These designations form the Humber Estuary European Marine Site (EMS). In addition, following advice from Natural England (Table 1), there is the potential for the Greater Wash SPA, which is located approximately 20 km from the proposed development, to be affected as it is designated for a range of seabird and diving bird species. The Wash and North Norfolk Coast SAC, which has common seals as a qualifying feature, also has the potential to be affected by the proposed development. The location of these sites in relation to the proposed development is shown on Figure 2.

3.1.3 The qualifying interest features and justification as to their inclusion or exclusion from the Stage 1 screening assessment is provided in Table 2. The judgement as to whether a site or feature needs to be considered is based on the available baseline information of the location, ecology and/or behaviour of interest features provided in Appendix A of this HRA and the detailed description of the proposed development provided in Chapter 2 of the ES (Application Document Reference number 8.2.2), and the activities involved during the construction and operational phase of the proposed development included in Chapter 3 of the ES (Application Document Reference number 8.2.3).

3.1.4 The potential impacts that could result in LSE on features of the Humber Estuary SAC, SPA and Ramsar, alone and in-combination, are considered in Table 3, Table 4 and Table 5 respectively. The potential impacts that could result in LSE on the Wash and North Norfolk Coast SAC are also considered in Table 3. Section 4.14 provides the in-combination effects assessment.

3.1.5 For context, the condition of the features of the Humber Estuary SAC, SPA and Ramsar site are 'not assessed'. However, the condition statement assessment of the respective Site of Special Scientific Interest (SSSI) Units predominantly class the estuary as in favourable (6.09% of the area) and unfavourable but recovering (88.21% of the area) condition.

Table 2. Identification of European/Ramsar sites and qualifying features relevant to the Screening assessment

Site	Qualifying features	Justification (✓ requires consideration, × not relevant to the screening assessment)	
Humber Estuary SAC	H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks	✓	Feature is present in the vicinity of the disposal site.
	H1130. Estuaries	✓	Feature is present within the footprint of the IERRT project.
	H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats	✓	Feature is present within the footprint of the IERRT project.
	H1150. Coastal lagoons	×	Two qualifying coastal lagoons areas are present within the Humber Estuary SAC boundary (Humberston Fitties and Northcoates Lagoon which are located over 15 km and 20 km respectively from the proposed IERRT development). These sites are outside any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham.
	H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand	×	Based on the current geographic extent and location of Natural Environment and Rural Communities Act (2006) Section 41 habitats of principal importance (Natural England, 2022) the nearest saltmarsh habitat is located approximately 3 km to the northwest of the IERRT project at Killingholme within the Humber Estuary Site of Special Scientific Interest (SSSI) Unit 093 – HIT to Second Jetty. This is outside any potential direct or indirect marine changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham.
	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	✓	As described above the nearest saltmarsh habitat is located approximately 3 km to the northwest of the IERRT project and outside of nay potential direct or indirect marine changes resulting from the construction and operational
			activities. However Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

			is sensitive to N deposition or NOx from operational marine vessel/ road vehicle emissions and requires consideration in relation to his pathway only.
	H2110. Embryonic shifting dunes	×	Based on the current geographic extent and location of Natural Environment and Rural Communities Act (2006) Section 41 habitats of principal importance (Natural England, 2022), the nearest coastal sand dunes within the Humber SAC are located more than 12 km southwest of the IERRT project at Cleethorpes. This is outside any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham.
	H2120. Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with Marram	×	
	H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland	×	
	H2160. Dunes with *Hippophae rhamnoides*; Dunes with sea-buckthorn	×	
	S1095. *Petromyzon marinus*; Sea lamprey	✓	Sea lamprey are recorded in the estuary and are known to also move through the estuary during spawning migrations (see Section 1.3 of Appendix A of this HRA). This species may be present in the vicinity of the proposed development.
	S1099. *Lampetra fluviatilis*; River lamprey	✓	River lamprey are recorded in the estuary and are known to also move through the estuary during spawning migrations (see Section 1.3 of Appendix A of this HRA). Their growth phase is primarily restricted to estuarine waters. This species may be present in the vicinity of the proposed development.
	S1364. *Halichoerus grypus*; Grey seal	✓	The nearest established breeding colony for grey seals is located over 25 km away at Donna Nook. In addition, small numbers have been observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) which is located approximately 4 km north east from the proposed development and around 3-4 km from the dredge disposal site (including
			transit routes). Whilst not sensitive at their haul out sites, grey seals may be present in the estuary in the vicinity of the Port of Immingham.
Humber Estuary	A021 *Botaurus stellaris*; Great bittern (Non-breeding)	×	The Humber region supports both breeding and wintering Great Bittern. Based on the extensive bird data available for the Humber Estuary, Great Bittern is recorded within reedbed habitats such as around Blacktoft Sands,

SPA	A021 *Botaurus stellaris*; Great bittern (Breeding)	✗	Far Ings and North Killingholme Haven clay pits (Section 1.4 of Appendix A of this HRA)These areas are outside of any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham (see Section 9.2 and Section 9.8 of Chapter 9 of the ES (Application Document Reference number 8.2.9)). Furthermore, this species does not normally occur on open mudflat habitat and has not been recorded in the Immingham Outer Harbour (IOH) bird monitoring that has been undertaken in the Immingham area (Section 1.4 of Appendix A of this HRA).
	A048 *Tadorna tadorna*; Common shelduck (Non-breeding)	✓	Common Shelduck have been regularly recorded on the foreshore in the area of the proposed development in locally important numbers (i.e. abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak) as summarised in Section 1.4 of Appendix A of this HRA).
	A081 *Circus aeruginosus*; Eurasian marsh harrier (Breeding)	✗	Marsh Harriers breed in the Humber region and are also recorded during passage periods and the winter. Based on the extensive bird data available for the Humber Estuary (see Section 1.4 of Appendix A of this HRA), Marsh Harrier primarily forage around reed beds and marshes in coastal areas as well as farmland near wetland and are recorded relatively frequently in the Immingham region (see Section 1.4 of Appendix A of this HRA). However, the species is not recorded hunting over mudflats for prey species and, therefore, does not overlap any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham
	A082 *Circus cyaneus*; Hen harrier (Non-breeding)	✗	Hen Harrier is a winter visitor and passage migrant on the Humber. Based on the extensive bird data available for the Humber Estuary (see Section 1.4 of
			Appendix A of this HRA), this species roosts and forages primarily in areas of saltmarsh and reedbed as well as open habitats such as arable fields and grassland. This species is only rarely recorded in the Immingham area.
	A132 *Recurvirostra avosetta*; Pied avocet (Non-breeding)	✗	Wintering populations of Pied Avocet are typically recorded in the inner estuary in the largest numbers (see Section 1.4 of Appendix A of this HRA)). This species is recorded in the Immingham region but is considered rare in the vicinity of the proposed development, for example only two individuals

			have been recorded in the relevant Count Sector B in the IOH monitoring between 2010/11 and 2021/22 (see Section 9.6 of the Nature Conservation and Marine Ecology Chapter 9 of the ES).
	A132 *Recurvirostra avosetta*; Pied avocet (Breeding)	✗	Pied Avocet are not known to breed on the foreshore in the Immingham area. This species is recorded in the Immingham region but is considered rare in the vicinity of the proposed development, for example only two individuals have been recorded in the relevant Count Sector B in the IOH monitoring between 2010/11 and 2021/22 (see Section 1.4 of Appendix A of this HRA). The area is, therefore, considered to be of very limited functional value for the species.
	A140 *Pluvialis apricaria*; European golden plover (Non-breeding)	✗	The Humber Estuary is one of the most important sites in the UK for Golden Plover with the species primary recorded roosting on mudflats and other intertidal habitats in the region (see Section 1.4 of Appendix A of this HRA). While this species is widely distributed through the estuary, the species is only very infrequently recorded in vicinity of the proposed development, for example only one single individual was recorded in the relevant Count Sector B in the IOH monitoring between 2016/17 and 2021/22 (see Section 1.4 of Appendix A of this HRA). The area is, therefore, considered to be of very limited functional value for the species.
	A143 *Calidris canutus*; Red knot (Non-breeding)	✓	Knot have been regularly recorded in low numbers (i.e., abundances in Sector B representing < 1% of the estuary wide population (based on the WeBS 5- year mean peak) as summarised in Section 1.4 of Appendix A of this HRA). However, this qualifying feature has been screened in on a precautionary basis as they have been regularly recorded on the foreshore in small flocks in some years.
	A149 *Calidris alpina*; Dunlin (Non-breeding)	✓	Dunlin have been regularly recorded on the foreshore in the area of the proposed development in locally important numbers (i.e. abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak) as summarised in Section 1.4 of Appendix A of this HRA).
	A151 *Philomachus pugnax*; Ruff (Non-breeding)	✗	The Humber Estuary is considered an important site for passage Ruff. Important areas of the Humber for Ruff are the intertidal mudflats and adjacent lagoons of Alkborough Flats and Blacktoft (see Section 1.4 of

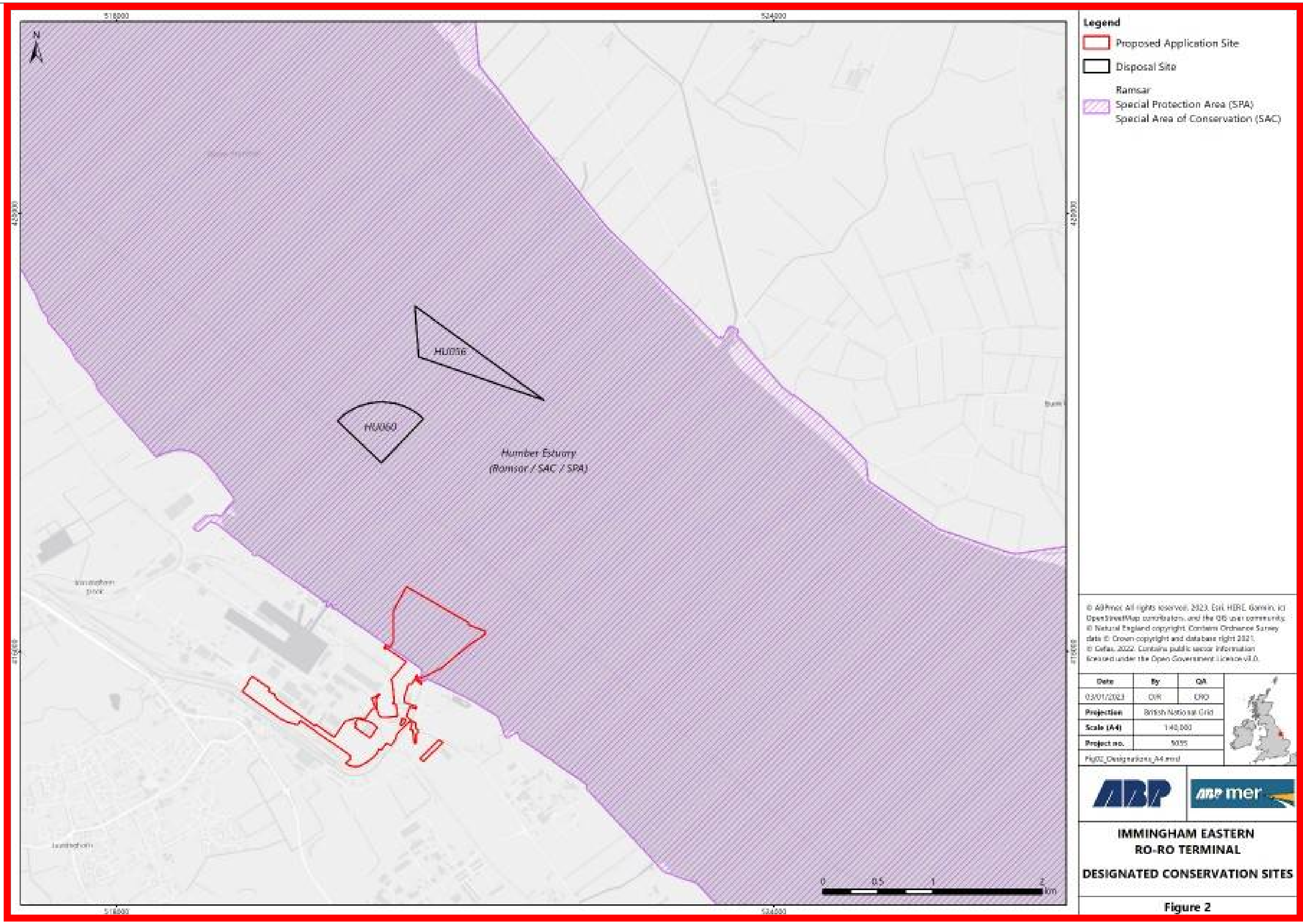
			Appendix A of this HRA). This species is more rarely recorded in the outer Humber Estuary and typically shows a preference for more sheltered sections of the inner Humber Estuary. This species is rarely recorded on mudflat habitat in the Immingham area, for example only one individual has been recorded in the relevant Count Sector B in the IOH monitoring between 2010/11 and 2021/22. The area is, therefore, considered to be of very limited functional value for the species.
	A156 *Limosa limosa islandica*; Black-tailed godwit (Non-breeding)	✓	Black-tailed Godwit have been regularly recorded on the foreshore in the area of the proposed development (in abundances in Sector B representing nationally or internationally important numbers as well regionally important numbers i.e., in abundances representing > 10% of the estuary wide population (based on the WeBS 5-year mean peak) as summarised in Section 1.4 of Appendix A of this HRA).
	A157 *Limosa lapponica*; Bar-tailed godwit (Non-breeding)	✓	Bar-tailed Godwit have been recorded in locally important numbers in some years in the area of the proposed development (i.e., in abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak as summarised in Section 1.4 of Appendix A of this HRA).
	A162 *Tringa totanus*; Common redshank (Non-breeding)	✓	Common Redshank have been regularly recorded locally important numbers on the foreshore in the area of the proposed development (i.e., abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak as summarised in Section 1.4 of Appendix A of this HRA).
	A195 *Sterna albifrons*; Little tern (Breeding)	×	Little Tern breed at Easington Lagoon, which is located approximately 20 km from the proposed development, with data suggesting this species forages within 5 km of nesting sites (Woodward *et al*., 2019). This species is considered very rare within the Immingham area.
	Waterbird assemblage	✓	As well as the qualifying species listed above in this table, the foreshore in the vicinity of the proposed development also supports a range of other species. The rationale for screening in assemblage species is provided in Appendix B of this HRA. On this basis, the following assemblage species were screened into the assessment: • Curlew; • Oystercatcher; • Teal;

			• Turnstone; • Ringed Plover; and • Mallard.
Humber Estuary Ramsar	Criterion 1 – natural wetland habitats that are of international importance: Near-natural estuary with component habitats, specifically dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	✓	The Criterion 1 interest feature includes habitats which are present within the footprint of the IERRT project (estuarine waters, intertidal mud and sand flats) and saltmarsh which is sensitive to N deposition or NOx from operational marine vessel/ road vehicle emissions only.
	Criterion 3 – supports populations of plants and/or animal species of international importance: ~~Breeding colony of grey seals *Halichoerus grypus* at Donna Nook.~~	✓	The nearest established breeding colony for grey seals is located over 25 km away at Donna Nook. In addition, small numbers have been observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) which is located approximately 4 km north east from the proposed ~~development and around 3-4 km from the dredge disposal site (including transit routes). Whilst not sensitive at their haul out sites, grey seals may be present in the estuary in the vicinity of the Port of Immingham.~~
	Breeding colony of grey seals *Halichoerus grypus* at Donna Nook.		development and around 3-4 km from the dredge disposal site (including transit routes). Whilst not sensitive at their haul out sites, grey seals may be present in the estuary in the vicinity of the Port of Immingham.
	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl.	✓	Assemblage species that form part of Criterion 5 of the Humber Ramsar site, specifically Curlew, Oystercatcher, Teal, Turnstone and Ringed Plover have been screened into the assessment. The rationale for screening in individual species can be seen above in the Humber Estuary SPA section of this Table.
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit,	✓	Species that form part of Criterion 6 of the Humber Ramsar site, specifically Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Redshank, Knot and Shelduck have been screened into the assessment. The rationale for screening in individual species can be seen above in the Humber Estuary SPA section of this Table.

	Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering).		
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: River lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*.	✓	River and sea lamprey are recorded in the estuary and are known to also move through the estuary during spawning migrations (see Section 1.3 of Appendix A of this HRA) . River lamprey growth phase is primarily restricted to estuarine waters. This species may be present in the vicinity of the proposed development.
Greater Wash SPA	A001 *Gavia stellata*; Red-throated diver (Non-breeding)	✗	The Humber Estuary supports relatively low numbers of wintering Red-throated Diver although it is acknowledged these could form part of the population occurring in the Greater Wash SPA. However, data suggests that Red-throated Diver are rarely recorded inshore in the Port of Immingham area with this species considered to be highly sensitive to vessel movements and typically avoid areas with high shipping intensity (Natural England and JNCC, 2016). On that basis, it is considered that this interest feature of the Greater Wash SPA will not overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham.
	A065 *Melanitta nigra*; Common scoter (Non-breeding)	✗	The Humber Estuary supports passage and wintering Common Scoter and it is acknowledged these could form part of the population occurring in the Greater Wash SPA. However, data suggests that Common Scoter are rarely recorded inshore in the Port of Immingham area with this species considered to be highly sensitive to vessel movements and typically avoid areas with high shipping intensity (Natural England and JNCC, 2016). Therefore, this interest feature of the Greater Wash SPA will not overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham.

	A177 *Hydrocoloeus minutus*; Little gull (Non-breeding)	×	Little Gull are rarely recorded in the Port of Immingham area (Natural England and JNCC, 2016) and, therefore, this interest feature of the Greater Wash SPA will not overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham (see Section 1.4 of Appendix A of this HRA).
	A191 *Sterna sandvicensis*; Sandwich tern (Breeding)	×	The Humber Estuary does not overlap with the foraging ranges of nesting Sandwich Terns from the breeding colonies of the Greater Wash SPA (the maximum foraging range of Sandwich Tern recorded is 80 km with the breeding colonies located over 90 km away on the North Norfolk coast). Most
			foraging activity also occurs much closer to the nesting colonies (Woodward *et al*., 2019; Natural England and JNCC, 2016). Therefore, it is highly unlikely this interest feature will overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham
	A193 *Sterna hirundo*; Common tern (Breeding)	×	The Humber Estuary does not overlap with the foraging ranges of nesting Common Terns from the breeding colonies of the Greater Wash SPA (the maximum foraging range of Common Tern recorded is 30 km with the breeding colonies located over 90 km away on the North Norfolk coast). Most foraging activity also occurs much closer to the nesting colonies (Woodward *et al*., 2019; Natural England and JNCC, 2016). Therefore, it is highly unlikely this interest feature will overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham.
	A195 *Sternula albifrons*; Little tern (Breeding)	×	Little Tern forages within 5 km of nesting sites (Woodward *et al*., 2019) and, therefore, this interest feature of the Greater Wash SPA will not overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the proposed development which are limited to within the vicinity of the Port of Immingham (see Section 1.4 of Appendix A of this HRA).
The Wash	S1365 Harbour seal *Phoca vitulina**	✓	It is acknowledged that there could potentially be connectivity between the Wash and North Norfolk Coast SAC and the Humber Estuary with respect to

and North Norfolk Coast SAC*			common seal movements. Common seals have been recorded foraging over 200 km from haul out sites outs including from sites in the Wash (Tollit *et al.*1998; Sharples *et al.*, 2008; Sharples *et al.,* 2012). The Wash and North Norfolk Coast SAC is located over 75 km from the Project. However, evidence suggests that harbour seals typically forage within 40-50 km of their haul out sites (SCOS, 2022) which is reflected in high predicted at-sea densities of common seals in the Wash and along the North Norfolk and Lincolnshire
			coasts and much lower predicted densities in the Humber Estuary or north of Spurn Point (Carter *et al.,* 2020). On this basis, the Immingham area is not considered to be key foraging habitat for common seals of the Wash and North Norfolk Coast SAC population although it is acknowledged that it is possible that individuals from this population could infrequently forage in this area.
*The Wash and North Norfolk Coast SAC also supports a range intertidal and subtidal qualifying habitat features but given that these features are located over 75 km from the Project they are not within the zone of influence of potential effects and therefore has no potential to cause LSE.			


Legend
Proposed Application Site
Disposal Site
Ramsar
Special Protection Area (SPA)
Special Area of Conservation (SAC)
HU056
HU060
Humber Estuary
(Ramsar / SAC / SPA)
0
0.5
1
2
km
Date
By
QA
Projection
British National Grid
Scale (A4)
Project no.
IMMINGHAM EASTERN
RO-RO TERMINAL
DESIGNATED CONSERVATION SITES
Figure 2

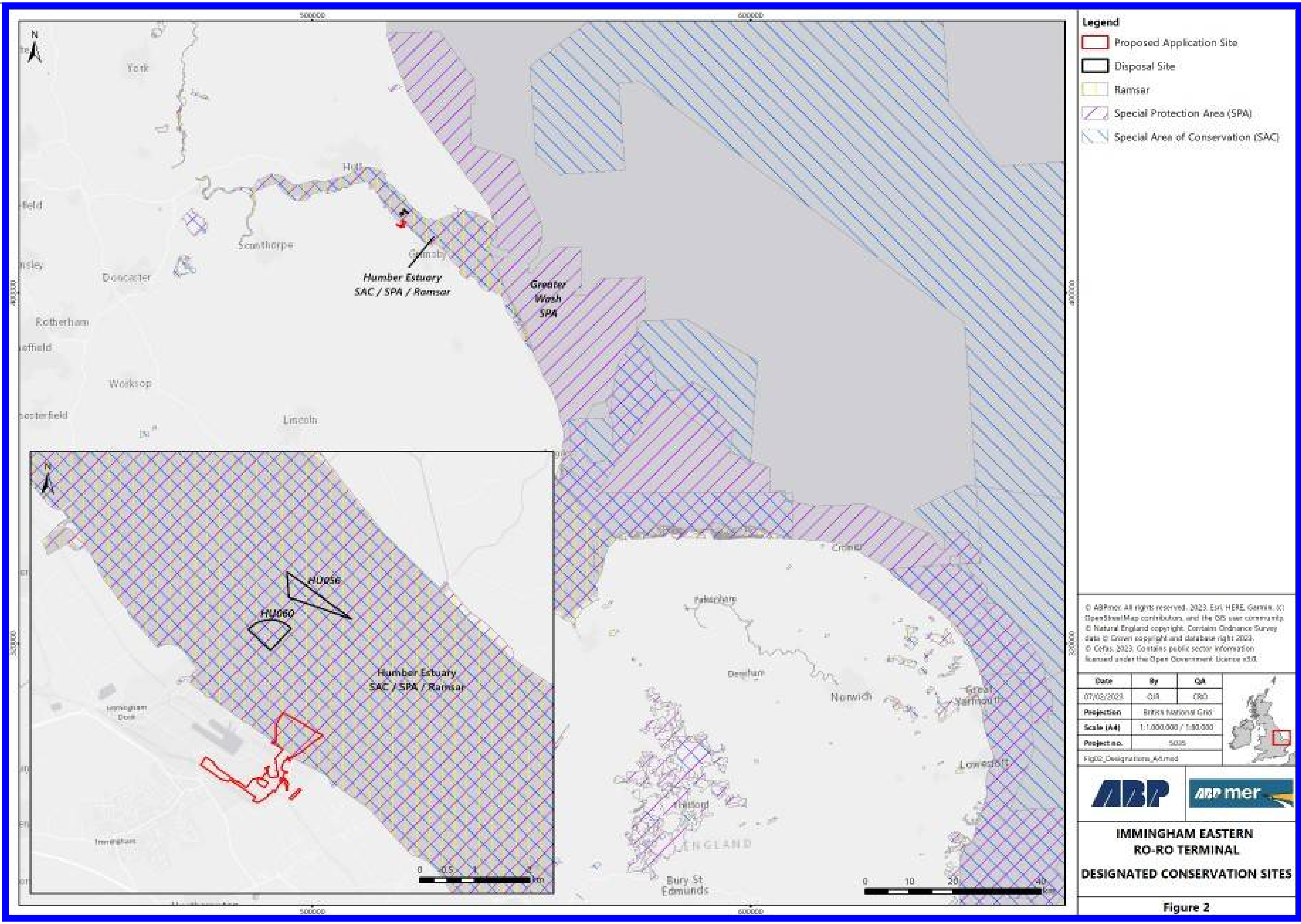


Figure 2. Location of designated sites

Table 3. Potential impacts that could result in LSE on features of the Humber Estuary SAC and the Wash and North

Norfolk Coast SAC

Site	Phase	Impact Pathways/ Potential Effects	Project activity	Feature	Potential for LSE alone and in-combination	Justification
Humber Estuary SAC	Construction	Direct loss of intertidal habitat as a result of capital dredging and the piles	Capital dredge and piling	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	Capital dredging will cause a direct, albeit very small loss of intertidal habitat which will be changed to subtidal habitat as a result of the deepening. Piling will also result in the small loss of intertidal.
		Direct loss of subtidal habitat as a result of the piles	Piling	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	Piling will also result in the small loss of subtidal.
		Direct changes to benthic habitats and species as result of	Capital dredge	H1140: Mudflats and sandflats not covered by seawater at low tide	Yes	Capital dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material ~~include~~
		seabed removal		H1130:		include changes to abundance and distribution through damage, mortality

		during dredgin g		Estuaries		or relocation to a disposal site.
		Direct changes to benthic habitats and species as a result of sediment deposition	Piling	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	No	Piling has the potential to result in the localised resuspension of sediment as a result of seabed disturbance. Sediment that settles out of suspension back onto the seabed as result of piling is expected to be negligible and benthic habitats and species are not expected to be sensitive to this level of change. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Capital dredge	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	Capital dredging has the potential to result in localised physical disturbance and smothering of seabed habitats and species (where the sediment settles out of suspension back onto the seabed).
			Dredge disposal	H1110. Sandbanks ~~which are slightly covered by~~	Yes	Dredge disposal will result in the deposition of sediments which has the ~~potential to cause physical disturbance and smothering of seabed habitats.~~
				which are slightly covered by		potential to cause physical disturbance and smothering of seabed habitats.

				sea water all the time		
				H1130: Estuaries		
		Indirect loss or change to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes	Marine works (capital dredging and piles)	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	The capital dredge and pile structures have the potential to result in changes to hydrodynamic and sedimentary processes (e.g., flow rates, accretion and erosion patterns). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal exposure and tidal elevation and, therefore, hydrodynamic and bathymetric changes caused by the dredging could affect the quality of marine habitats and change the distribution of marine species.
			Dredge disposal	H1110. Sandbanks which are slightly covered by ~~sea water all the time~~ ~~H1130: Estuaries~~	Yes	The disposal of dredged material at the marine disposal site has the potential to result in changes to hydrodynamic and sedimentary processes (e.g., water levels, flow rates, changes to tidal prism, accretion and erosion patterns). ~~Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal exposure and tidal elevation and,~~
				sea water all the time		Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal exposure and

				H1130: Estuaries		tidal elevation and, therefore, hydrodynamic and bathymetric changes caused by the disposal could affect the quality of marine habitats and change the distribution of marine species.
		Changes in water and sediment quality on benthic habitats and species	Piling	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	No	The negligible, highly localised and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) associated with bed disturbance during piling is considered unlikely to produce adverse effects in any species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Capital dredge	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	Changes in water quality during capital dredging could impact benthic habitats and species through an increase in suspended sediment concentrations (SSC) and the release toxic contaminants bound in sediments.
			~~Dredge disposal~~	~~H1110. Sandbanks~~	~~Yes~~	~~Changes in water quality could occur during dredged material disposal~~

						~~through~~
			Dredge disposal	H1110. Sandbanks which are slightly covered by sea water all the time H1130: Estuaries	Yes	Changes in water quality could occur during dredged material disposal through the deposition of material causing elevated SSC and contaminant levels. This could potentially impact on benthic habitats and species.
				~~H1130: Estuaries~~		
		The potential introduction and spread of non-native species	Construction, dredging and dredge disposal	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries ~~H1110. Sandbanks which are slightly covered by sea water all the time~~	Yes	Non-native species have the potential to be transported into the local area as a result of construction, dredging and dredge disposal activity. Potential effects alone are considered in Section 4.12 although in-combination effects are assumed to be negligible and not of a magnitude to cause an LSE assuming that standard biosecurity
				H1110. Sandbanks which are		measures are implemented for the IERRT development and also for other projects.

				slightly covered by sea water all the time		
		~~Physical change to habitats~~	~~Construction road and marine~~	~~H1330: Atlantic salt meadows~~	~~No~~	~~The nearest saltmarsh habitat (H1330) is approximately 3 km north-west of the site. The assessment has concluded that due~~
		Physical change to habitats resulting from the deposition of airborne pollutants	Construction road and marine vessel emissions	H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1140: Mudflats and sandflats not covered by seawater at low tide	No	The nearest saltmarsh habitat (H1330) is approximately 3 km north-west of the site. The assessment has concluded that due to the transient, intermittent and temporary nature of construction marine vessel emissions, and the distance from the nearest sensitive habitat, there will be no likely significant effects on SAC habitats (see Chapter 13: Air Quality (Application Document Reference number 8.2.13)). Similarly, the assessment has not identified any potential for LSE arising from construction road vehicle emissions (see Chapter 13: Air Quality).
				H1130: Estuaries H1110. Sandbanks which are ~~slightly covered by sea water all the time~~	No	These are marine habitats and are therefore not sensitive to changes in air quality due marine and/ or road vehicle emissions during construction. It is inappropriate to apply the acidity critical loads for other estuary sensitive habitat ~~as these are based on the effects of acid deposition on rooted macrophytes, which are not relevant to these habitat types.~~

				slightly covered by sea water all the time		as these are based on the effects of acid deposition on rooted macrophytes, which are not relevant to these habitat types. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
				~~S1095: Sea lamprey *Petromyzon marinus*~~	~~No~~	~~There are no acidity critical loads applicable to the estuarine habitats of either seals or lamprey. It is inappropriate to apply the acidity critical loads for other estuary sensitive habitat~~
				S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	No	There are no acidity critical loads applicable to the estuarine habitats of either seals or lamprey. It is inappropriate to apply the acidity critical loads for other estuary sensitive habitat as these are based on the effects of acid deposition on rooted macrophytes, which are not relevant to either faunal group. As there is therefore no pathway for impact there is no potential for LSE alone or in-combination.

			Construction dust emissions	H1330: Atlantic salt meadows (*Glauco-* ~~*Puccinellietalia maritimae*)~~	No	The nearest saltmarsh habitat (H1330) is approximately 3 km north-west of the site and is therefore well outside the zone of influence of any construction dust emissions. This impact pathway is
				Puccinellietalia maritimae)		therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
				H1140: Mudflats and sandflats not covered by seawater at low tide	Yes	Given the proximity of this habitat to the construction activities as it is within the footprint of the IERRT jetty and jetty access road, further assessment of this pathway has been undertaken due to the potential for likely significant effects.
				H1130: Estuaries H1110. Sandbanks which are slightly covered by sea water all the time	No	These are marine habitats and are therefore not sensitive to changes in air quality due to dust smothering during construction. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
				~~which are slightly covered by sea water all~~		

				~~the time~~		
		Direct loss or changes to migratory fish habitat	Piling	S1095: Sea lamprey *Petromyzon marinus* ~~S1099: River lamprey *Lampetra fluviatilis*~~	No	There is the potential for impacts to fish as a result of habitat loss due to installation of piles and the footprint of the proposed development. However, the direct footprint of the piling only ~~covers a highly localised area with the mobile nature of lamprey allowing them to utilise nearby areas. This impact pathway is, therefore, not considered further in the HRA.~~
				S1099: River lamprey *Lampetra fluviatilis*		covers a highly localised area with the mobile nature of lamprey allowing them to utilise nearby areas. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Capital dredge	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	No	Capital dredging has the potential to result in seabed disturbance and smothering of seabed habitats and species. However, the capital dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries and both species also move through the estuary during spawning migrations. Therefore, given the high mobility of both river and sea lamprey (and also

						the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the
						~~river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the~~ ranges of lamprey. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Dredge disposal	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	~~Yes~~No	Disposal at the marine disposal site will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. However, the capital dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries and both species also move through the estuary during spawning migrations.

						Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the ranges of lamprey.
						~~footprint of dredging only represent a small proportion of the ranges of lamprey.~~ This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Changes in water and sediment quality on migratory fish species	Piling	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	No	The expected highly localised and temporary changes in suspended sediment levels (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)) and related changes in sediment bound contaminants and dissolved oxygen (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference number 8.2.8)) associated with bed disturbance during piling are considered highly unlikely to produce adverse effects in any migratory fish species. The potential for accidental spillages will also be negligible during

						construction through following established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Capital dredge	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	Yes	Changes in water quality during capital dredging could impact migratory fish species through an increase in SSC and the release of toxic contaminants bound in sediments.
				~~*Petromyzon marinus*~~ ~~S1099: River lamprey *Lampetra fluviatilis*~~		~~the release of toxic contaminants bound in sediments.~~
			Dredge disposal	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	Yes	Changes in water quality could occur during dredged material disposal through the deposition of material causing elevated SSC and contaminant levels. This could potentially impact on migratory fish species.
		Underwater	Piling	S1095: Sea	Yes	During piling, there is the potential for

		noise effects on migratory fish species		lamprey *Petromyzon marinus* S1099: River lamprey ~~*Lampetra fluviatilis*~~		noise disturbance to fish. Percussive (impact) and vibro piling will produce underwater noise above background conditions and at a level that may cause a risk of injury and behavioural ~~changes to migratory fish in the vicinity of the proposed development.~~
				Lampetr a fluviatilis		changes to migratory fish in the vicinity of the proposed development.
			Capital dredge	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	Yes	Elevated underwater noise and vibration levels caused by the action of the dredger could potentially affect migratory fish.
				~~*Petromyzon marinus*~~ ~~S1099: River lamprey *Lampetra fluviatilis*~~		
			Dredge disposal	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey	Yes	Underwater noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect migratory fish.

				Lampetra fluviatilis		
		Lighting effects on migratory fish and seals	Construction	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey ~~*Lampetra fluviatilis*~~ ~~S1364: Grey seal~~	No	With respect to potential lighting effects during construction, equipment such as piling rigs, cranes etc. will be lit for safety reasons. Beams of light from construction lighting will largely be restricted to the surface waters as light is unlikely to ~~penetrate far into the water column given the high turbidity of the Humber Estuary. Furthermore, evidence suggests that lamprey are not considered to be~~
				Lampetr a fluviatilis S1364: Grey seal *Halichoerus grypus*		penetrate far into the water column given the high turbidity of the Humber Estuary. Furthermore, evidence suggests that lamprey are not considered to be particularly sensitive to lighting and will often be attracted to lighting rather than causing a barrier to movements (Stamplecoskie *et al.*, 2012; Zielinski *et al*., 2019). Therefore, such localised changes would not cause disruption or blocking of migratory routes for these species. Seals are also known to forage in areas with artificial lighting (such as harbours, offshore wind farms and fish farms) with lighting not known to cause adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have

						some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency through enhancing vision of this predator near the surface. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are
						considered to be negligible and not of a magnitude to cause a LSE.
		Direct loss or changes in marine mammal foraging habitat	Construction (piling, capital dredge and dredge disposal)	S1364: Grey seal *Halichoerus grypus*	No	There is the potential for impacts to marine mammals as a result of changes to marine mammal foraging habitat and prey resources. However, the footprint of the proposed development only covers a highly localised area that constitutes a negligible fraction of the known ranges of local marine mammal populations. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
						~~impact pathway is, therefore, not considered further in the HRA.~~
		Changes in water and sediment quality on marine mammals	Piling	S1364: Grey seal *Halichoerus grypus*	No	The negligible, highly localised and temporary changes in suspended sediment levels (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)) and related changes in

						sediment bound contaminants and dissolved oxygen (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference ~~number 8.2.8)) associated with bed disturbance during piling is considered highly unlikely to produce adverse effects in any marine mammal species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway is, therefore, not considered further in the HRA.~~
						number 8.2.8)) associated with bed disturbance during piling is considered highly unlikely to produce adverse effects in any marine mammal species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Capital dredge	S1364: Grey seal *Halichoerus grypus*	No	The plumes resulting from dredging are expected to have a relatively minimal and local effect on SSC in the vicinity of the proposed development

						(see Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during capital dredging (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water
						~~the ES (Application Document Reference number 8.2.7)). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during capital dredging (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water~~ column contamination (Chapter 8 of the ES (Application Document Reference number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Todd *et al.*, 2015). Furthermore, potential for accidental spillages will also be

						negligible during all phases through the application of established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Dredge disposal	S1364: Grey seal *Halichoerus grypus*	No	The plumes resulting from dredge disposal are expected to have a relatively minimal and local effect on SSC (described in more detail in the Physical Processes assessment in
			~~Dredge disposal~~	~~S1364: Grey seal *Halichoerus grypus*~~	~~No~~	~~The plumes resulting from dredge disposal are expected to have a relatively minimal and local effect on SSC (described in more detail in the Physical Processes assessment in~~ Chapter 7 of the ES (Application Document Reference number 8.2.7)). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during disposal (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water column contamination (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are

						considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Todd *et al.*, 2015). Furthermore, potential for accidental spillages will also be negligible during construction through the application of established industry
						~~potential for accidental spillages will also be negligible during construction through the application of established industry~~ guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Collision risk to marine mammals	Construction, dredging and dredge disposal	S1364: Grey seal *Halichoerus grypus*	No	Vessels involved in construction and dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing lethal injury (Schoeman *et al.,* 2020). Furthermore, the region is already characterised by heavy shipping traffic.

						The additional movements due to construction activity (including capital dredging) will only constitute a small increase in vessel traffic in the area which will also be temporary in nature. In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP ~~Research 1999; CSIP,~~
						Research 1999; CSIP, 2020). For example, out of 144 post mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported (CSIP, 2020). In addition, marine mammals foraging within the Humber Estuary region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Underwater noise effects on marine	Piling	S1364: Grey seal *Halichoerus*	Yes	Percussive (impact) and vibro piling will produce underwater noise above background conditions and at a level

		mammals		*grypus*		that may cause a risk of injury and behavioural changes to marine mammals if they are present in the vicinity of the proposed development. There is, therefore, considered to be a ~~potential for LSE on the grey seal feature both alone and in-combination with other plans and projects.~~
						potential for LSE on the grey seal feature both alone and in-combination with other plans and projects.
			Capital dredge	S1364: Grey seal *Halichoerus grypus*	Yes	Elevated noise and vibration levels caused by the action of the dredger could potentially affect marine mammals by inducing adverse behavioural reactions.
			Dredge disposal	S1364: Grey seal *Halichoerus grypus*	Yes	Elevated noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect marine mammals by inducing adverse behavioural reactions.
		Visual disturbance of hauled out seals	Construction, dredging and dredge disposal	S1364: Grey seal *Halichoerus grypus*	No	The nearest established breeding colony for grey seals is located over 25 km away at Donna Nook. Approximately 10 to 15 grey seals were also observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during the project specific benthic surveys as detailed in Appendix 9.1 to the ES. This haul out site is located approximately 4 km north east from the proposed development and around 3-4 km from the dredge disposal sites

						(including transit routes). No seal haul out sites ~~are known to occur nearer to the proposed development.~~ ~~Seals which are hauled out on land, either resting or breeding, are considered~~
						are known to occur nearer to the proposed development. Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Hoover-Miller *et al*, 2013). The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source. Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800 m although seals generally only disperse into the water at distances <150-200 m (Wilson, 2014; Mathews, *et al*., 2016; Henry and Hammill, 2001; Strong and Morris, 2010). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5 m and 25 m resulted in over 64 % of seals entering the water, but at

						distances of between 50 m and 100 m ~~only 1 % entered the water (Curtin *et al.*, 2009). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within a tidal cycle (Paterson *et al.*, 2019).~~
						only 1 % entered the water (Curtin *et al.*, 2009). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within a tidal cycle (Paterson *et al.*, 2019). Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the proposed development) are out of the zone of influence of any potential visual disturbance effects as a result of dredging, dredge disposal or construction activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Operation	Direct changes to benthic habitats and species	Operation	H1140: Mudflats and sandflats not covered by seawater at low	Yes	Changes in sunlight levels as a result of shading due to marine infrastructure has the potential, albeit minimal, to cause changes to the benthic community occurring in an

		beneath marine ~~infrastructure due to shading~~		tide ~~H1130: Estuaries~~		area.
		infrastructure due to shading		H1130: Estuaries		
		Changes to intertidal habitats and species as a result of the movement of Ro-Ro vessels during operation	Berth operations	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	There is potential for physical disturbance and erosion to the foreshore nearby to the proposed development as a result of the movement of Ro-Ro vessels and other ships using the berths.
		~~during operation~~		~~H1130: Estuaries~~		
		Changes to benthic habitats and species as result of seabed removal during dredging	Maintenance dredging	H1140: Mudflats and sandflats not covered by seawater at low tide H1130: Estuaries	Yes	Maintenance dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site. Given that the dredge footprint has not previously been subject to any maintenance dredging, there is, therefore, considered to be a

						potential, albeit minimal, for LSE.
		~~Changes to seabed habitats and species as a result of sediment deposition~~	~~Maintenance dredging and disposal~~	~~H1130: Estuaries~~ ~~H1140: Mudflats and sandflats not covered by seawater at low tide~~ ~~H1110. Sandbanks~~	~~No~~	~~Maintenance dredge and dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats.~~ ~~As a result of a less intensive dredge programme (and an overall lower predicted dredge volume), future maintenance dredging will result in smaller changes in SSC and sedimentation (within the dredge plumes~~
		Changes to seabed habitats and species as a result of sediment deposition	Maintenance dredging and disposal	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide H1110. Sandbanks which are slightly covered by sea water all the time	No	Maintenance dredge and dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. As a result of a less intensive dredge programme (and an overall lower predicted dredge volume), future maintenance dredging will result in smaller changes in SSC and sedimentation (within the dredge plumes and at the disposal site) as compared to the capital dredge. Deposition of sediment as a result of dredging will be highly localised and similar to background variability. The benthic species occurring within and near to the dredge area typically

						consist of burrowing infauna (such as polychaetes, oligochaetes or bivalves), which are considered tolerant to some sediment deposition. Based on evidence provided in relevant Marine Evidence based Sensitivity Assessment (MarESA) assessments, the specific species characterising the ~~subtidal and intertidal benthic samples collected as part of the project-specific intertidal survey (Section 1.3 of Appendix A of this HRA and Appendix 9.1 of the ES) are considered tolerant to deposition of at least 50 mm with many species considered capable of burrowing through much greater levels of sediment deposition. On this basis they are not considered to be sensitive to the the predicted millimetric changes in deposition. . In addition, the species~~
						subtidal and intertidal benthic samples collected as part of the project-specific intertidal survey (Section 1.3 of Appendix A of this HRA and Appendix 9.1 of the ES) are considered tolerant to deposition of at least 50 mm with many species considered capable of burrowing through much greater levels of sediment deposition. On this basis they are not considered to be sensitive to the predicted millimetric changes in deposition. . In addition, the species recorded in the benthic invertebrate

						surveys are fast growing and/or have rapid reproductive rates which allow populations to typically rapidly recolonise disturbed habitats, many within a few months following the disturbance events (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). Clay Huts licensed disposal site (HU060) will be used for maintenance disposal as per the existing maintenance dredge licence. ~~The disposal site is located in the mid channel and is subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. This disposal site is already used for the disposal of maintenance dredge arisings (millions of wet tonnes of dredge sediment are disposed of at HU060 annually) which will also cause some disturbance due to sediment deposition. This is reflected in a generally impoverished assemblage at the disposal site.~~
						The disposal site is located in the mid channel and is subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. This disposal site is already used for the disposal of maintenance dredge arisings (millions

						of wet tonnes of dredge sediment are disposed of at HU060 annually) which will also cause some disturbance due to sediment deposition. This is reflected in a generally impoverished assemblage at the disposal site. The benthic species recorded include mobile infauna (such as errant polychaetes e.g., *Arenicola* spp. and amphipods) which are able to burrow through sediment. They are, therefore, considered tolerant to some sediment deposition. In addition, characterising species typically have opportunistic life history strategies, with short life histories (typically two years or less), rapid maturation and the production of large numbers of small propagules which makes them capable of rapid recoverability should mortality as a ~~result of smothering occur (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016; Tyler-Walters and Garrard, 2019). On this basis, any effects are considered to be temporary and short term. This impact pathway is, therefore, not considered further in the HRA.~~
						result of smothering occur (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016; Tyler- Walters and Garrard, 2019). On this basis, any effects are

						considered to be temporary and short term. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		~~Indirect changes to seabed habitats and species as a~~	~~Maintenance dredging and disposal~~	~~H1130: Estuaries~~ ~~H1140: Mudflats and~~	~~No~~	~~The predicted physical processes impacts from future maintenance dredging will be similar to that which already arises from the ongoing maintenance of the existing Immingham berths.~~
		Indirect changes to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes	Maintenance dredging and disposal	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide H1110. Sandbanks which are slightly covered by sea water all the time	No	The predicted physical processes impacts from future maintenance dredging will be similar to that which already arises from the ongoing maintenance of the existing Immingham berths. Maintenance dredging has the potential to result in changes to hydrodynamic and sedimentary processes (e.g., water levels, flow rates, changes to tidal prism, accretion and erosion patterns). However, as described in more detail in the Physical Processes assessment (Chapter 7 of the ES (Application Document Reference number 8.2.7)), only changes in hydrodynamic and ~~sedimentary processes that are of a negligible magnitude are predicted. These changes will not be discernible~~

						~~against natural processes at nearby intertidal habitats. Furthermore, the predicted changes are not expected to modify existing subtidal habitat types found in the area. This impact pathway is, therefore, not considered further in the HRA.~~
						sedimentary processes that are of a negligible magnitude are predicted. These changes will not be discernible against natural processes at nearby intertidal habitats. Furthermore, the predicted changes are not expected to modify existing subtidal habitat types found in the area. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Changes in water and sediment quality on benthic habitats and species	Maintenance dredge and dredge disposal	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide H1110. Sandbanks which are slightly	No	Changes in water quality (as summarised in Chapter 8 of the ES (Application Document Reference number 8.2.8)) are also expected to be lower than for the capital dredge and similar to existing maintenance dredging. Elevated SSCs due to maintenance dredging and dredge disposal are considered to be of a magnitude that can occur naturally or as a result of existing maintenance dredging/disposal and sediment

				covered by		plumes resulting from dredging are also considered to
				~~seawater at low tide~~ ~~H1110. Sandbanks which are slightly covered by~~ sea water all the time		~~Elevated SSCs due to maintenance dredging and dredge disposal are considered to be of a magnitude that can occur naturally or as a result of existing maintenance dredging/disposal and sediment plumes resulting from dredging are also considered to~~ dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle). Naturally very high SSCs typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides. The estuarine benthic communities recorded in the region are considered tolerant to this highly turbid environment (De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). Magnitude of change is therefore assessed as negligible. The results of the sediment contamination sampling are summarised above and the Water and Sediment Quality chapter (Chapter 8 of the ES (Application Document

						Reference number 8.2.8)). In summary, low levels of contamination were found in the samples and there is no reason to believe the sediment will
						~~Water and Sediment Quality chapter (Chapter 8 of the ES (Application Document Reference number 8.2.8)). In summary, low levels of contamination were found in the samples and there is no reason to believe the sediment will~~ be unsuitable for disposal in the marine environment. During maintenance dredging and dredge disposal, sediment will be rapidly dispersed in the water column. Therefore, the already low levels of contaminants in the dredged sediments will be dispersed further. The probability of changes in water quality occurring at the disposal site is considered to be low and the overall exposure to change is considered to be negligible. The sensitivity of subtidal habitats and species to contaminants is assessed as low to moderate because, although contaminants can cause toxicity in subtidal communities, the concentrations of contaminants required to produce both lethal and sub-lethal effects are generally high (although responses vary considerably between species). This impact pathway is~~,~~ therefore, not considered

						further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Non-native species transfer during vessel operations	Vessel operations	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide H1110. Sandbanks which are slightly covered by sea water all the time	Yes	Non-native species have the potential to be transported into the local area on the hulls of vessels during operation. Non- native invasive species also have the potential to be transported via vessel ballast water. Potential effects alone are considered in Section 4.12 although in-combination effects are assumed to be negligible and not of a magnitude to cause a LSE assuming that standard biosecurity measures are implemented for the IERRT development and also for other projects.
		Physical change to habitats resulting from the deposition of airborne pollutants	Operational marine and road vehicle emissions	H1330: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1140: Mudflats and sandflats not covered by	Yes	As discussed in respect of construction impacts, the majority of the SAC habitats closest to site are marine environments and therefore not sensitive to N deposition or NOx from operational marine vessel/ road vehicle emissions. Predicted operational N deposition and NOx at five receptors within the SAC are presented in Table 13.15 in Chapter 13: Air Quality (Application Document Reference ~~number 8.2.13). Annual mean~~

				seawater at low tide		number 8.2.13). Annual mean NOx and N deposition exceed 1% of the Critical Load screening threshold at three of the SAC receptors, and therefore likely significant effects from this pathway cannot be screened out. Predicted NH3 and NH3 derived N deposition at the same five SAC receptors are presented in Table 13.16 in Chapter 13: Air Quality (Application Document Reference number 8.2.13). The predicted NH3 concentrations are below 1% of the Critical Level threshold at all receptors and likely significant effects are therefore screened out from this pathway.
				H1130: Estuaries H1110 Sandbanks which are slightly covered by sea water all the time	No	These habitats are not susceptible to the effects of nitrogen or ammonia deposition and are therefore screened out from further assessment as there is no potential for likely significant effects to occur. It is inappropriate to apply the acidity critical loads for other estuary sensitive habitat as these are based on the effects of acid deposition on rooted macrophytes, which are not relevant to these habitat types.
				~~S1095: Sea lamprey~~	~~No~~	~~There are no acidity critical loads applicable to the estuarine habitats of~~
				S1095: Sea lamprey *Petromyzon marinus*	No	There are no acidity critical loads applicable to the estuarine habitats of either seals or lamprey. It is inappropriate to apply the acidity

				S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*		critical loads for other estuary sensitive habitat as these are based on the effects of acid deposition on rooted macrophytes, which are not relevant to either faunal group. As there is no pathway for impact, this is therefore screened out as there is no LSE alone or in- combination.
		Changes to migratory fish habitat	Maintenance dredge and dredge disposal	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	No	Maintenance dredging and dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. However, the maintenance dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries and both species also move through the estuary during spawning ~~migrations. Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey~~
						migrations. Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging

						only represent a small proportion of the ranges of lamprey. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Changes in water and sediment quality on migratory fish	Maintenance dredge and dredge disposal	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	No	Changes in water quality (as summarised in Chapter 8 of the ES (Application Document Reference number 8.2.8)) are also expected to be lower than for the capital dredge and similar to existing maintenance dredging. With specific respect to lamprey, these species are known to migrate through estuaries with high SSC (including the Humber Estuary). Elevated SSCs due to dredging are considered to be of a magnitude that can occur naturally or ~~as a result of ongoing maintenance dredging/disposal.~~ ~~Sediment plumes resulting from dredging and dredge disposal are also considered to dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time~~
						as a result of ongoing maintenance dredging/disposal. Sediment plumes resulting from

						dredging and dredge disposal are also considered to dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle) as described in more detail in the Physical Processes assessment (Chapter 7 of the ES (Application Document Reference number 8.2.7)). Therefore, lamprey would also be able to avoid the temporary sediment plumes. Based on these factors there is therefore considered limited potential for migrating fish to be adversely affected by the predicted changes in SSC. With respect to sediment contamination, generally low levels of contamination were found in the sediment contamination samples as presented in the Water and Sediment Quality assessment in Chapter 8 of the ~~ES (Application Document Reference number 8.2.8).~~ ~~Based on this sampling data, the overall level of contamination in the proposed dredge area is considered to be low and the sediment plume would be expected to rapidly dissipate by the strong tidal currents in the area. Significant elevations in the concentrations of~~

						ES (Application Document Reference number 8.2.8). Based on this sampling data, the overall level of contamination in the proposed dredge area is considered to be low and the sediment plume would be expected to rapidly dissipate by the strong tidal currents in the area. Significant elevations in the concentrations of contaminants within the water column are not anticipated. This impact pathway is, therefore, not considered further in the HRA.
		Underwater noise effects on migratory fish	Vessel operations including maintenance dredge and dredge disposal	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	Yes	Vessel movements during operation may also result in disturbance through changes in underwater noise and vibration (see Table 9.25 in Section 9.8 of the Nature Conservation and Marine Ecology Chapter 9 of the ES (Application Document Reference number 8.2.9)). Only mild behavioural responses in close proximity to the Ro- Ro or dredging vessels are anticipated with noise levels unlikely to be discernible above ambient levels in the wider Humber Estuary area. However, ~~this impact pathway is, considered further in the HRA on a precautionary basis.~~
						this impact pathway is, considered further in the HRA on a precautionary

						basis.
		~~Lighting effects on migratory fish and seals~~	~~Vessel and berth operations~~	~~S1095: Sea lamprey *Petromyzon marinus*~~ ~~S1099: River lamprey~~	~~No~~	~~With respect to potential lighting effects, the jetties, pontoons and pier decking will be lit for safety and operational purposes.~~ ~~Beams of light from operational lighting will largely be restricted to the surface waters as light is unlikely to penetrate far into the water column given the high~~
		Lighting effects on migratory fish and seals	Vessel and berth operations	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	No	With respect to potential lighting effects, the jetties, pontoons and pier decking will be lit for safety and operational purposes. Beams of light from operational lighting will largely be restricted to the surface waters as light is unlikely to penetrate far into the water column given the high turbidity of the Humber Estuary. Furthermore, evidence suggests that lamprey are not considered to be particularly sensitive to lighting and will often be attracted to lighting rather than causing a barrier to movements (Stamplecoskie *et al.,* 2012; Zielinski *et al*., 2019). Therefore, such localised changes would not cause disruption or blocking of migratory routes for these species. Seals are also known to forage in

						areas with artificial lighting (such as harbours, offshore wind farms and fish farms) with lighting not known to cause ~~adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency through enhancing vision of this predator near the surface.~~
		~~Underwater noise effects on marine mammals~~	~~Maintenance dredge and dredge disposal~~	~~S1364: Grey seal *Halichoerus grypus*~~	~~Yes~~	~~Vessel movements during operation may also result in disturbance through changes in underwater noise and vibration (see Table 9.25 in Section 9.8 of~~adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency through enhancing vision of this predator near the surface. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Underwater noise effects on marine mammals	Maintenance dredge and dredge disposal	S1364: Grey seal *Halichoerus grypus*	Yes	Vessel movements during operation may also result in disturbance through changes in underwater noise and vibration (see Table 9.25 in Section 9.8

						of the Nature Conservation and Marine Ecology Chapter 9 of the ES (Application Document Reference number 8.2.9)). Only mild behavioural responses in close proximity to the Ro- Ro or dredging vessels are anticipated with noise levels unlikely to be discernible above ambient levels in the wider Humber Estuary area. However, this impact pathway is, considered ~~further in the HRA on a precautionary basis.~~
						further in the HRA on a precautionary basis.
		Visual disturbance of hauled out seals	Vessel operations, maintenance dredge and dredge disposal	S1364: Grey seal *Halichoerus grypus*	No	The nearest established breeding colony for grey seals is located over 25 km away at Donna Nook. Approximately 10 to 15 grey seals were also observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during the project specific benthic surveys as detailed in Appendix 9.1 to the ES. This haul out site is located approximately 4 km north east from the proposed development. No seal haul out sites are known to occur nearer to the proposed development. Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Hoover-Miller *et al*, 2013).

						The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source.
						~~particularly sensitive to visual disturbance (Hoover-Miller *et al*, 2013).~~ ~~The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source.~~ Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800 m although seals generally only disperse into the water at distances <150-200 m (Wilson, 2014; Mathews, *et al*., 2016; Henry and Hammill, 2001; Strong and Morris, 2010). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5 m and 25 m resulted in over 64 % of seals entering the water, but at distances of between 50 m and 100 m only 1 % entered the water (Curtin *et al*., 2009). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within a tidal

						cycle (Paterson *et al.,* 2019). Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the proposed development) are out of the zone of influence of any potential visual disturbance effects as a result of maintenance dredging and vessel
						~~Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the proposed development) are out of the zone of influence of any potential visual disturbance effects as a result of maintenance dredging and vessel~~ operations. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Collision risk to marine mammals	Vessel operations	S1364: Grey seal *Halichoerus grypus*	No	Vessels using the berths during operation will be typically approaching at slow speeds (2-4 knots) and maintenance dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing lethal injury (Schoeman *et al.,* 2020). Furthermore, the region is already

						characterised by heavy shipping traffic. The additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area on a typical day (up to six additional Ro-Ro vessel movements per day at the Port of Immingham, as well as tugs) which represents
						~~six additional Ro-Ro vessel movements per day at the Port of Immingham, as well as tugs) which represents~~ approximately a 3 % increase in vessel traffic in the study area. There will also be maintenance dredger and barge movements but that is estimated to only be necessary approximately three to four times a year. In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP, 2020). For example, out of 144 post mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported (CSIP, 2020). In addition,

						marine mammals frequently foraging within the region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination
						effects are considered to be negligible and not of a magnitude to cause a LSE.
The Wash and North Norfolk Coast	Construction	Direct loss or changes in marine mammal foraging habitat	Construction (piling, capital dredge and dredge disposal)	S1365: Harbour seal *Phoca vitulina*	No	There is the potential for impacts to marine mammals as a result of changes to marine mammal foraging habitat and prey resources. However, the footprint of the Project only covers a highly localised area that constitutes a negligible fraction of the known ranges of local marine mammal populations. This impact pathway is, therefore, not considered further in the HRA.
		Changes in water and sediment quality on marine mammals	Piling	S1365: Harbour seal *Phoca vitulina*	No	The negligible, highly localised and temporary changes in suspended sediment levels (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)) and related changes in sediment bound contaminants and dissolved oxygen (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of

						the ES (Application Document Reference number 8.2.8)) associated with bed disturbance during piling is considered ~~highly unlikely to produce adverse effects in any marine mammal species. The potential for accidental~~
						highly unlikely to produce adverse effects in any marine mammal species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Capital dredge	S1365: Harbour seal *Phoca vitulina*	No	The plumes resulting from dredging are expected to have a relatively minimal and local effect on SSC in the vicinity of the proposed development (see Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during capital dredging (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water column contamination (Chapter 8 of

						the ES (Application Document Reference ~~number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term,~~
						number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Todd *et al.*, 2015). Furthermore, potential for accidental spillages will also be negligible during all phases through the application of established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Dredge disposal	S1365: Harbour seal *Phoca vitulina*	No	The plumes resulting from dredge disposal are expected to have a relatively minimal and local effect on

						SSC (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)). ~~Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during disposal (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water column contamination (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference number 8.2.8)). In addition, the temporary and localised changes in water~~
						Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during disposal (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water column contamination (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these

						highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Todd *et al.*, 2015). Furthermore, potential for accidental spillages will also be negligible during construction through the application of established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered ~~further in the HRA.~~
						further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Collision risk to marine mammals	Construction, dredging and dredge disposal	S1365: Harbour seal *Phoca vitulina*	No	Vessels involved in construction and dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing lethal injury (Schoeman *et al.,* 2020). Furthermore, the region is already characterised by heavy shipping traffic. The additional movements due to construction activity (including capital dredging) will only constitute a small increase in vessel traffic in the area which will also be temporary in nature.

						In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP, 2020). For example, out of 144 post mortem
						~~(including capital dredging) will only constitute a small increase in vessel traffic in the area which will also be temporary in nature.~~ ~~In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP, 2020). For example, out of 144 post mortem~~ examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported (CSIP, 2020). In addition, marine mammals foraging within the Humber Estuary region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are

						considered to be negligible and not of a magnitude to cause a LSE.
		Lighting effects on marine mammals	Construction	S1365: Harbour seal *Phoca vitulina*	No	With respect to potential lighting effects during construction, equipment such as piling rigs, cranes etc. will be lit for safety reasons. Beams of light from construction lighting will largely be restricted to the surface waters as light is unlikely to penetrate far into the water column
		~~marine mammals~~				~~piling rigs, cranes etc. will be lit for safety reasons.~~ ~~Beams of light from construction lighting will largely be restricted to the surface waters as light is unlikely to penetrate far into the water column~~ given the high turbidity of the Humber Estuary. Seals are also known to forage in areas with artificial lighting (such as harbours, offshore wind farms and fish farms) with lighting not known to cause adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency through enhancing vision of this predator near the

						surface.
		Underwater noise effects on marine mammals	Piling	S1365: Harbour seal *Phoca vitulina*	Yes	Percussive (impact) and vibro piling will produce underwater noise above background conditions and at a level that may cause a risk of injury and behavioural changes to marine mammals if they are present in the vicinity of the proposed development. There is, therefore, considered to be a potential for LSE on the grey seal feature both alone and in-combination with other plans and projects.
						~~therefore, considered to be a potential for LSE on the grey seal feature both alone and in-combination with other plans and projects.~~
			Capital dredge	S1365: Harbour seal *Phoca vitulina*	Yes	Elevated noise and vibration levels caused by the action of the dredger could potentially affect marine ~~mammals by inducing adverse behavioural reactions.~~
						mammals by inducing adverse behavioural reactions.
			Dredge disposal	S1365: Harbour seal *Phoca vitulina*	Yes	Elevated noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect marine mammals by inducing adverse behavioural reactions.
		Visual disturbance of hauled out seals	Construction, dredging and dredge disposal	S1365: Harbour seal *Phoca vitulina*	No	The nearest known haul out site for common seals is located over 25 km away at Donna Nook (which could potentially have connectivity to the Wash and North Norfolk Coast SAC).

						Seals hauled out at Donna Nook are out of the zone of influence of any potential visual disturbance effects as a result of dredging, dredge disposal or construction activity. This impact pathway is, therefore, not considered further in the HRA.
	~~Operation~~	~~Underwater noise effects~~	~~Maintenance dredge and~~	~~S1365: Harbour seal *Phoca vitulina*~~	~~Yes~~	~~Vessel movements during operation may also result in disturbance through changes in underwater noise and~~
	Operation	Underwater noise effects on marine mammals	Maintenance dredge and dredge disposal	S1365: Harbour seal *Phoca vitulina*	Yes	Vessel movements during operation may also result in disturbance through changes in underwater noise and vibration. Only mild behavioural responses in close proximity to the Ro- Ro or dredging vessels are anticipated with noise levels unlikely to be discernible above ambient levels in the ~~wider Humber Estuary area. However, this impact pathway is, considered further in the HRA on a precautionary basis.~~
						wider Humber Estuary area. However, this impact pathway is, considered further in the HRA on a precautionary basis.
		Visual disturbance of hauled out seals	Vessel operations, maintenance dredge and dredge disposal	S1365: Harbour seal *Phoca vitulina*	No	The nearest known haul out site for common seals is located over 25 km away at Donna Nook (which could potentially have connectivity to the Wash and North Norfolk Coast SAC). Seals hauled out at Donna Nook are out of the zone of influence of any potential visual disturbance effects as

						a result of maintenance dredging and vessel operations. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Lighting effects on marine mammals	Operation	S1365: Harbour seal *Phoca vitulina*	No	With respect to potential lighting effects, the jetties, pontoons and pier decking will be lit for safety and operational purposes. Beams of light from operational lighting will largely be restricted to the surface waters as light is unlikely to penetrate far into the water column given the high turbidity of the Humber Estuary. Seals are also
						~~also~~ known to forage in areas with artificial lighting (such as harbours, offshore wind farms and fish farms) with lighting not known to cause adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency through enhancing vision of this predator near the surface. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.

		Collision risk to marine mammals	Vessel operations	S1365: Harbour seal *Phoca vitulina*	No	Vessels using the berths during operation will be typically approaching at slow speeds (2-4 knots) and maintenance dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing ~~lethal injury (Schoeman *et al.*, 2020). Furthermore, the region is already characterised by heavy shipping traffic. The additional operational vessel movements resulting from the proposed development will only~~
						lethal injury (Schoeman *et al.*, 2020). Furthermore, the region is already characterised by heavy shipping traffic. The additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area on a typical day (up to six additional Ro-Ro vessel movements per day at the Port of Immingham, as well as tugs) which represents approximately a 3 % increase in vessel traffic in the study area. There will also be maintenance dredger and barge movements but that is estimated to only be necessary approximately three to four times a

						year. In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP, 2020). For example, out of 144 post mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including ~~starvation and by-catch, although some incidents are likely to remain unreported (CSIP, 2020). In addition, marine mammals frequently foraging within the region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with~~
						starvation and by-catch, although some incidents are likely to remain unreported (CSIP, 2020). In addition, marine mammals frequently foraging within the region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway is therefore, ~~therefore,~~ not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.

Table 4. Potential impacts that could result in LSE on features of the Humber Estuary SPA

Phase	Impact Pathways/ Potential Effects	Project activity	Feature	Potential for LSE alone and in-combination	Justification
Construction	Direct loss or change to supporting intertidal habitat	Piling	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa*	Yes	Piling will cause a direct loss of a small area of intertidal habitat (0.012 ha). This loss will be highly localised. However, given the protection afforded to the mudflat that is utilised by feeding waterbirds in this area, there is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2).
			totanus (Non-		

			breeding)		
			Waterbird assemblage		
		Capital dredge	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A149: Dunlin *Calidris alpina alpina* (Non-breeding)	Yes	Capital dredging will cause a direct, albeit minimal, loss of intertidal habitat as well as potential changes which could cause changes to the prey resources available for coastal waterbirds. Whilst the changes are minimal, potential LSE on the waterbird features screened into the assessment (Table 2) cannot be discounted.
			A162: Common Redshank *Tringa totanus* (Non-breeding)		
			Waterbird assemblage		

		Dredge disposal	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)	No	All SPA features screened into the assessment (Table 2) are bird species that occur on or near intertidal habitat (or functionally linked coastal land). Therefore, given the distance of the dredge disposal site offshore, no potential effects on supporting habitat for SPA species will occur alone or in-combination.
			A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		
	Indirect loss of supporting intertidal	Marine works (capital	A048; Common Shelduck (Non-breeding) *Tadorna*	Yes	The capital dredge and pile structures have the potential to result in changes to hydrodynamic and sedimentary processes

	habitat as a result of changes to hydrodynamic and sedimentary processes	dredging and piles)	*tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* ~~A156: Black-tailed Godwit *Limosa*~~		(e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns) which could cause erosion to intertidal mudflat used by feeding birds. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2).
			A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		
	Changes in water or sediment	Capital dredging and dredge	A048; Common Shelduck (Non-breeding) *Tadorna*	No	All SPA features screened into the HRA (Table 2) are coastal waterbirds that feed on intertidal invertebrates by using the

	quality	disposal	*tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* ~~A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*~~		beak to capture prey on intertidal habitats (either when exposed to air or when covered in very shallow water). Therefore, they are not considered sensitive to the directs effects of elevated suspended sediment plumes (unlike diving birds which use pursuit or plunge diving to capture prey underwater). It is considered possible that SPA features could be sensitive to indirect effects ~~resulting from changes to intertidal benthic habitats and species due to suspended~~
			A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		resulting from changes to intertidal benthic habitats and species due to suspended sediment concentrations (i.e. changes to invertebrate prey resources on supporting mudflat). However, given estuarine benthic communities recorded on mudflats and the shallow mud in the region are considered tolerant to this highly turbid environment and the predicted SSCs are within the range that can frequently occur naturally and also as a result of ongoing dredge activity, potential effects of elevated SSC on prey resources are considered to be negligible (Section 4.8). With respect to sediment contamination during construction, potential effects on intertidal benthic habitats and species are considered to be insignificant (Section 4.9). On this basis, potential effects on waterbirds as a result of bioaccumulation through consuming prey (i.e., intertidal benthos) will be negligible. This impact

					pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Lighting effects on coastal waterbirds during construction	Construction	A048; Common Shelduck (Non-breeding) Tadorna tadorna A143: Red Knot (Non-breeding) Calidris canutus A157: Bar-tailed Godwit (Non-breeding) Limosa lapponica A156: Black-tailed Godwit Limosa limosa islandica (Non-breeding) A149: Dunlin Calidris alpina alpina (Non-breeding) A162: Common Redshank Tringa totanus (Non-	No	With respect to potential lighting effects, construction equipment such as piling rigs, cranes etc. will be lit for safety reasons. Waders and other waterbirds feeding on intertidal mudflats are known to feed nocturnally. Evidence suggests that artificial illumination can improve foraging (through increasing prey intake rate) and, therefore, lighting can have a positive effect on the nocturnal foraging of waterbirds (Santos *et al*., 2010). This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.

			breeding)		
			~~A157: Bar-tailed Godwit (Non-breeding) Limosa lapponica~~ ~~A156: Black-tailed Godwit Limosa limosa islandica (Non-breeding)~~ ~~A149: Dunlin Calidris alpina alpina (Non-breeding)~~ ~~A162: Common Redshank Tringa totanus (Non-breeding)~~ Waterbird assemblage		~~lighting can have a positive effect on the nocturnal foraging of waterbirds (Santos *et al.*, 2010).~~
	Noise and visual disturbance to coastal waterbirds	Construction activity (including capital dredging)	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus*	Yes	During construction, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2) both alone and in- combination with other plans and projects.

			A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa*		
			~~A143: Red Knot (Non-breeding) *Calidris canutus*~~ ~~A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*~~ ~~A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)~~		

			~~A149: Dunlin *Calidris alpina alpina* (Non-breeding)~~ ~~A162: Common Redshank *Tringa*~~ *totanus* (Non-breeding) Waterbird assemblage		
Operation	Direct changes to coastal waterbird foraging and roosting habitat as a result of marine infrastructure	Berth operations	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A149: Dunlin *Calidris*	Yes	Marine infrastructure associated with the proposed development (raised jetty structure, linkspan etc.) could potentially cause direct damage or reduced functionality to waterbird feeding and roosting habitat. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2) .

			alpina alpina (Non-breeding) ~~A162: Common Redshank *Tringa totanus* (Non-breeding)~~ ~~Waterbird assemblage~~		
			A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		
	Lighting effects on coastal waterbirds during operation	Berth operations	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156:	No	With respect to potential lighting effects, the jetties, pontoons and pier decking will be lit for safety and operational purposes. Waders and other waterbirds feeding on intertidal mudflats are known to feed nocturnally. Evidence suggests that artificial illumination can improve foraging (through increasing prey intake rate) and can, therefore, lighting can have a positive effect on the nocturnal foraging of waterbirds (Santos *et al*., 2010). This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.

			Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) ~~A149: Dunlin *Calidris alpina alpina* (Non-breeding)~~ ~~A162: Common Redshank *Tringa totanus* (Non-breeding)~~		
			A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		
	Noise and visual disturbance to coastal waterbirds	Berth operations	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus*	Yes	During operation, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2)

			A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa* ~~*limosa islandica* (Non-breeding)~~ ~~A149: Dunlin *Calidris alpina alpina* (Non-breeding)~~ ~~A162: Common Redshank *Tringa*~~		
			limosa islandica (Non-breeding) A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		

Table 5. Potential impacts that could result in LSE on features of the Humber Estuary Ramsar

Phase	Impact Pathways/ Potential Effects	Project activity	Feature	Potential for LSE alone and in-combination	Justification
Construction	Direct loss of intertidal habitat as a result of capital dredging and the piles	Capital dredge and piling	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	Yes	Capital dredging will cause a direct, albeit negligible loss of intertidal habitat which will be changed to subtidal habitat as a result of the deepening. Piling will also result in the small loss of intertidal.
	Direct loss of subtidal habitat as a result of the piles	Piling	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems ~~and humid dune slacks, estuarine~~	Yes	Piling will also result in a loss, albeit minimal, of subtidal. This impact pathway has, therefore, been scoped into the assessment.

			and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		
	Direct changes to benthic habitats and species as result of seabed removal during dredging	Capital dredge	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	Yes	Capital dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site.
	Direct changes to benthic habitats and species as a result of ~~sediment deposition~~	Piling	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example ~~of a near-natural estuary with the following component habitats:~~	No	Piling has the potential to result in the localised resuspension of sediment as a result of seabed disturbance. Sediment that settles out of suspension back onto the seabed as result of piling is expected to be negligible and benthic ~~habitats and species are not expected to be sensitive to this level of change. This impact~~
	sediment deposition		of a near-natural estuary with the		habitats and species are not expected to be sensitive to this level of change. This

			following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Capital dredge	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	Yes	Capital dredging has the potential to result in localised physical disturbance and smothering of seabed habitats and species (where the sediment settles out of suspension back onto the seabed).
		Dredge disposal	Criterion 1 – natural wetland habitats that ~~are of international importance: The site is a representative example of a near-natural estuary~~	Yes	Dredge disposal will result in the deposition of sediments which has the ~~potential to cause physical disturbance and smothering of seabed habitats.~~
			are of international		potential to cause physical disturbance

			importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		and smothering of seabed habitats.
	Indirect loss or change to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes	Marine works (capital dredging and piles)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and ~~coastal brackish/saline lagoons.~~	Yes	The capital dredge and pile structures have the potential to result in changes to hydrodynamic and sedimentary processes (e.g., flow rates, accretion and erosion patterns). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal exposure and tidal elevation and, therefore, hydrodynamic and bathymetric changes caused by the dredging could affect the quality of marine habitats and change the distribution of marine species.
			coastal brackish/saline lagoons.		
		~~Dredge disposal~~	~~Criterion 1 – natural wetland habitats that are of international~~	~~Yes~~	~~The disposal of dredged material at the marine disposal site has the potential to result in changes to hydrodynamic and~~

			~~importance:~~		~~sedimentary processes (e.g., water levels, flow rates, changes to tidal prism,~~
		Dredge disposal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	Yes	The disposal of dredged material at the marine disposal site has the potential to result in changes to hydrodynamic and sedimentary processes (e.g., water levels, flow rates, changes to tidal prism, accretion and erosion patterns). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal exposure and tidal elevation and, therefore, hydrodynamic and bathymetric changes caused by the disposal could affect the quality of marine habitats and change the distribution of marine species.
	Changes in water and sediment quality on benthic habitats and species	Piling	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems ~~and humid dune slacks, estuarine waters, intertidal mud and sand flats,~~	No	The negligible, highly localised and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) associated with bed disturbance during piling is considered unlikely to produce adverse effects in any species. The potential for accidental spillages will also be negligible during construction through ~~following established industry guidance and protocols. This impact pathway is therefore, not considered further in the HRA.~~

			~~saltmarshes, and coastal brackish/saline lagoons.~~		
			and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		following established industry guidance and protocols. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		~~Capital dredge~~	~~Criterion 1 – natural wetland habitats that are~~	~~Yes~~	~~Changes in water quality during capital dredging could impact benthic habitats~~
		Capital dredge	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	Yes	Changes in water quality during capital dredging could impact benthic habitats and species through an increase in SSC and the release toxic contaminants bound in sediments. with other plans and projects.
		Dredge disposal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example~~ of a~~	Yes	Changes in water quality could occur during dredged material disposal through the deposition of material causing elevated SSC and contaminant levels. This could potentially impact on

			~~near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.~~		benthic habitats and species.
			of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		
	The potential introduction and spread of non-native species	Construction, dredging and dredge disposal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters,	Yes	Non-native species have the potential to be transported into the local area as a result of construction, dredging and dredge disposal activity. Potential effects alone are considered in Section 4.12 although in-combination effects are assumed to be negligible and not of a magnitude to cause a LSE assuming that standard biosecurity measures are implemented for the IERRT development and also for other projects.

			intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		
	Physical change to	Construction	Criterion 1 – natural wetland habitats that	Yes	The majority of the Ramsar habitats closest to the construction site are
	~~Physical change to~~ habitats resulting from the deposition of airborne pollutants	~~Construction~~	~~Criterion 1 – natural wetland habitats that~~ are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	~~Yes~~	~~The majority of the Ramsar habitats closest to the construction site are~~ marine habitats and are therefore not sensitive to changes in air quality due to dust smothering or marine vessel/ road vehicle emissions during construction. The nearest saltmarsh habitat (H1330) is approximately 3 km north-west of the site. The assessment has concluded that due to the transient, intermittent and temporary nature of construction marine vessel emissions, and the distance from the nearest sensitive habitat, there will be no likely significant effects on Ramsar habitats (see Chapter 13: Air Quality (Application Document Reference number 8.2.13)). Similarly, the assessment has not identified any potential for LSE arising from construction road vehicle emissions (see Chapter 13: Air Quality (Application Document Reference number 8.2.13)). However, construction dust emissions on intertidal mudflats and sand flats have been screened in on a precautionary basis.

	Direct loss or changes to migratory fish habitat	Piling	~~saltmarshes, and coastal brackish/saline lagoons.~~Criterion 8 – Internationally important source of food for fishes, spawning	No	~~no likely significant effects on Ramsar habitats (see Chapter 13: Air Quality (Application Document Reference number 8.2.13)). Similarly, the assessment has not identified any potential for LSE arising from construction road vehicle emissions (see Chapter 13: Air Quality (Application Document Reference number 8.2.13)).~~ There is the potential for impacts to fish as a result of habitat loss due to installation of piles and the footprint of the proposed development. However, ~~construction dust emissions on intertidal mudflats and sand flats have been screened in on a precautionary basis.~~
	~~Direct loss or changes to migratory fish habitat~~	~~Piling~~	~~Criterion 8 – Internationally important source of food for fishes, spawning~~ grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	~~No~~	~~There is the potential for impacts to fish as a result of habitat loss due to installation of piles and the footprint of the proposed development. However,~~ the direct footprint of the piling only covers a highly localised area with the mobile nature of lamprey allowing them to utilise nearby areas. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Capital dredge	Criterion 8 – Internationally	No	Dredging by trailer suction hopper dredger has the potential to result in the

			important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		direct uptake of fish and fish eggs by the action of the draghead (entrainment). Backhoe dredging can also directly remove fish and fish eggs in the bucket. In addition, capital dredging has the potential to result in seabed disturbance and smothering of seabed habitats and species. However, the capital dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries and both species also move ~~through the estuary during spawning migrations.~~ ~~Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the ranges of lamprey. This impact pathway is,~~
					through the estuary during spawning migrations. Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby

					areas with the footprint of dredging only represent a small proportion of the ranges of lamprey. This impact pathway is therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Dredge disposal	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between ~~coastal waters and their spawning areas.~~	No	Disposal at the marine disposal site will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. However, the capital dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries and both species also move through the estuary during ~~spawning migrations. Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the ranges of lamprey. This impact pathway is, therefore, not considered further in the HRA.~~
			coastal waters and their spawning areas.		spawning migrations. Therefore, given the high mobility of both river and sea

					lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the ranges of lamprey. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	~~Changes in water and~~	~~Piling~~	~~Criterion 8 – Internationally important~~	~~No~~	~~The expected highly localised and temporary changes in suspended~~
	Changes in water and sediment quality on migratory fish species	Piling	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between ~~coastal waters and their spawning areas.~~	No	The expected highly localised and temporary changes in suspended sediment levels (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)) and related changes in sediment bound contaminants and dissolved oxygen (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference number 8.2.8)) associated with bed disturbance during piling are considered ~~highly unlikely to produce adverse effects in any fish species. The potential for accidental spillages will also be negligible during construction through following established industry guidance~~

					~~and protocols. This impact pathway is, therefore, not considered further in the HRA.~~
			coastal waters and their spawning areas.		highly unlikely to produce adverse effects in any fish species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway is therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Capital dredge	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	Yes	Changes in water quality during capital dredging could impact migratory fish species through an increase in SSC and the release of toxic contaminants bound in sediments.
		Dredge disposal	~~route for both river lamprey *Lampetra fluviatilis* and sea~~S1095: Sea	Yes	Changes in water quality could occur during dredged material disposal

			lamprey *Petromyzon marinus* ~~between coastal waters and their spawning areas.~~		
		~~Dredge disposal~~	~~S1095: Sea lamprey *Petromyzon marinus*~~ S1099: River lamprey *Lampetra fluviatilis*	~~Yes~~	~~Changes in water quality could occur during dredged material disposal~~ through the deposition of material causing elevated SSC and contaminant levels. This could potentially impact on migratory fish species.
	Underwater noise effects on migratory fish species	Piling	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	Yes	During piling, there is the potential for noise disturbance to fish. Percussive (impact) and vibro piling will produce underwater noise above background conditions and at a level that may cause a risk of injury and behavioural changes to fish in the vicinity of the proposed development.
		Capital dredge	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The	Yes	Elevated underwater noise and vibration levels caused by the action of the dredger could potentially affect migratory fish.

			Humber Estuary acts as an important migration route for both ~~river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.~~		
			river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		
		Dredge disposal	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	Yes	Underwater noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect migratory fish.
			~~waters and their spawning areas.~~		

	Direct loss or changes in marine mammal foraging habitat	Construction (piling, capital dredge and dredge disposal)	Criterion 3 – supports populations of plants and/or animal species of international importance: ~~The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.~~	No	There is the potential for impacts to marine mammals as a result of changes to marine mammal foraging habitat and prey resources. However, the footprint of the proposed development only covers a highly localised area that ~~constitutes a negligible fraction of the known ranges of local marine mammal populations. This impact pathway is, therefore, not considered further in the HRA.~~
			The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.		constitutes a negligible fraction of the known ranges of local marine mammal populations. This impact pathway is, therefore, not considered further in the HRA.
	Lighting effects on migratory fish and seals	Construction	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The		With respect to potential lighting effects during construction, equipment such as piling rigs, cranes etc. will be lit for safety reasons. Beams of light from construction lighting will largely be restricted to the

			Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		surface waters as light is unlikely to penetrate far into the water column given the high turbidity of the Humber Estuary. Furthermore, evidence suggests that lamprey are not considered to be particularly sensitive to lighting and will often be attracted to lighting rather than causing a barrier to movements (Stamplecoskie *et al.*, 2012; *Zielinski et al.*, 2019). Therefore, such localised
			~~lamprey *Petromyzon marinus* between coastal waters and their spawning areas.~~ Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.		~~lamprey are not considered to be particularly sensitive to lighting and will often be attracted to lighting rather than causing a barrier to movements (Stamplecoskie *et al.*, 2012; *Zielinski et al.*, 2019). Therefore, such localised~~ changes would not cause disruption or blocking of migratory routes for these species. Seals are also known to forage in areas with artificial lighting (such as harbours, offshore wind farms and fish farms) with lighting not known to cause adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency through enhancing vision of this predator near the surface.
	Changes in water and	Piling	Criterion 3 – supports populations of plants	No	The negligible, highly localised and temporary changes in suspended

	sediment quality on marine mammals		and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in		sediment levels (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)) and related changes in sediment bound contaminants and dissolved oxygen (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference
			~~seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in~~ England and the furthest south regular breeding site on the east coast.		~~contaminants and dissolved oxygen (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference~~ number 8.2.8)) associated with bed disturbance during piling is considered highly unlikely to produce adverse effects in any marine mammal species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Capital dredge	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports	No	The plumes resulting from dredging are expected to have a relatively minimal and local effect on SSC in the vicinity of the proposed development (see Physical Processes assessment in Chapter 7 of the ES (Application Document Reference number 8.2.7)).

			a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular		Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during capital dredging (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water column contamination (Chapter 8 of the ES
			breeding site on the east coast.		~~column contamination (Chapter 8 of the ES~~ (Application Document Reference number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Todd *et al.*, 2015). Furthermore, potential for accidental spillages will also be negligible during all phases through the application of established industry guidance and protocols. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
		Dredge	Criterion 3 – supports	No	The plumes resulting from dredge

		disposal	populations of plants and/or animal species of international importance: ~~The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus*~~		disposal are expected to have a relatively minimal and local effect on SSC (described in more detail in the Physical Processes assessment in Chapter 7 of the ES (Application ~~Document Reference number 8.2.7)). Marine mammals are well adapted to turbid conditions and,~~
			The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.		Document Reference number 8.2.7)). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during disposal (Todd *et al.*, 2015). The extent of sediment dispersal is not expected to cause significant elevations in water column contamination (described in more detail in the Water and Sediment Quality assessment in Chapter 8 of the ES (Application Document Reference number 8.2.8)). In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Todd *et al.*, 2015). Furthermore, potential for accidental

					spillages will also be negligible during construction through the application of established industry guidance and protocols. This impact ~~pathway is, therefore, not considered further in the HRA.~~
					pathway is therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Collision risk to marine mammals	Construction, dredging and dredge disposal	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	No	Vessels involved in construction and dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing lethal injury (Schoeman *et al.,* 2020). Furthermore, the region is already characterised by heavy shipping traffic. The additional movements due to construction activity (including capital dredging) will only constitute a small increase in vessel traffic in the area which will also be temporary in nature. In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP, 2020). For

					example, out of 144 post ~~mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some~~
					mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported (CSIP, 2020). In addition, marine mammals foraging within the Humber Estuary region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Underwater noise effects on marine mammals	Piling	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook.	Yes	Percussive (impact) and vibro piling will produce underwater noise above background conditions and at a level that may cause a risk of injury and behavioural changes to marine mammals in the vicinity of the proposed development.

			It is the second largest ~~grey seal colony in England and the furthest south regular breeding site on the east coast.~~		
			grey seal colony in England and the furthest south regular breeding site on the east coast.		
		Capital dredge	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	Yes	Elevated noise and vibration levels caused by the action of the dredger could potentially affect marine mammals by inducing adverse behavioural reactions.
			~~The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in~~		

			~~England and the furthest south regular breeding site on the east coast.~~		
		Dredge disposal	S1364: Grey seal *Halichoerus grypus*	Yes	Elevated noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect marine mammals by inducing adverse behavioural reactions.
	Visual disturbance	Construction, dredging and	Criterion 3 – supports populations of plants	No	The nearest established breeding colony for grey seals is located over 25
	~~Visual disturbance~~ of hauled out seals	~~Construction, dredging and~~ dredge disposal	~~Criterion 3 – supports populations of plants~~ and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	~~No~~	~~The nearest established breeding colony for grey seals is located over 25~~ km away at Donna Nook. Approximately 10 to 15 grey seals were also observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during the project specific benthic surveys as detailed in Appendix ~~9.1~~ 9.1 to the ES. This haul out site is located approximately 4 km north east from the proposed development and around 3-4 km from the dredge disposal sites (including transit routes). No seal haul out sites are known to occur nearer to the proposed development. Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Hoover-Miller *et al*, 2013).

					The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source. Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800 m although seals generally only
			~~breeding site on the east coast.~~		~~out sites are known to occur nearer to the proposed development.~~ ~~Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Hoover-Miller *et al*, 2013).~~ ~~The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source. Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800 m although seals generally only disperse into the water at distances <150-200 m (Wilson, 2014; Mathews, *et al*., 2016; Henry and Hammill, 2001; Strong and Morris, 2010). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5 m and 25 m resulted in over~~

					~~64 % of seals entering the water, but at distances of between 50 m and 100 m only 1 % entered the water (Curtin *et al.*, 2009). Recent disturbance research has also found no large-scale~~
					disperse into the water at distances <150-200 m (Wilson, 2014; Mathews, *et al.*, 2016; Henry and Hammill, 2001; Strong and Morris, 2010). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5 m and 25 m resulted in over 64 % of seals entering the water, but at distances of between 50 m and 100 m only 1 % entered the water (Curtin *et al.*, 2009). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within a tidal cycle (Paterson *et al.,* 2019). Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the proposed development) are out of the zone of influence of any potential visual disturbance effects as a result of dredging, dredge disposal or construction activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-
					combination effects are considered to

					be negligible and not of a magnitude to cause a LSE.
	Direct loss or change to supporting intertidal habitat	Piling	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	Yes	Piling will cause a direct loss of intertidal habitat. This loss will be highly localised. However, given the protection afforded to the mudflat that is utilised by feeding waterbirds in this area, there is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2).
		Capital dredge	~~Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black- tailed~~	Yes	Capital dredging will cause a direct, albeit minimal, loss of intertidal habitat as well as potential changes which could cause changes to the prey resources available for coastal waterbirds. There is, therefore,

			~~Godwit, Bar-tailed Godwit (overwintering)~~ Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2).
	Indirect loss of supporting intertidal habitat as a	Marine works (capital	A048; Common Shelduck (Criterion 5 – Bird Assemblages of	Yes	The capital dredge and pile structures have the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates,
			~~tailed Godwit, Bar-tailed Godwit (overwintering)~~		
	~~Indirect loss of supporting~~	~~Marine works~~	~~A048; Common Shelduck (Criterion 5~~	~~Yes~~	~~The capital dredge and pile structures have the potential to result in changes to~~

	~~intertidal habitat as a~~ result of changes to hydrodynamic and sedimentary processes	~~(capital~~ dredging and piles)	~~– Bird Assemblages of~~ International Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		~~hydrodynamic and sedimentary processes (e.g. water levels, flow rates,~~ changes to tidal prism, accretion and erosion patterns) which could cause erosion to intertidal mudflat used by feeding birds. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2).
	Changes in water or sediment quality	Capital dredging and dredge disposal	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-	No	All features screened into the HRA (Table 2) are coastal waterbirds that feed on intertidal invertebrates by using the beak to capture prey on intertidal habitats (either when exposed to air or when covered in very shallow water). Therefore, they are not considered
			~~Wintering waterfowl - 153,934 waterfowl (5-~~ year peak mean		~~(either when exposed to air or when covered in very shallow water). Therefore, they are not considered~~ sensitive to the directs effects of elevated suspended sediment plumes

			1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		(unlike diving birds which use pursuit or plunge diving to capture prey underwater). It is considered possible that SPA features could be sensitive to indirect effects resulting from changes to intertidal benthic habitats and species due to suspended sediment concentrations (i.e., changes to invertebrate prey resources on supporting mudflat). However, given estuarine benthic communities recorded on mudflats and the shallow mud in the region are considered tolerant to this highly turbid environment and the predicted SSCs are within the range that can frequently occur naturally and also as a result of ongoing dredge activity, potential effects of elevated SSC on prey resources are considered to be negligible (Section 4.8). With respect to sediment contamination during construction, potential effects on intertidal benthic habitats and species are considered to be insignificant (Section 4.9). On this basis, potential effects on waterbirds as a result of
					~~basis, potential effects on waterbirds as a result of~~ bioaccumulation through consuming prey (i.e., intertidal benthos) will be negligible. This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude

					to cause a LSE.
	Lighting effects on coastal waterbirds during construction	Construction	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage), Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed ~~Godwit, Bar-tailed Godwit (overwintering)~~	No	With respect to potential lighting effects, construction equipment such as piling rigs, cranes etc. will be lit for safety reasons. Waders and other waterbirds feeding on intertidal mudflats are known to feed nocturnally. Evidence suggests that artificial illumination can improve foraging (through increasing prey intake rate) and, therefore, lighting can have a positive effect on the nocturnal foraging of waterbirds (Santos *et al.,* 2010). This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
			Godwit, Bar-tailed Godwit (overwintering)		
	~~Noise and visual disturbance~~	~~Construction activity (including~~	~~Criterion 5 – Bird Assemblages of International Importance:~~	~~Yes~~	~~During construction, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds. There is, therefore, considered to be a potential for~~
	Noise and visual disturbance	Construction activity (including	Criterion 5 – Bird Assemblages of International	Yes	During construction, there is the potential for airborne noise and visual disturbance to affect coastal

	to coastal waterbirds	capital dredging)	Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		waterbirds. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2).
Operation	Direct changes to benthic ~~habitats and species beneath marine infrastructure due to shading~~	Operation	Criterion 1 – natural wetland habitats that ~~are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid~~	Yes	Changes in sunlight levels as a result of shading due to marine infrastructure has ~~the potential to cause changes to the benthic community occurring in an area.~~
	habitats and species beneath marine		are of international importance: The site is a representative example of a near-natural estuary		the potential to cause changes to the benthic community occurring in an area.

	infrastructure due to shading		with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		
	Changes to intertidal habitats and species as a result of the movement of Ro-Ro vessels during operation	Berth operations	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and ~~coastal brackish/saline lagoons.~~	Yes	There is potential for physical disturbance and erosion to the foreshore nearby to the proposed development as a result of the movement of Ro-Ro vessels and other ships using the berths.
			coastal brackish/saline lagoons.		
	Changes to benthic habitats and species as result of seabed	Maintenance dredging	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a	Yes	Maintenance dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material

	removal during dredging		near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		include changes to abundance and distribution through damage, mortality or relocation to a disposal site. Given that the dredge footprint has not previously been subject to any maintenance dredging, there is, therefore, considered to be a potential for LSE on this feature.
	~~during dredging~~		~~component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.~~		~~to a disposal site. Given that the dredge footprint has not previously been subject to any maintenance dredging, there is, therefore, considered to be a potential for LSE on this feature.~~
	Changes to seabed habitats and species as a result of sediment deposition	Maintenance dredging and disposal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems ~~and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and~~	No	Maintenance dredge and dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. As a result of a less intensive dredge programme (and an overall lower predicted dredge volume), future maintenance dredging will result in ~~smaller changes in SSC and sedimentation (within the dredge plumes and at the disposal site) as compared to the capital dredge. Deposition of sediment as a result of dredging will be~~

			~~coastal brackish/saline lagoons.~~		~~highly localised and similar to background variability. The benthic species occurring within and near to the dredge area typically consist of burrowing infauna (such as polychaetes,~~
			and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		smaller changes in SSC and sedimentation (within the dredge plumes and at the disposal site) as compared to the capital dredge. Deposition of sediment as a result of dredging will be highly localised and similar to background variability. The benthic species occurring within and near to the dredge area typically consist of burrowing infauna (such as polychaetes, oligochaetes or bivalves), which are considered tolerant to some sediment deposition. The predicted millimetric changes in deposition are, therefore, considered unlikely to cause smothering effects. In addition, the species recorded in the benthic invertebrate surveys are fast growing and/or have rapid reproductive rates which allow populations to typically rapidly recolonise disturbed habitats, many within a few months following the disturbance events (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). Clay Huts licensed disposal site (HU060) will be used for maintenance ~~disposal as per the existing~~

					~~maintenance dredge licence.~~ ~~The disposal site is located in the mid channel and are subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. This disposal site is already used for the disposal of maintenance dredge arisings (millions of~~
					disposal as per the existing maintenance dredge licence. The disposal site is located in the mid channel and are subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. This disposal site is already used for the disposal of maintenance dredge arisings (millions of wet tonnes of dredge sediment are disposed of at HU060 annually) which will also cause some disturbance due to sediment deposition. This is reflected in a generally impoverished assemblage at the disposal site. The benthic species recorded include mobile infauna (such as errant polychaetes e.g., *Arenicola* spp. and amphipods) which are able to burrow through sediment. They are, therefore, considered tolerant to some sediment deposition. In addition, characterising

					species typically have opportunistic life history strategies, with short life histories (typically two years or less), rapid maturation and the production of large ~~numbers of small propagules which makes them capable of rapid recoverability should mortality as a result of smothering occur (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016; Tyler-Walters and Garrard, 2019). On this basis, any effects are considered to be temporary and short term. This impact pathway is,~~
					numbers of small propagules which makes them capable of rapid recoverability should mortality as a result of smothering occur (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016; Tyler-Walters and Garrard, 2019). On this basis, any effects are considered to be temporary and short term. This impact pathway is therefore, not considered further in the HRA alone. In addition, in- combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Indirect changes to seabed habitats and species as a result of changes to	Maintenance dredging and disposal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary	No	The predicted physical processes impacts from future maintenance dredging will be similar to that which already arises from the ongoing maintenance of the existing Immingham berths.

	hydrodynamic and sedimentary processes		with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and ~~coastal brackish/saline lagoons.~~		Maintenance dredging has the potential to result in changes to hydrodynamic and sedimentary processes (e.g., water levels, flow rates, changes to tidal prism, accretion and erosion patterns). However, as described in more detail in the Physical Processes assessment ~~(Chapter 7 of the ES (Application Document Reference number 8.2.7)), only changes in hydrodynamic and sedimentary processes that are of a negligible magnitude are predicted. These changes will not be discernible against natural processes at nearby intertidal habitats. Furthermore, the predicted changes are not expected to modify existing subtidal habitat types found in the area. This impact pathway~~
			coastal brackish/saline lagoons.		(Chapter 7 of the ES (Application Document Reference number 8.2.7)), only changes in hydrodynamic and sedimentary processes that are of a negligible magnitude are predicted. These changes will not be discernible against natural processes at nearby intertidal habitats. Furthermore, the predicted changes are not expected to modify existing subtidal habitat types found in the area. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to

					cause a LSE.
	Changes in water and sediment quality on benthic habitats and species	Maintenance dredge and dredge disposal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, ~~intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.~~	No	Changes in water quality (as summarised in Chapter 8 of the ES (Application Document Reference number 8.2.8)) are also expected to be lower than for the capital dredge and similar to existing maintenance dredging. Elevated SSCs due to maintenance dredging and dredge disposal are considered to be of a magnitude that can occur naturally or as a result of ~~existing maintenance dredging/disposal and sediment plumes resulting from dredging are also considered to dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle).~~ ~~Naturally very high SSCs typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides. The estuarine benthic communities recorded in the region are considered tolerant to this~~
			intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		existing maintenance dredging/disposal and sediment plumes resulting from dredging are also considered to

					dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle). Naturally very high SSCs typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides. The estuarine benthic communities recorded in the region are considered tolerant to this highly turbid environment (De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). Magnitude of change is therefore assessed as negligible. The results of the sediment contamination sampling are summarised above and the Water and Sediment Quality chapter (Chapter 8 of the ES (Application Document Reference number 8.2.8)). In summary, low levels of contamination were found in the samples and there is no reason to believe the sediment will be unsuitable for disposal in the marine environment. During maintenance dredging and dredge disposal, sediment will be rapidly dispersed in the water column. Therefore, the already low levels of contaminants in the dredged sediments

					will be dispersed further. The probability of changes in water quality occurring at the disposal site is considered to be low and the overall exposure to change is considered to be negligible. The sensitivity of subtidal habitats and species to contaminants is assessed as low to moderate because, although contaminants can cause toxicity in subtidal communities, the concentrations of contaminants required to produce both lethal and sub-lethal effects are generally high (although responses vary considerably between species). This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
					~~low to moderate because, although contaminants can cause toxicity in subtidal communities, the concentrations of contaminants required to produce both lethal and sub-lethal effects are generally high (although responses vary considerably between species). This impact pathway is, therefore, not considered further in the HRA.~~
	Non-native species transfer during vessel	Vessel operations	Criterion 1 – natural wetland habitats that are of international importance: The site is	Yes	Non-native species have the potential to be transported into the local area on the hulls of vessels during operation. Non- native invasive species also have

	operations		a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		the potential to be transported via vessel ballast water. Potential effects alone are considered in Section 4.12 although in-combination effects are assumed to be negligible and not of a magnitude to cause a LSE assuming that standard biosecurity measures are implemented for the IERRT development and also for other projects.
	Physical change to habitats resulting from the deposition of airborne pollutants	Operation	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters,	Yes (NOx and N deposition)	As discussed in respect of construction impacts, the majority of the Ramsar habitats closest to site are marine environments and therefore not sensitive to N deposition or NOx from operational marine vessel/ road vehicle emissions. Predicted operational N deposition and NOx at five receptors within the SAC are presented in Table 13.15 in Chapter 13: Air Quality (Application Document Reference number 8.2.13). Annual mean NOx and
	~~the deposition of airborne pollutants~~		~~The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters,~~ intertidal mud and sand		~~to N deposition or NOx from operational marine vessel/ road vehicle emissions. Predicted operational N deposition and NOx at five receptors within the SAC are presented in Table 13.15 in Chapter 13: Air Quality (Application Document Reference number 8.2.13). Annual mean NOx and~~ N deposition show minor exceedances of the 1% of the

			flats, saltmarshes, and coastal brackish/saline lagoons.		Critical Load screening threshold at three of the Ramsar receptors, and therefore likely significant effects from this pathway cannot be screened out. Predicted NH3 and NH3 derived N deposition at the same five Ramsar receptors are presented in Table 13.16 in Chapter 13: Air Quality (Application Document Reference number 8.2.13). The predicted NH3 concentrations are below 1% of the Critical Level threshold at all receptors and likely significant effects are therefore screened out from this pathway.
	Changes to migratory fish habitat	Maintenance dredge and dredge disposal	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon*	No	Maintenance dredging and dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. However, the maintenance dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries
			~~nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea~~		~~However, the maintenance dredge will not overlap with the spawning grounds of lamprey which are further upstream in freshwater habitat. Both species are recorded in the estuary at other life stages with the growth phase of river lamprey primarily restricted to estuaries~~

			~~lamprey *Petromyzon*~~ *marinus* between coastal waters and their spawning areas.		and both species also move through the estuary during spawning migrations. Therefore, given the high mobility of both river and sea lamprey (and also the parasitic fish prey of these species), lamprey will easily be able to avoid the zone of influence of the dredging and utilise other nearby areas with the footprint of dredging only represent a small proportion of the ranges of lamprey. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Changes in water and sediment quality on migratory fish	Maintenance dredge and dredge disposal	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between	No	Changes in water quality (as summarised in Chapter 8 of the ES (Application Document Reference number 8.2.8)) are also expected to be lower than for the capital dredge and similar to existing maintenance dredging. With specific respect to lamprey, these species are known to migrate through estuaries with high SSC (including the Humber Estuary). Elevated SSCs due to dredging are considered to be of a
			~~route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between~~ coastal		~~With specific respect to lamprey, these species are known to migrate through estuaries with high SSC (including the Humber Estuary). Elevated SSCs due to dredging are considered to be of a~~

			waters and their spawning areas.		magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. Sediment plumes resulting from dredging and dredge disposal are also considered to dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle) as described in more detail in the Physical Processes assessment (Chapter 7 of the ES (Application Document Reference number 8.2.7)). Therefore, lamprey would also be able to avoid the temporary sediment plumes. Based on these factors there is therefore considered limited potential for migrating fish to be adversely affected by the predicted changes in SSC. With respect to sediment contamination, generally low levels of contamination were found in the sediment contamination samples as presented in the Water and Sediment Quality assessment in Chapter 8 of the ES
					~~were found in the sediment contamination samples as presented in the Water and Sediment Quality assessment in Chapter 8 of the ES~~ (Application Document Reference

					number 8.2.8). Based on this sampling data, the overall level of contamination in the proposed dredge area is considered to be low and the sediment plume would be expected to rapidly dissipate by the strong tidal currents in the area. Significant elevations in the concentrations of contaminants within the water column are not anticipated. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Underwater noise effects on migratory fish	Vessel operations including maintenance dredge and dredge disposal	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra*	Yes	Vessel movements during operation may also result in disturbance through changes in underwater noise and vibration (see Table 9.25 in Section 9.8 of the Nature Conservation and Marine Ecology Chapter 9 of the ES (Application Document Reference number 8.2.9)). Only mild behavioural responses in close proximity to the Ro- Ro or dredging vessels are anticipated
			~~lamprey *Lampetra*~~ *fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		~~vessels are anticipated~~ with noise levels unlikely to be discernible above ambient levels in the wider Humber Estuary area. However, this impact pathway is considered further in the HRA on a precautionary basis.

	Lighting effects on migratory fish and seals	Vessel and berth operations	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas. Criterion 3 – supports populations of plants and/or animal species of international importance: ~~The Humber Estuary Ramsar site supports a~~	No	With respect to potential lighting effects, the jetties, pontoons and pier decking will be lit for safety and operational purposes. Beams of light from operational lighting will largely be restricted to the surface waters as light is unlikely to penetrate far into the water column given the high turbidity of the Humber Estuary. Furthermore, evidence suggests that lamprey are not considered to be particularly sensitive to lighting and will often be attracted to lighting rather than causing a barrier to movements (Stamplecoskie *et al.,* 2012; Zielinski *et al*., 2019). Therefore, such localised changes would not cause disruption or blocking of migratory routes for these species. Seals are also known to forage in areas with artificial lighting (such as harbours,
			The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular		offshore wind farms and fish farms) with lighting not known to cause adverse effects in this species. Rather than disrupting any foraging movements, lighting might also have some minor and localised beneficial effects given that lighting has been shown to aggregate fish shoals and will also potentially improve foraging efficiency

			breeding site on the east coast.		through enhancing vision of this predator near the surface.
	Underwater noise effects on marine mammals	Maintenance dredge and dredge disposal	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	Yes	Vessel movements during operation may also result in disturbance through changes in underwater noise and vibration (see Table 9.25 in Section 9.8 of the Nature Conservation and Marine Ecology Chapter 9 of the ES (Application Document Reference number 8.2.9)). Only mild behavioural responses in close proximity to the Ro- Ro or dredging vessels are anticipated with noise levels unlikely to be discernible above ambient levels in the wider Humber Estuary area. However, this impact pathway is, considered further in the HRA on a precautionary basis.
	~~Visual disturbance~~	~~Vessel operations,~~	~~Criterion 3 – supports populations of plants~~	~~No~~	~~The nearest established breeding colony for grey seals is located over 25 km away~~
	Visual disturbance of hauled out seals	Vessel operations, maintenance dredge and dredge disposal	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular	No	The nearest established breeding colony for grey seals is located over 25 km away at Donna Nook. Approximately 10 to 15 grey seals were also observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during the project specific benthic surveys as detailed in Appendix ~~9.1~~ 9.1 to the ES. This haul out site is located approximately 4 km north east from the proposed development. No seal haul out sites are known to occur nearer to the proposed development.

			breeding site on the east coast.		Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Hoover-Miller *et al*, 2013). The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source. Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800 m although seals generally only ~~disperse into the water at distances <150-200 m (Wilson, 2014; Mathews, *et al*., 2016; Henry and Hammill, 2001; Strong and~~
					disperse into the water at distances <150-200 m (Wilson, 2014; Mathews, *et al*., 2016; Henry and Hammill, 2001; Strong and Morris, 2010). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5 m and 25 m resulted in over 64 % of seals entering the water, but at distances of between 50 m and 100 m only 1 % entered the water (Curtin *et al*., 2009). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within

					a tidal cycle (Paterson *et al.,* 2019). Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the proposed development) are out of the zone of influence of any potential visual disturbance effects as a result of maintenance dredging and vessel operations. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	~~Collision risk to marine mammals~~	~~Vessel operations~~	~~Criterion 3 – supports populations of plants and/or animal species of international importance:~~	~~No~~	~~Vessels using the berths during operation will be typically approaching at slow speeds (2-4 knots) and maintenance dredging/dredge disposal~~
	Collision risk to marine mammals	Vessel operations	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	No	Vessels using the berths during operation will be typically approaching at slow speeds (2-4 knots) and maintenance dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing lethal injury (Schoeman *et al.,* 2020). Furthermore, the region is already characterised by heavy shipping traffic. The additional operational vessel movements resulting from the proposed

					development will only constitute a small increase in vessel traffic in the area on a typical day (up to six additional Ro-Ro vessel movements per day at the Port of Immingham, as well as tugs) which represents approximately a 3 % increase in vessel traffic in the study area. There will also be maintenance dredger and barge movements but that ~~is estimated to only be necessary approximately three to four times a year.~~ ~~In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP,~~
					is estimated to only be necessary approximately three to four times a year. In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (ABP Research 1999; CSIP, 2020). For example, out of 144 post mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported

					(CSIP, 2020). In addition, marine mammals frequently foraging within the region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway is~~,~~ therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Direct changes to coastal	Berth operations	Criterion 5 – Bird Assemblages of	Yes	Marine infrastructure associated with the proposed development (raised jetty structure, linkspan etc.) could potentially
	~~Direct changes to coastal~~ waterbird foraging and roosting habitat as a result of marine infrastructure	~~Berth operations~~	~~Criterion 5 – Bird Assemblages of~~ International Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin,	~~Yes~~	~~Marine infrastructure associated with the proposed development (raised jetty structure, linkspan etc.) could potentially~~ cause direct damage or reduced functionality to waterbird feeding and roosting habitat. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2)

			Black-tailed Godwit, Bar-tailed Godwit (overwintering)		
			~~Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Bar-tailed Godwit (overwintering)~~		
	Lighting effects on coastal waterbirds during operation	Berth operations	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-~~year peak mean 1998/99-2002/3)~~ ~~Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage), Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed~~	No	With respect to potential lighting effects, the jetties, pontoons and pier decking will be lit for safety and operational purposes. Waders and other waterbirds feeding on intertidal mudflats are known to feed nocturnally. Evidence suggests that artificial illumination can improve ~~foraging (through increasing prey intake rate) and can, therefore, lighting can have a positive effect on the nocturnal foraging of waterbirds (Santos *et al*., 2010).~~

			year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage), Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		foraging (through increasing prey intake rate) and can, therefore, lighting can have a positive effect on the nocturnal foraging of waterbirds (Santos *et al*., 2010). This impact pathway is therefore, not considered further in the HRA alone. In addition, in-combination effects are considered to be negligible and not of a magnitude to cause a LSE.
	Noise and visual disturbance to coastal waterbirds	Berth operations	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5- year peak mean 1998/99-2002/3) ~~Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot,~~	Yes	During operation, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds. There is, therefore, considered to be a potential for LSE on the waterbird features screened into the assessment (Table 2)

			~~Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)~~		
			Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		

3.2 Transboundary screening

3.2.1 Under Regulation 32 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 2017 EIA Regulations) and based on the information that ABP provided in the Scoping Report (ABPmer, 2021), PINS is of the view that the proposed development is likely to have a significant effect on the environment in a European Economic Area (EEA) State (PINS, 2022).

3.2.2 In reaching this view, PINS has applied the precautionary approach as explained in PINS Advice Note 12 (PINS, 2022), and taken into account the information supplied by ABP at the time of scoping.

3.2.3 In PINS' view, the trade routes associated with the IERRT, combined with the overlap of the proposed development with European/Ramsar sites, could lead to potential impacts on bird populations associated with EEA States (PINS, 2022).

3.2.4 The following species associated with populations in EEA states are interest features of the Humber Estuary SPA:

- Red knot (*Calidris canutus*) comprising 6.3 % of the Northeastern Canada/Greenland/Iceland/North western Europe populations; and
- Black-tailed godwit (*Limosa limosa*) comprising 2.6 to 3.2 % of the Icelandic breeding population.

3.2.5 The following species associated with populations in EEA states are interest features of the Humber Estuary Ramsar:

- Golden plover representing 2.2 % of the Iceland and Faroes/East Atlantic population; and
- Black-tailed godwit comprising 2.6 to 3.2 % of the Iceland/West Europe populations.

3.2.6 On this basis, the EEA States of Iceland and Denmark have been notified of these potential transboundary issues by PINS.

3.2.7 Black-tailed Godwit are regularly recorded on the foreshore in the area of the proposed development, and lower numbers of Knot also regularly occur in the area (see Section 1.4 of Appendix A of this HRA). As detailed in Table 4, there is considered to be a potential for LSE on these interest features both alone and in-combination with other plans and projects and, therefore, these interest features have been taken forward into the assessment stage of the HRA (Section 4).

3.2.8 Although Golden Plover is widely distributed through the Humber Estuary, this species is only very infrequently recorded in vicinity of the proposed development, for example only one single individual was recorded in the relevant Count Sector B in the Immingham Outer Harbour (IOH) monitoring between 2016/17 and 2020/21 (see Section 1.4 of Appendix A of this HRA).

The area is, therefore, considered to be of very limited functional value for the species. On this basis, there is considered to be no potential for an LSE on this interest feature either alone or in-combination with other plans and projects and, therefore, this interest feature is not considered further in the HRA.

3.3 Screening conclusion

3.3.1 The screening review has determined that there are likely significant effects on European/Ramsar sites and qualifying features as a result of the proposed development, both alone or in -combination with other plans or projects, and an AA by the Competent Authority is therefore likely to be required. There is a requirement to progress to the next stage of the HRA (Section 4).

3.3.2 Considering the information provided in Table 2 and all impact pathways as detailed in Table 3, Table 4 and Table 5 the proposed development has the potential to result in an LSE on the following European/Ramsar sites and features, and these have been taken forward into the Appropriate Assessment stage:

Humber Estuary SAC

- H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks;
- H1130. Estuaries;
- H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats;
- H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (air quality effects only);
- S1095. *Petromyzon marinus*; Sea lamprey;
- S1099. *Lampetra fluviatilis*; River lamprey; and
- S1364. *Halichoerus grypus*; Grey seal.

Humber Estuary SPA

- A048 *Tadorna tadorna*; Common Shelduck (Non-breeding);
- A143 *Calidris canutus*; Red knot (Non-breeding);
- A149 *Calidris alpina alpina*; Dunlin (Non-breeding);
- A156 *Limosa limosa islandica*; Black-tailed Godwit (Non-breeding);
- A157 *Limosa lapponica*; Bar-tailed Godwit (Non-breeding);
- A162 *Tringa totanus*; Common Redshank (Non-breeding); and
- Waterbird assemblage.

The Wash and North Norfolk Coast SAC

- S1365 Harbour seal *Phoca vitulina.*

Humber Estuary Ramsar site

- Criterion 1 – natural wetland habitats that are of international importance;

- Criterion 3 – supports populations of plants and/or animal species of international importance;
- Criterion 5 – Bird Assemblages of International Importance;
- Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance; and
- Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path.

3.3.3 It should be noted that with respect to maintenance dredging, this activity already falls within the consent granted by the current marine licence for the disposal of maintenance dredge material from the Port of Immingham (L/2014/00429/2). The level of maintenance dredging and disposal required at IERRT during the operational phase is anticipated to be required around three to four times a year (though this will be dependent on a range of factors - see Chapter 3 of the ES (Application Document Reference number 8.2.3)).

3.3.4 The frequency and volume of material deposited at the disposal site from each load will not change compared with current maintenance dredging activities as the same plant and methods are proposed to be used. Furthermore, the volume of material that will need to be maintenance dredged from the IERRT berth pocket will be lower than the volumes of capital dredge material. Regular maintenance dredging (i.e., occurring every 3-4 months) is anticipated to be restricted to a relatively small proportion of the total maintenance dredge area (i.e. focused around the finger pier piles and adjacent areas of the berth pockets and pontoons). The remainder of the area will only be required to be dredged much more periodically (frequency in these areas will be dictated by operational requirements but dredging is anticipated to be required approximately every 1-2 years or more). Overall, the changes brought about as a result of the maintenance dredge and disposal of maintenance dredge material during operation will be comparable to that which already arises from the ongoing maintenance of the existing Immingham berths (see Section 9.8 of the Nature Conservation and Marine Ecology Chapter 9 of the ES (Application Document Reference number 8.2.9) for a more detailed description of potential effects). There is, therefore, considered to be no potential for LSE to result on the interest feature either alone or in-combination with other plans and projects with respect to pathways relating to sediment deposition, water quality and changes to physical processes summarised in **Table 3**, **Table 4** and **Table 5**. However, there is considered to be the potential for an LSE due to potential habitat changes resulting from the removal of seabed material during maintenance dredging (given that the dredge footprint has not previously been subject to maintenance dredging) and also underwater noise.

4 Stage 2 – Appropriate Assessment

4.1 Overview

4.1.1 In accordance with PINS Advice Note 10 (PINS, 2022), at Stage 1, ABP (as the applicant) has concluded that LSE on European site(s) and qualifying features are considered to exist, either alone or in -combination with other plans or projects and an AA by the Competent Authority is likely to be required. In line with this guidance the assessment has documented Stage 1 (in Section 3 above) and now moves to Stage 2 (AA) (this Section 4).

4.1.2 This second stage of the HRA involves undertaking an assessment of the potential effects on the integrity of the European/Ramsar sites and interest features that have been screened into the assessment in view of the site's conservation objectives (see **Table 6**). Where there are potential adverse effects, a review of mitigation options is carried out and mitigation measures are identified with a view to avoiding or minimising the effects. If, despite the identified measures of mitigation, there still remains a potential AEOI, the HRA must progress to Stage 3.

4.1.3 The potential effects on interest features of European/Ramsar sites that have been screened into the AA (see Section 3.3) have been reviewed and are presented in this section. This assessment has been carried out in the context of the nature and scale of the proposed development, the geographic location relative to the interest features of European/Ramsar sites and the ecology, behaviour and sensitivities of the interest features to these environmental pressures/changes.

4.1.4 PINS Advice Note 10 (PINS, 2022) recommends that all relevant information is presented in a summary table which identifies all European sites and qualifying features and each pathway of effect which has been considered at each HRA Stage (screening, AA/IROPI and the derogations, as applicable). It is recommended that this exercise is undertaken for each phase of the proposed development (construction, operation, decommissioning, as relevant). A summary table containing this information is provided in Appendix D.

Table 6. Qualifying interest features screened into the assessment and conservation objectives of European/Ramsar sites

Site	Features Screened In	Conservation Objectives
Humber Estuary SAC	▪ H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks; ▪ H1130. Estuaries; ▪ H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats; ▪ H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (air quality effects only); ▪ S1095. *Petromyzon marinus*; Sea lamprey; ▪ S1099. *Lampetra fluviatilis*; River lamprey; and ▪ S1364. *Halichoerus grypus*; Grey seal.	With regard to the natural habitats and/or species for which the site has been designated, and subject to natural change; Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; ▪ The extent and distribution of qualifying natural habitats and habitats of qualifying species; ▪ The structure and function (including typical species) of qualifying natural habitats; ▪ The structure and function of the habitats of qualifying species; ▪ The supporting processes on which qualifying natural habitats and habitats of qualifying species rely; ▪ The populations of qualifying species; and ▪ The distribution of qualifying species within the site.
The Wash and North Norfolk Coast	▪ 365. Harbour seal *Phoca vitulina.*	With regard to the natural habitats and/or species for which the site has been designated, and subject to natural change; Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; ~~▪ The extent and distribution of qualifying natural~~

		~~habitats and habitats of qualifying species;~~
		▪ The extent and distribution of qualifying natural habitats and habitats of qualifying species; ▪ The structure and function (including typical species) of qualifying natural habitats; ▪ The structure and function of the habitats of qualifying species; ▪ The supporting processes on which qualifying natural habitats and habitats of qualifying species rely; ▪ The populations of qualifying species; and ▪ The distribution of qualifying species within the site.
Humber Estuary SPA	▪ A048 *Tadorna tadorna*; Common Shelduck (Non-breeding); ▪ A143 *Calidris canutus*; Red knot (Non- breeding); ▪ A149 *Calidris alpina alpina*; Dunlin (Non- breeding); ▪ A156 *Limosa limosa islandica*; Black-tailed Godwit (Non-breeding); ▪ A157 *Limosa lapponica*; Bar-tailed Godwit (Non-breeding); ▪ A162 *Tringa totanus*; Common Redshank (Non-breeding); and ▪ Waterbird assemblage.	With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified, and subject to natural change; Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; ▪ The extent and distribution of the habitats of the qualifying features; ▪ The structure and function of the habitats of the qualifying features; ▪ The supporting processes on which the habitats of the qualifying features rely; ▪ The population of each of the qualifying features; and ▪ The distribution of the qualifying features within the site.
Humber Estuary	▪ Criterion 1 – natural wetland habitats that are of international importance;	For Ramsar sites, a decision has been made by Defra and Natural England not to produce Conservation Advice

Ramsar site	▪ Criterion 3 – supports populations of plants and/or animal species of international importance; ▪ Criterion 5 – Bird Assemblages of International Importance; ▪ Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance; and ▪ Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path.	packages, instead focussing on the production of High Level Conservation Objectives. As the provisions on the Habitats Regulations relating to HRAs extend to Ramsar sites, Natural England considers the Conservation Advice packages for the overlapping European Marine Site designations to be, in most cases, sufficient to support the management of the Ramsar interests. See the conservation objectives for Ramsar interest features covered by overlapping the Humber Estuary SAC and Humber Estuary SPA.
* Denotes a priority natural habitat or species		

Source: JNCC (2022); Natural England (2017; 2021a; 2021b; 2022).

4.2 Assessment of effects

4.2.1 The assessment has been structured based on the following key impact pathways screened into the AA:

- **Section 4.3: Physical loss of habitat and associated species**
  - The potential effects of the direct loss of qualifying intertidal habitat;
  - The potential effects of the direct loss of supporting intertidal habitat on qualifying species;
  - The potential effects of the direct loss of qualifying subtidal habitat features; and
  - The potential effects due changes to waterbird foraging and roosting habitat as a result of the presence of marine infrastructure during operation on qualifying species.

- **Section 4.4: Physical damage through disturbance and/or smothering of habitat**
  - The potential effects of changes to qualifying habitats as result of the removal of seabed material during capital dredging;
  - The potential effects of changes to qualifying species as result of the removal of seabed material during capital dredging;
  - The potential effects of changes to qualifying habitats as a result of sediment deposition during capital dredging;
  - The potential effects of changes to qualifying habitats as a result of sediment deposition during capital dredge disposal;
  - The potential effects of changes to qualifying habitats as result of the removal of seabed material during maintenance dredging; and
  - The potential effects of changes to qualifying intertidal habitats as a result of the movement of Ro-Ro vessels during operation.

- **Section 4.5: Physical loss or damage of habitat through alterations in physical processes**
  - Indirect loss or change to qualifying habitats and species as a result of changes to hydrodynamic and sedimentary processes as a result of the marine works; and
  - Indirect changes to qualifying habitats as a result of changes to hydrodynamic and sedimentary processes during capital dredge disposal.

- **Section 4.6: Direct changes to qualifying habitats beneath marine infrastructure due to shading**
  - Direct changes to qualifying habitats beneath marine infrastructure due to shading.
- **Section 4.7: Physical change to habitats resulting from the deposition of airborne pollutants**

  - Physical change to qualifying habitats resulting from construction dust deposition resulting in smothering during construction.
  - Physical change to qualifying habitats resulting from the deposition of N and NOx from marine vessel and road vehicle emissions during operation.

- **Section 4.8: Non-toxic contamination through elevated SSC**
  - The potential effects of elevated SSC during capital dredging on qualifying habitats and species; and
  - The potential effects of elevated SSC during capital dredge disposal on qualifying habitats and species

- **Section 4.9: Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases**
  - The potential effects of the release of contaminants during capital dredging on qualifying habitats and species; and
  - The potential effects of the release of contaminants during capital dredge disposal on qualifying habitats and species.

- **Section 4.10: Airborne noise and visual disturbance**
  - The potential effects of airborne noise and visual disturbance during construction on qualifying species; and
  - The potential effects of airborne noise and visual disturbance during operation on qualifying species.

- **Section 4.11: Disturbance through underwater noise and vibration**
  - The potential effects of underwater noise and vibration during piling on qualifying species; and
  - The potential effects of underwater noise and vibration during capital and maintenance dredging and disposal as well as operational vessel movements on qualifying species.

- **Section 4.12: Biological disturbance due to potential introduction and spread of non-native species**
  - The potential effects of the introduction and spread of non-native species during construction on qualifying habitats; and
  - The potential effects of the introduction and spread of non-native species during operation on qualifying habitats.

4.2.2 Each of the above pathways has then been structured based on the following sub-sections:

- ***General scientific context:*** A review of the best available scientific evidence on the pathway to provide contextual information;

- ***Summary of potential effects:*** This section provides a description of the potential effects on receptors relevant to the qualifying feature;
- ***Mitigation:*** For those pathways for which mitigation is required a description of the measures will be provided; and
- ***Assessment of the potential for an AEOI:*** The potential effects will be considered in the context of relevant conservation objectives for the particular qualifying feature and the best scientific evidence on the pathway to reach a conclusion on the potential for an AEOI.

4.2.3 The information presented in this report relating to each pathway should also be reviewed in the context of the baseline information provided in (see Appendix A of this HRA).

4.2.4 Consideration of intra-project combined effects is provided in Section 4.12 of this HRA.

4.2.5 An in-combination assessment considering other relevant plans/projects is then provided in Section 4.13 of this HRA.

4.3 Physical loss of habitat and associated species

The potential effects of the direct loss of qualifying intertidal habitat

General scientific context

4.3.1 The impact of direct habitat loss can involve building over marine habitats (such as reclamation) or the permanent physical removal of substratum and associated organisms from the seabed. Direct habitat loss can also occur due to deepening as a result of dredging causing a change from an intertidal to a subtidal environment.

4.3.2 Intertidal habitats are sensitive to physical loss at locations where new structures are introduced onto the seabed (i.e., within the development 'footprint' of these structures). The significance of such losses will vary on a site-by-site basis in response to differences in the extent and duration of the losses as well as the relative value of the habitats in question. The value of the habitats is, in turn, reflected by the species that are present and level of statutory and non-statutory protection afforded to them. As any effects are very much dependent upon site specific considerations, a generic scientific review is not appropriate in this case and the focus of the assessment is based on site-specific considerations.

Summary of effects

4.3.3 The IERRT development will result in the direct loss of 0.012 ha of intertidal habitat. This direct loss is due to the following:

- Capital dredging which has the potential to cause a direct loss of 0.006 ha of intertidal habitat which will become subtidal habitat as a result of the deepening; and
- Piling, which will cause a direct loss of 0.006 ha of intertidal mudflat habitat.

4.3.4 It should be noted that the potential direct loss of intertidal habitat due to the capital dredge is located on the side slope of the proposed dredge pocket. The existing slope in this area is similar in gradient to the 1 in 4 dredge slope that is proposed for the IERRT project (see Chapter 2 and Chapter 3 of the ES (Application Document Reference numbers 8.2.2 and 8.2.3 respectively)). Furthermore, the amount of material that needs to be dredged within the berth pocket in this location is limited. It is, therefore, anticipated that the existing slope will remain stable and will not require further dredging to maintain navigational safety, resulting in no direct habitat loss from the capital dredge. Nevertheless, this assessment accounts for a potential loss of 0.006 ha as a worst case scenario and on a precautionary basis.

4.3.5 Dredging will also cause a direct change in intertidal habitat. This is assessed in more detail in Section 4.4 in the sub-sections entitled '*The potential effects of changes to qualifying habitats as result of the removal of seabed material during capital dredging'* (Paragraphs 4.4.11 to 4.4.16) and *'The potential effects of changes to qualifying habitats as a result of sediment deposition during capital dredging'* (Paragraphs 4.4.30 to 4.4.34).

4.3.6 The project-specific intertidal benthic survey recorded sandy mud habitat within and near to the proposed dredge footprint characterised by nematodes, the oligochaetes *Tubificoides benedii*, the mud shrimp *Corophium volutator*, the gastropod mudsnail *Peringia ulvae*, tellins including Baltic tellin *Limecola balthica* and the polychaetes *Hediste diversicolor* and *Pygospio elegans*. All the species recorded from the samples in this area were considered commonly occurring in the region and considered typical of the community recorded on mudflats in the nearby area (Appendix 9.1 of the ES; ABPmer, 2009; IECS, 2010; Able UK Limited, 2021). Species such as *Corophium volutator, Peringia ulvae, Limecola balthica* and polychaetes are prey items for a range of coastal waterbirds. The potential effects of the loss of intertidal habitat and prey resources for waterbirds is discussed in greater detail in Section in the sub-section titled *'The potential effects of the direct loss of intertidal habitat on qualifying species'* (Paragraphs 4.3.12 to 4.3.19).

4.3.7 The combined worst case intertidal habitat loss as a result of the capital dredge and piling represents approximately 0.000033 % the Humber Estuary SAC and approximately 0.000128 % of the 'mudflats and sandflats not covered by seawater at low tide' feature of the Humber Estuary SAC[2].

4.3.8 This loss also represents 0.000032 % of the Humber Estuary SPA/Ramsar[3]. When considering this in the context of intertidal area, the area of loss represents approximately 0.000135 % of intertidal foreshore habitats[4] and approximately 0.000188 % of mudflat[5] within the

1.1.2 [2] Based on the extents given in the Standard Data Form on the JNCC website (JNCC, 2022a)

1.1.3 [3] Based on the extents given in the Standard Data Form on the JNCC website (JNCC, 2022b)

1.1.4 [4] Based on using the 'Intertidal Substrate Foreshore (England and Scotland)' data layer

SPA/Ramsar.

4.3.9 Furthermore, the potential intertidal loss resulting from the capital dredging (noting that this is considered a worst case as explained above) would consist of a very narrow strip on the lower shore around the sublittoral fringe (see Figure 2.1 in Volume 2 of the ES (Application Document Reference number 8.3.2)). This potential loss is considered to be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g., due to sea level rise, inter-annual tidal cycles (e.g., the 18.6 year lunar nodal cycle), seasonal patterns in accretion and erosion or following storm events). For context, natural variation in tidal water elevations between 2018 and 2022 equated to 37 cm (between measured lowest astronomical tide elevations). Over a 900 m stretch of foreshore between the Eastern Jetty and the IOT for which bathymetric data is available, this equates to a natural variation in intertidal habitat area (between these years) of approximately
0.3 ha. The loss of habitat due to piling will also be highly localised (i.e., limited to the extent of the piled infrastructure). These *de minimis* (i.e., negligible and ecologically inconsequential) changes in mudflat extent are of a magnitude which will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary.

Mitigation

4.3.10 Mitigation is not relevant to and as a consequence, not required for this impact pathway.

Assessment of the potential for an AEOI

4.3.11 Based on the evidence provided above and the rationale provided in Table 7, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

layer (https://magic.defra.gov.uk/Metadata_for_MAGIC/SPIRE%20intertidal%20substrate%20fores hore.pdf

1.1.5 [5] Based on using mudflat data layer of the Priority Habitat Inventory (England) (https://data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england).

Associated British Ports

Table 7. The potential for an AEOI due to the direct loss of qualifying intertidal habitat

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1140: Mudflats and sandflats not covered by seawater at low tide	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	The potential effects have been considered in the context of the site's conservation objectives. As discussed above, the loss in intertidal habitat is *de minimis* (i.e., negligible and ecologically inconsequential) in extent and considered negligible in the context of the amount of similar habitat in the region (and as a proportion of the SAC/Ramsar site). On this basis any change to the '*extent and distribution of qualifying natural habitats*' conservation objective is considered inconsequential. A loss on this scale is also considered to be insignificant in terms of the '*the structure and function (including typical species) of qualifying natural habitats'* conservation objective.
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

The potential effects of the direct loss of supporting intertidal habitat on qualifying species

General scientific context

4.3.12 The quality of intertidal habitat as a feeding resource for waterbirds can be highly variable both spatially and temporally (Mander *et al*., 2013). Higher energetic costs for waterbirds could occur in areas where habitat change has caused a reduction in prey distribution and density. This may affect local populations in the long-term through impacts on individual fitness (survival, body condition and fecundity) (Bowgen, 2016).

4.3.13 Habitat loss can also result in increased densities of birds already using a site, increasing the potential for interference competition (Santos *et al*., 2005; Bowgen, 2016). Loss of intertidal habitat could displace birds and cause them to redistribute either locally or to neighbouring sites (Gunnarsson *et al*., 2005). This in turn might affect the birds at those sites through competition and density-dependent mortality. Redshank displaced following the construction of an amenity barrage at Cardiff Bay (South Wales), for example, experienced a poorer body condition and had a lower survival rate after they moved (Burton *et al*., 2006). Lambeck (1991) found that Oystercatchers displaced following large-scale habitat loss in the Delta region of The Netherlands experienced significantly higher mortality than those originally ringed elsewhere in the Delta, it is presumed as a result of the increased densities in recipient areas.

Summary of effects

4.3.14 The development will result in the direct loss of 0.012 ha of intertidal habitat due to the following:

- Capital dredging will potentially cause a direct loss of 0.006 ha of intertidal habitat which will be changed to subtidal habitat as a result of the deepening; and
- The piles will cause a direct loss of 0.006 ha of intertidal mudflat habitat.

4.3.15 As explained in paragraph 4.3.4 this represents a worst case scenario. This loss represents 0.000032 % of the Humber Estuary SPA/Ramsar[6]. When considering this in the context of intertidal area, the area of loss represents approximately 0.000135 % of intertidal foreshore habitats[7] and approximately 0.000188 % of mudflat[8] within the SPA.

1.1.6 [6] Based on the extents given in the Standard Data Form on the JNCC website (JNCC, 2022b)

1.1.7 [7] Based on using the 'Intertidal Substrate Foreshore (England and Scotland)' data layer (https://magic.defra.gov.uk/Metadata_for_MAGIC/SPIRE%20intertidal%20substrate%20fore s hore.pdf

1.1.8 [8] Based on using mudflat data layer of the Priority Habitat Inventory (England) (https://data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england).

4.3.16 The predicted intertidal losses relating to the capital dredging consist of very narrow strips on the lower shore around the sublittoral fringe. These losses

are considered to be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g., due to seasonal patterns in accretion and erosion or following storm events). The loss of habitat due to piling will also be highly localised. These *de minimis* (i.e., negligible and ecologically inconsequential) changes in mudflat extent are also of a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary.

4.3.17 In terms of functional value, the foreshore in the Port of Immingham area is used by a range of species for feeding including Black-tailed Godwit, Dunlin, Redshank, Shelduck, Oystercatcher, Curlew, Teal and Mallard (see Section 1.4 of Appendix A of this HRA). Many of these birds feed clustered around the tideline and will follow the tideline as it pushes up and down the shore on flood and ebb tides respectively[9]. These species could, therefore, potentially be feeding in the predicted areas of habitat loss, albeit minimal habitat loss as explained above, during low water periods. In addition, however, the predicted direct areas of intertidal habitat loss are themselves only exposed during low water spring tidal phases (remaining underwater during neap tidal phases) under current (pre-dredge) conditions. As a consequence, these very small areas remain largely inundated with water and are only uncovered for a very short duration.

4.3.18 To put this into context, consideration has been given to the proportion of time that the areas of loss are available to feed over the course of a year. Based on tide gauge data at Immingham in 2020, the areas of direct loss were completely submerged for over 99 % of the time. These areas of direct loss, therefore, currently provide almost no feeding opportunities for coastal waterbirds. Furthermore, the spatial extent of loss represents a barely measurable and inconsequential reduction in available habitat for these mobile species even at a local scale.

4.3.19 On this basis, it can be concluded that any change to prey resources for birds feeding in the local area will be negligible and individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) will not be affected.

Mitigation

1.1.9 [9] Wading birds can often concentrate their foraging efforts in newly exposed or covered areas during ebbing and rising tides (when sediments were wet or still covered by a thin layer of water). It is thought that that moving tidal waterline briefly creates particular suitable conditions for waders (invertebrates move deeper in the substate or become less as the tide falls and the substrate dries (as well as showing less surface cues) (Granadeiro *et al*., 2006; Pienkowski, 1983).

4.3.20 Mitigation is not relevant to and is as a consequence not required for this impact pathway.

Assessment of the potential for an AEOI

4.3.21 Based on the evidence provided above and the rationale provided in **Table 8**, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 8. The potential for an AEOI due to the direct loss of supporting intertidal habitat on qualifying species

Site	Features	Potential AEOI	Justification
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	The potential effects have been considered in the context of the site's conservation objectives. The predicted intertidal habitat loss will not cause changes to '*the populations of each of the qualifying features'* conservation objective. This is because the scale of loss is not considered to be of a magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected. The '*distribution of the qualifying features within the site'* conservation objective will not be affected as the predicted loss is *de minimis* (i.e., negligible and ecologically inconsequential) in extent and of a scale that would not cause changes in local distribution. The footprint of predicted habitat loss under existing conditions already provides very limited feeding opportunities due to the low elevation position on the shore and *de minimis* extent (i.e., negligible and ecologically inconsequential). This loss is considered negligible in the context of available feeding habitat even at a local scale along the eastern frontage of the port. The effects of the habitat loss will also be highly limited in terms of the overall wider functionality of the local mudflats for feeding birds. On this basis, any change to the '*structure and*
	A143: Red Knot (Non-breeding) *Calidris canutus*		
	A149: Dunlin *Calidris alpina alpina* (Non-breeding)		
	A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)		
	A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*		
	A162: Common Redshank *Tringa totanus* (Non-breeding)		
	Waterbird assemblage		
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)		
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		
			function of the habitats of the qualifying features'

			conservation objective is considered inconsequential. The loss in intertidal habitat is considered negligible in the context of the amount of similar habitat in the region (and as a proportion of the SPA/Ramsar). On this basis any change to the '*extent and distribution of the habitats of the qualifying features'* conservation objectives is considered inconsequential.

The potential effects of the direct loss of qualifying subtidal habitat

General scientific context

4.3.22 The impact of direct habitat loss can involve building over marine habitats (such as reclamation) or the permanent physical removal of substratum and associated organisms from the seabed.

4.3.23 Subtidal habitats are sensitive to physical loss at locations where new structures are introduced onto the seabed (i.e., within the development 'footprint' of these structures). The significance of such losses will vary on a site-by-site basis in response to differences in the extent and duration of the losses as well as the relative value of the habitats in question. The value of the habitats is, in turn, reflected by the species that are present and level of statutory and non-statutory protection afforded to them. As any effects are very much dependent upon site specific considerations, a generic scientific review is not appropriate in this case and the focus of the assessment is based on site-specific considerations.

Summary of effects

4.3.24 Piling in the subtidal area will result in the direct loss of 0.027 ha of seabed habitat. This habitat represents approximately 0.000074 % of the Humber Estuary SAC. However, a small amount of subtidal habitat will potentially be gained following the dredging of the existing intertidal (described in Paragraph 4.3.14).

4.3.25 The project-specific subtidal survey (see Section 1.3 of Appendix A of this HRA and Appendix 9.1 of the ES (Application Document Reference number 8.4.9 (a))) recorded a benthic community characterised by nematodes, the mudshrimp *Corophium volutator*, polychaetes (such as *Streblospio shrubsolii Polydora cornuta Tharyx* spp. and *Nephtys* spp), oligochaetes *Tubificoides* spp. and barnacle *Amphibalanus improvise*s. These characterising species dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at most of the sample stations. The loss in subtidal habitat as a result of the piles is considered negligible in the context of extent of the overall amount of similar marine habitats found locally in the Humber Estuary. All the species recorded were considered commonly occurring and not protected. Furthermore, faunal assemblage recorded are also considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary (ABPmer, 2009; IECS, 2010; Able UK Limited, 2021).

4.3.26 The loss of subtidal habitats due to piling will be highly localised. The *de minimis* (i.e., negligible and ecologically inconsequential) changes in subtidal habitat extent is of a magnitude which will not change the overall structure or functioning of the subtidal habitats within the Port of Immingham area or more widely in the Humber Estuary.

Mitigation

4.3.27 Mitigation is not relevant to and is as a consequence not required for this impact pathway.

Assessment of the potential for an AEOI

4.3.28 Based on the evidence provided above and the rationale provided in **Table 9**, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 9. The potential for an AEOI due to the direct loss of qualifying subtidal habitat

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	The potential effects have been considered in the context of the site's conservation objectives. As discussed above, the loss in subtidal habitat as a result of the piles is considered to be negligible in the context of the amount of similar habitat in the region and as a proportion of the SAC/Ramsar. As a consequence, this loss is inconsequential in terms of '*the extent and distribution of qualifying natural habitats'* conservation objective. A loss on this scale is also considered to be insignificant in terms of the '*the structure and function (including typical species) of qualifying natural habitats'* conservation objective.
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

The potential effects due to changes to waterbird foraging and roosting habitat as a result of the presence of marine infrastructure during operation on qualifying species

4.3.29 For clarity it should be noted that this pathway relates to potential changes to foraging and roosting habitat as a result of the physical presence of marine infrastructure. The potential effects of the direct loss of intertidal habitat on qualifying species is assessed in Paragraphs 4.3.12 to 4.3.12.

4.3.30 It should also be noted that this pathway specifically relates to the structures themselves rather than human activity on the infrastructure which is assessed in Section 4.10. However, it is acknowledged that such effects are likely to some extent to be interrelated.

General scientific context

4.3.31 Any port and harbour development has the potential to cause reduced functionality to waterbird feeding and roosting habitat due to port infrastructure.

4.3.32 Waterbirds often show a preference for foraging in open spaces with clear sightlines when feeding so that scanning distances can be maximised. On this basis, certain species of coastal waterbirds might show a reluctance to approach tall anthropogenic structures or those that create enclosed spaces. One of the main reasons for not approaching a structure is thought to be the same as waders avoiding feeding near high banks, tall hedges/trees and in enclosed spaces (such as small fields surrounded by trees) (Milsom *et al.,* 1998), i.e., they are trying to avoid any sudden attack by a predator that may be hiding in or behind the structure. Just as raptors often exploit tall structures to aid prey detection, species that may be targeted by raptors would naturally avoid tall structures to minimise predation risk. Many waders and waterfowl may avoid areas in which their sightlines are reduced, even though in certain circumstances this may reduce the quantity of high-quality foraging habitat available to them or access to important roosting sites. However, it is often difficult to separate the direct impact of the structure from other factors associated with development, such as human activity causing potential disturbance stimuli (see Section 4.10) (Walters *et al*., 2014).

4.3.33 The addition of anthropogenic structures to coastal waters can also result in a new habitat for colonising epibiota (such as mussels, periwinkles, limpets and barnacles) which are considered prey items for certain wading birds such as Turnstone, Oystercatcher and Purple Sandpiper. Certain species (such as Turnstone) are also regularly recorded feeding on epifaunal species which have colonised anthropogenic structures in the intertidal such as jetties and coastal defences (Naylor *et al*., 2017).

4.3.34 Coastal waterbirds also regularly roost on a variety of artificial structures in harbours and ports including pontoons, platforms, sea walls and dolphins (mooring structures) (Jackson *et al*., 2021; Jackson, 2017; Cutts, 2021). Species commonly recorded in the UK using such structures include gulls,

Cormorants and waders such as Dunlin, Turnstone and Oystercatchers.

Factors that can influence the level of use by waterbirds of artificial roosting structures include the proximity to nearby feeding grounds, the level of human disturbance and perceived predator risk.

Summary of effects

4.3.35 Marine infrastructure associated with the proposed development (raised jetty structure, linkspan etc.) will not prevent any direct access to established roosting habitat used by coastal waterbirds in the area. This includes the outfall pipe which is used by roosting Cormorants and gulls and the derelict concrete structures present on the mudflat used by Turnstone and gulls (Figure A.7 in Appendix A of this HRA). Turnstone is the only SPA species screened into Stage 2 (Appropriate Assessment) which has been recorded using these structures. Turnstone are considered to be very tolerant to potential disturbance and would be expected to continue using these structures during construction. In addition, as stated in Section 1.4 of Appendix A of this HRA, Turnstone are also recorded using other structures in the area such as beams on jetty structures and the bottom of the seawall. Such structures are used for both feeding and roosting by Turnstone. There is, therefore, considered to be a wide variety of alternative structures available in the nearby area for this species to utilise.

4.3.36 The approach jetty will be an open piled structure with large gaps between each of the piles (approximately 12 m) and between the jetty deck and the foreshore seabed (i.e., the mudflat surface) (3 m to 8 m). This will minimise the enclosed feel and allow birds feeding near the structure to maintain sightlines. It should be noted that observations from the ornithology surveys in the area suggest that birds regularly feed in very close proximity to both the Eastern Jetty (approximately 250 m from the proposed development) and the Immingham Oil Terminal approach jetty (approximately 50 m from the proposed development) - which are both similar open piled structures - with species such as Redshank, Dunlin, Turnstone regularly recorded underneath jetties and Curlew, Shelduck and Black-tailed Godwit approaching them relatively closely (<10-20 m). On this basis, birds would be expected to show similar highly localised responses to structures associated with the proposed development with responses ranging from no avoidance for some species to potentially some local avoidance (i.e., directly underneath or in close proximity) for other species. This is unlikely, however, to change the overall distribution of waterbirds more widely along the foreshore fronting Immingham. In addition, for all species, the proximity that birds feed does not appear to be influenced by seasonality (with birds recorded feeding within <10 to 20 m of structures in comparable densities to distances further away throughout all winter periods).

4.3.37 Further detailed analysis to better understand the behaviour of birds feeding around structures and the potential displacement effects associated with the creation of enclosed areas (due to jetties be constructed near to each other) is provided below.

4.3.38 The analysis has focused on the area of mudflat in Sector B between the Eastern Jetty and the adjoining pipeline jetty which is completely surrounded by port infrastructure. It is also situated in a busy area of the port being close to lock entrance and Marine Control Centre. This area is shown in Figure 3.

This area is considered important feeding habitat for a wide variety of waterbirds (as shown in Figure A.7 of Appendix A of this HRA) and can support similar numbers to that which occurs closer to the proposed IEERT development.

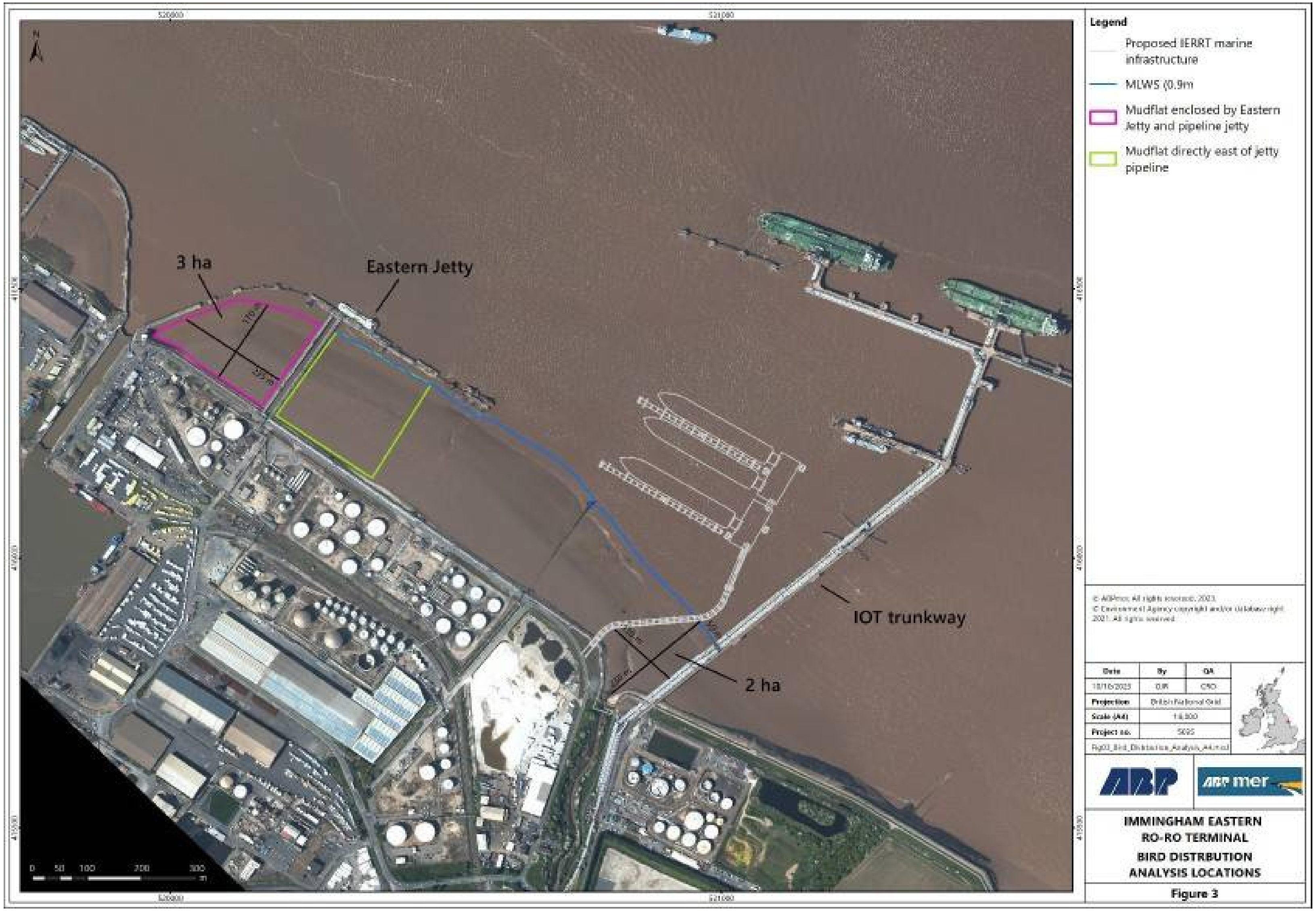


Figure 3. Bird distribution analysis locations

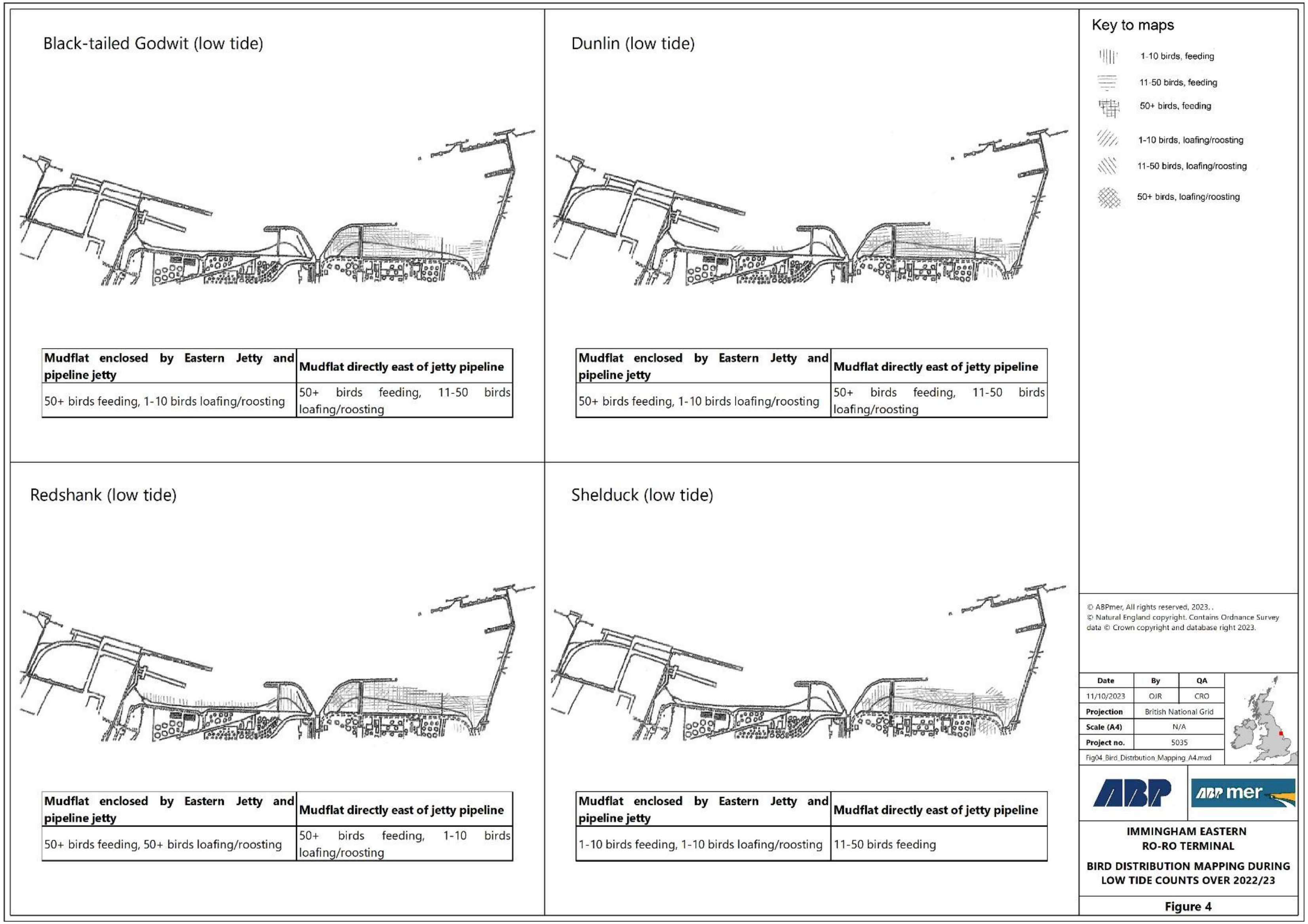


Figure 4. Bird distribution mapping during low tide counts over 2022/23

4.3.39 Summary species distribution maps at low tide for the 2022/2023 survey season for Black-tailed Godwit, Dunlin, Redshank and Shelduck are provided below in Figure 4. Bird densities within the area enclosed by the Eastern Jetty and pipeline jetty have been compared with bird densities in the area of mudflat directly to the east of the pipeline jetty – the results are also summarised in Figure 4.

4.3.40 The width of mudflat in this area is approximately 200 m, narrowing further down the foreshore. This is a similar to the situation that would arise once the IERRT infrastructure is in operation, as there would be an enclosed area of mudflat between the IERRT approach jetty and Immingham Oil Terminal (IOT) trunkway. Therefore, the Eastern Jetty area and area of foreshore around the IERRT approach jetty/IOT are considered broadly analogous in terms of bird utilisation and infrastructure.

4.3.41 The results show that birds use the area of mudflat enclosed by the Eastern Jetty in similar densities to the open area of mudflat to the east of the jetty pipeline connecting the Eastern Jetty. Furthermore, the same local waterbird populations use the area around the Eastern Jetty as the area of foreshore around the proposed IERRT development and so are already considered habituated to feeding in areas of mudflat enclosed by infrastructure. It is also worth noting that the distance between piles and the height of IERRT jetty will be greater than the pipeline jetty connecting the Eastern Jetty. Therefore, the mudflat enclosed by the IERRT jetty will be less restricted, minimising the enclosed feel and allowing birds feeding near the structure to maintain sightlines (as noted above). Furthermore, changes to the creek on the intertidal mudflat (the Habrough Marsh Drain outfall) due to changes in physical processes have been assessed in Chapter 7 of the ES [APP-043] during both construction and operation (see paragraphs 7.8.21 7.8.44, 7.8.63 and 7.8.80). This assessment concludes that the creek will not be significantly impacted by the development.

4.3.42 Based on the above, birds would be expected to feed below or very close to the proposed development's approach jetty and indeed other infrastructure on the foreshore - none of which will prevent direct access to established roosting habitat. As a consequence, any avoidance of marine infrastructure is expected to be limited (and highly localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area.

Mitigation

4.3.43 As a consequence, mitigation is not relevant to nor is it required for this impact pathway.

Assessment of the potential for an AEOI

4.3.44 Based on the evidence provided above and the rationale provided in **Table 10**, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 10. The potential for an AEOI on qualifying species due to changes to waterbird foraging and roosting habitat as a result of the presence of marine infrastructure

Site	Features	Potential AEOI	Justification
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, these species would be expected to feed close to the approach jetty and other infrastructure on the foreshore (<10-20 m). As a consequence, direct access to established roosting habitat will be neither impeded nor prevented. It follows, therefore, that any avoidance of marine infrastructure is expected to be limited (and localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. As a consequence, any change to '*the distribution of the qualifying features within the site'* and '*structure and function of the habitats of the qualifying features*' conservation objectives are considered inconsequential. The predicted effects are considered unlikely to cause any changes to '*the population of each of the qualifying features*' conservation objective because the scale of change is not of a magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected.
	A149: Dunlin *Calidris alpina alpina* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding)	In the context of the site's conservation objectives, there is considered to be no potential	Based on the information provided above, these species would be expected to feed under or very close to the approach jetty and other infrastructure on the foreshore with no direct access to established roosting habitat prevented. Therefore, any avoidance of marine infrastructure is expected to be limited (and highly localised) and is unlikely to change
		AEOI on the	the overall distribution of waterbird assemblages more widely

		qualifying interest features.	on the foreshore in the local area. As a consequence, any change to '*the distribution of the qualifying features within the site'* and '*structure and function of the habitats of the qualifying features*' conservation objectives are considered inconsequential. The predicted effects are considered unlikely to cause any changes to '*the population of each of the qualifying features'* conservation objective because the scale of change is not of a magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected.
	Waterbird assemblage	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, assemblage species would be expected to feed under or close to the approach jetty and other infrastructure on the foreshore (<10-20 m) with no direct access to established roosting habitat prevented. Therefore, any avoidance of marine infrastructure is expected to be limited (and localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. As a consequence, any change to '*the distribution of the qualifying features within the site'* and '*structure and function of the habitats of the qualifying features*' conservation objectives are considered inconsequential. The predicted effects are considered unlikely to cause any changes to '*the population of each of the qualifying features'* conservation objective because the scale of change is not of a
			magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the

			Humber Estuary) are affected.
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, coastal waterbird features would be expected to feed under or close to the approach jetty and other infrastructure on the foreshore with no direct access to established roosting habitat prevented. Therefore, any avoidance of marine infrastructure is expected to be limited (and localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. As a consequence, any change to '*the distribution of the qualifying features within the site'* and '*structure and function of the habitats of the qualifying features*' conservation objectives are considered inconsequential. The predicted effects are considered unlikely to cause any changes to '*the population of each of the qualifying features*' conservation objective because the scale of change is not of a magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected.
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		

4.4 Physical damage through disturbance and/or smothering of habitat

The potential effects of changes to qualifying habitats as result of the removal of seabed material during capital dredging

4.4.1 For clarity it should be noted this pathway relates to potential changes to subtidal and intertidal habitat as a result of the physical removal of sediment material from the seabed. The potential effects of the direct loss of intertidal habitat are assessed in Paragraphs 4.3.1 to 4.3.11.

General scientific context

4.4.2 Dredging causes a direct physical removal of sediments, causing a modification to existing subtidal and intertidal habitats. This impacts benthic fauna associated with the dredged material including changes to abundance and distribution through damage, mortality or relocation to a disposal site, which may impact habitat quality.

4.4.3 The speed of recovery of the temporarily disturbed areas is dependent on the scale and timing of the disturbance, the life histories of species and the stability and diversity of the benthic community present. For example, while the opportunistic bivalve *Abra* spp. is vulnerable to physical disturbance (due to its fragile shell), the species is considered to have a high recoverability due to a high fecundity and larval dispersal rate (Marine Ecological Surveys Limited, 2008; De-Bastos, 2016a). Furthermore, a regularly disturbed sedimentary habitat with a low diversity benthic assemblage is likely to recover more quickly (i.e., return to its disturbed or 'environmentally-stressed' baseline condition) than a stable habitat with a pre-existing mature and diverse assemblage (Johnson *et al*., 2017).

4.4.4 In general, where studies have been undertaken to understand the effects of physical disturbance, they have shown recolonisation of deposited sediments by benthic species to be quite rapid. Sites are initially colonised by short lived, fast growing, opportunistic species ('r-selected') that are tolerant of high levels of disturbance; infaunal species dominate, particularly polychaetes worms. In time, these are succeeded by longer lived, slower growing species with a lower tolerance for disturbance (Newell *et al*., 1998; Tillin *et al*., 2011). Rates of recovery reported in reviewed literature suggest that a recovery time of six to 24 months is characteristic of many mobile sands and estuarine muds where frequent disturbance of the deposits precludes the establishment of long-lived communities (Tillin *et al*., 2019; De-Bastos, 2016b). In contrast, a community of sands and gravels may take two to three years to establish, depending on the proportion of sand and level of environmental disturbance by waves and currents (Newell *et al*., 1998; Bolam *et al*., 2003).

Summary of effects

4.4.5 It is estimated that a maximum of 190,000 m^3 of material in total will be removed as a result of the dredge over a maximum area estimated at being in the order of 70,000 m^2 (see Chapter 2, Section 2.3 of the ES (Application

Document Reference number 8.2.2)). It is expected that the majority or all of the material will be removed with a backhoe dredger, although some material may also be removed by trailer suction hopper dredger (TSHD).

4.4.6 The dredging will lead to changes to 6.8 ha of subtidal habitat as a direct result of the physical removal of subtidal sediment, as well as a change to 0.003 ha of intertidal which will become lower in elevation (but remain intertidal) due to the dredging of the slope of the dredge pocket. These habitat changes are assessed in this section.

Changes to subtidal habitats and species

4.4.7 Following the capital dredge, the dredge pockets will provide a similar habitat to that occurring under pre-dredge conditions as a result of sediment deposition. The baseline benthic surveys predominantly recorded surface sediment within and near to the dredge footprints with a high silt content (i.e., mud and sandy mud) (see Section 1.3 of Appendix A of this HRA and Appendix 9.1 of the ES (Application Document Reference number 8.2.9)). Modelling predicts that accretion of silt in the order of 10-15 cm would be expected to occur within a matter of months within the dredge footprint (as summarised in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). This would provide a suitable depth for colonisation[10] and return the surface layer of the seabed in the dredge footprint to its existing sediment character (i.e., fine sediment with a high silt content) which would then be expected to be recolonised by a similar assemblage to baseline conditions.

4.4.8 The speed of recolonisation is expected to occur over a relatively short period of time based on an understanding of the benthic community present in the area and the life history strategies of the species. The project-specific subtidal survey (see Section 1.3 of Appendix A of this HRA and Appendix 9.1 of the ES (Application Document Reference number 8.2.9)) recorded a generally impoverished benthic community which is likely to reflect the existing high levels of physical disturbance in the area due to strong tidal currents and sediment movement.

4.4.9 Samples were characterised by nematodes, the mudshrimp *Corophium volutator*, polychaetes (such as *Streblospio shrubsolii Polydora cornuta Tharyx* spp. and *Nephtys* spp.), oligochaetes *Tubificoides* spp. and barnacle Amphibalanus improvises. These characterising species dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at most of the sample stations. These species are typically fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than 1-2 years and for some species within a few months (De-Bastos and Hill, 2016; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). The benthic communities would, therefore, be expected to recolonise the dredge footprint relatively quickly. All the species recorded are commonly occurring and not protected. In addition,

4.4.7 [10] The majority of marine infauna is known to occur in the upper few centimetres of sediment (Kingston, 2001; Reuscher *et al.,* 2019).

the faunal assemblage recorded is considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary (ABPmer, 2009; IECS, 2010; Able UK Limited, 2021). Subtidal habitats in the area around the Port of Immingham are considered to be typically of limited ecological value.

4.4.10 It should be noted that this assessment specifically relates to the effects of the capital dredge. The frequency of dredging required as part of maintenance dredging, however, will mean that the seabed in the berths is likely to be disturbed on a regular basis once the proposed development is operational. Changes to benthic habitats and species as result of the removal of seabed material during maintenance dredging is assessed in Paragraphs 4.4.46 to 4.4.49.

Changes to intertidal habitats and species

4.4.11 A very small area of lower shore intertidal habitat at the top edge of the dredge slope will become steepened and slightly lower in the tidal frame as a result of the dredging (0.003 ha). The habitat will, however, remain intertidal mudflat.

4.4.12 As noted above (Paragraph 4.3.4), it is anticipated that the existing slope will remain stable and will not require further dredging to maintain navigational safety. This will, therefore, result in no direct change to intertidal habitat from the capital dredge. Nevertheless, this assessment accounts for a 0.003 ha change calculated on a worst case and precautionary basis.

4.4.13 The habitat change represents approximately 0.000055% of the Humber Estuary SAC and approximately 0.000213% of the 'mudflats and sandflats not covered by seawater at low tide' feature of the Humber Estuary SAC[11].

4.4.14 It should be noted that habitat change at this *de minimis* scale (i.e., negligible and ecologically inconsequential) is in the range of local natural variability and is expected to be immeasurable in real terms when taking account of the variation in water levels, wave climate and accuracy of the modelled bathymetry.

4.4.15 The speed of recolonisation following dredging is expected to occur over a relatively short period of time based on an understanding of the benthic community present in the area and the life history strategies of the species. The project-specific intertidal survey (see Section 1.3 of Appendix A of this HRA)and Appendix 9.1 of the ES (Application Document Reference number 8.4.9 (a))) recorded a benthic community characterised by nematodes, the oligochaetes *Tubificoides benedii* and *Enchytraeidae* spp., the mud shrimp *Corophium volutator*, the gastropod mudsnail *Peringia*

4.4.8 [11] Based on the extents given in the Standard Data Form on the JNCC website (JNCC, 2022a).

ulvae, Baltic tellin *Limecola balthica* and the polychaetes *Hediste diversicolor* and *Pygospio elegans*. All the species recorded within the site specific intertidal benthic survey in the local area are commonly occurring. These species are also typically fast growing and/or have rapid reproductive rates which allow

populations to fully re-establish in typically less than 1-2 years and for some species within a few months (Ashley and Budd, 2020; Tillin and Rayment, 2016). The benthic communities would, therefore, be expected to recolonise this area of intertidal change relatively rapidly.

4.4.16 While the lowering could result in some localised changes to infaunal composition, the key commonly recorded species recorded on the foreshore in the project-specific surveys are found at a range of shore heights from the sublittoral fringe to the upper shore and are considered relatively tolerant to changes in emergence which do not alter the extent of the intertidal (Ashley and Budd, 2020; Tillin and Rayment, 2016). Therefore, characterising species and ecological structure will be similar to baseline condition. On this basis, there is no reason to suggest that this lower elevation mudflat will be ecologically poorer or provide a lower functionality.

Mitigation

4.4.17 Mitigation is not relevant to this impact pathway and is, therefore, not required.

Assessment of the potential for an AEOI

4.4.18 Based on the evidence provided above and the rationale provided in Table 11, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 11. The potential for an AEOI due to changes to qualifying habitats as result of the removal of seabed material during capital dredging

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	The capital dredge will not cause a change in habitat type (i.e., it will remain subtidal habitat with a similar substrate type) and therefore '*the extent and distribution of qualifying natural habitats'* conservation objective will not change. Following dredging, the subtidal habitat would be expected to be recolonised relatively rapidly by a broadly similar invertebrate assemblage to baseline conditions. On this basis, the '*structure and function (including typical species) of qualifying natural habitats*' conservation objective would be expected not to change. Any '*Supporting processes on which qualifying natural habitats and habitats of qualifying species rely'* are also not expected to change as a direct result of sediment removal.
	H1140: Mudflats and sandflats not covered by seawater at low tide	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	As discussed above, the *de minimis* (i.e., negligible and ecologically inconsequential) predicted intertidal habitat change due to the lowering in elevation of intertidal around the dredge pocket is considered to be in the range of local natural variability and is predicted to be immeasurable in real terms when taking account of the variation in water levels, wave climate and accuracy of the modelled bathymetry. This highly localised change will not alter the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary. Furthermore, the recoverability of the intertidal community following this change is expected to be relatively rapid with key characterising species likely to be similar to baseline conditions (given that many of the species occur at a range of shore heights from the sublittoral fringe to the upper shore).
			Based on these considerations, there is no reason to suggest

			that this lower elevation mudflat will be ecologically poorer or provide a lower functionality in terms of prey resources for waterbirds. On this basis '*the structure and function (including typical species) of qualifying natural habitats'* conservation objective will not be affected. The change in intertidal habitat is considered negligible in the context of the amount of similar habitat in the region (and as a proportion of the SAC). On this basis any change to the '*extent and distribution of qualifying natural habitats*' conservation objective is considered inconsequential.
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	With respect to intertidal mud, and as discussed above, the *de minimis* (i.e., negligible and ecologically inconsequential) predicted intertidal habitat change due to the lowering in elevation of intertidal around the dredge pocket is considered to be in the range of local natural variability and is predicted to be immeasurable in real terms when taking account of the variation in water levels, wave climate and accuracy of the modelled bathymetry. This highly localised change will not alter the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary. Furthermore, the recoverability of the intertidal community following this change is expected to be relatively rapid with key characterising species likely to be similar to baseline conditions (given that many of the species occur at a range of shore heights from the sublittoral fringe to the upper shore). Based on these considerations, there is no reason to suggest that this lower elevation mudflat will be ecologically poorer or provide a lower functionality in terms of prey resources for waterbirds. On this basis '*the structure and*
			function (including typical species) of qualifying natural habitats' conservation objective will not be affected. The change in intertidal habitat is considered negligible in the context of the amount of similar habitat in the region (and as

			a proportion of the SAC). On this basis any change to the '*extent and distribution of qualifying natural habitats*' conservation objective is considered inconsequential. With respect to subtidal habitats, the capital dredge will not cause a change in habitat type (i.e., it will remain subtidal habitat with a similar substrate type) and therefore '*the extent and distribution of qualifying natural habitats'* conservation objective will not change. Following dredging, the subtidal habitat would be expected to be recolonised relatively rapidly by a broadly similar invertebrate assemblage to baseline conditions. On this basis, the '*structure and function (including typical species) of qualifying natural habitats*' conservation objective would be expected not to change. Any '*Supporting processes on which qualifying natural habitats and habitats of qualifying species rely'* are also not expected to change as a direct result of sediment removal.

The potential effects of changes to qualifying species as result of the removal of seabed material during capital dredging

General scientific context

4.4.19 The quality of intertidal habitat as a feeding resource for waterbirds can be highly variable both spatially and temporally (Mander *et al*., 2013). Higher energetic costs for waterbirds could occur in areas where habitat change has caused a reduction in prey distribution and density. This may affect local populations in the long-term through impacts on individual fitness (survival, body condition and fecundity) (Bowgen, 2016).

4.4.20 Habitat change can also result in increased densities of birds already using a site, increasing the potential for interference competition (Santos *et al*., 2005; Bowgen, 2016). Severe degradation of intertidal habitat could displace birds and cause them to redistribute either locally or to neighbouring sites (Gunnarsson *et al*., 2005). This in turn might affect the birds at those sites through competition and density-dependent mortality. Redshank displaced following the construction of an amenity barrage at Cardiff Bay (South Wales), for example, experienced a poorer body condition and had a lower survival rate after they moved (Burton *et al*., 2006). Lambeck (1991) found that Oystercatchers displaced following large-scale habitat loss in the Delta region of The Netherlands experienced significantly higher mortality than those originally ringed elsewhere in the Delta, presumably as a result of the increased densities in recipient areas.

Summary of effects

4.4.21 It is anticipated that the proposed development will result in a very small change in an area of lower shore intertidal habitat at the top edge of the dredge slope which will become steepened and slightly lower in the tidal frame as a result of the dredging (0.003 ha) (Paragraph 4.4.12).

4.4.22 The habitat change represents approximately 0.000008 % of the Humber Estuary SPA/Ramsar. When considering this in the context of intertidal, the area of change represents approximately 0.000034 % of intertidal foreshore habitats[12] and approximately 0.000047 % of mudflat[13] within the SPA.

4.4.23 Habitat change at this *de minimis* scale (i.e., negligible and ecologically inconsequential) is in the range of local natural variability and is expected to be immeasurable in real terms when taking account of the variation in water levels, wave climate and accuracy of the modelled bathymetry. Any changes

4.4.9 [12] Based on using the 'Intertidal Substrate Foreshore (England and Scotland)' data layer (https://magic.defra.gov.uk/Metadata_for_MAGIC/SPIRE%20intertidal%20substrate%20fores hore.pdf

4.4.10 [13] Based on using mudflat data layer of the Priority Habitat Inventory (England) (https://data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england).

in infaunal composition (including prey items) due to the lowering in elevation in this area will be highly localised with key characterising species likely to be similar[14]. Furthermore, in reality this *de minimis* area (i.e., negligible and ecologically inconsequential) represents an inconsequential change for these mobile species even at a local scale. The location of this change on the lower shore (near the sublittoral fringe) means that any change to the area exposed at each state of the tide for birds to feed or any reduction in the potential time available for feeding within this area will be negligible[15]. On this basis the overall functioning of the mudflat in the area and the prey resources available to coastal waterbirds will not be affected and will not cause a change in bird distribution.

Mitigation

4.4.24 Mitigation is not relevant to this impact pathway nor is it required.

Assessment of the potential for an AEOI

4.4.25 Based on the evidence provided above and the rationale provided in Table 12, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

[14] The key commonly recorded species recorded on the foreshore in the project-specific intertidal benthic surveys included waterbird prey items such as the bivalve *Limecola balthica*, mudshrimp *Corophium volutator* and ragworm *Hediste diversicolor*. These are found at a range of shore heights from the sublittoral fringe to the upper shore and are considered relatively tolerant to changes in emergence which do not alter the extent of the intertidal (Ashley and Budd, 2020; Tillin and Rayment, 2016).

[15] Based on tide gauge data at Immingham in 2020, the area of change was completely submerged during the 12-month period for 99 % of the time.

Associated British Ports

Table 12. The potential for an AEOI due to changes to qualifying species as result of the removal of seabed material during capital dredging

Site	Features	Potential AEOI	Justification
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	The potential effects have been considered in the context of the site's conservation objectives. The predicted *de minimis* (i.e., negligible and ecologically inconsequential) intertidal habitat change will not cause changes to '*the populations of each of the qualifying features'* conservation objective. This is because the scale of change is not considered to be of a magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected. The '*distribution of the qualifying features within the site*' conservation objective will not be affected as any change in distribution would be negligible. The effects of the habitat change will also be negligible in terms of the functionality of the local mudflats for feeding birds and in the context of the amount of similar habitat in the region (and as a proportion of the SPA). On this basis, any change to the '*structure and function of the habitats of the qualifying features'* and *'extent and distribution of the habitats of the qualifying features'* conservation objectives are considered inconsequential.
	A143: Red Knot (Non-breeding) *Calidris canutus*		
	A149: Dunlin *Calidris alpina alpina* (Non-breeding)		
	A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)		
	A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*		
	A162: Common Redshank *Tringa totanus* (Non-breeding)		
	Waterbird assemblage		
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)		
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		

The potential effects of changes to qualifying habitats as a result of sediment deposition during capital dredging

General scientific context

4.4.26 Sediments suspended and dispersed during the marine works, dredging and disposal have the potential to resettle over the seabed. This potential blanketing or smothering of benthic species may cause stress, reduced rates of growth or reproduction and in the worst cases the effects may be fatal (Pineda *et al.,* 2017; Bolam *et al*., 2016).

4.4.27 Habitats within estuarine and coastal environments have highly fluctuating conditions including the resuspension and deposition of sediments on a daily basis (through tidal action), lunar cycles (due to the differing influences of spring and neap tides) and on a seasonal basis (due to storm activity and conditions of extreme waves). Subtidal and intertidal habitats are, therefore, characterised by such perturbations and the biological communities of these environments are well adapted to survival under fluctuating conditions.

4.4.28 If the amount of sediment deposited is too great to allow species to survive burial, then recovery occurs via re-colonisation and/or migration to the new sediment surface (Bolam *et al.,* 2006a; 2006b). In general, the rate of recovery is dependent upon just how stable and diverse the assemblage was in the first place. A regularly disturbed sedimentary habitat with a low diversity benthic assemblage is likely to recover more quickly (i.e., return to its disturbed or 'environmentally-stressed' baseline condition) than a stable habitat with a pre-existing mature and diverse assemblage. A study by Bolam *et al.* (2004), for instance, concluded that the relatively rapid recovery observed at a location on the Crouch Estuary was due to the opportunistic nature of the invertebrate assemblages and the dispersive behaviour of the dominant species that were present before the material was deposited. Furthermore, in cases where the quantity and type of sediment deposited does not differ greatly from natural sedimentation, e.g., of similar particle size, the effects are likely to be relatively small as many of the species are capable of migrating up through the deposited sediments (Budd, 2004).

4.4.29 The Marine Evidence based Sensitivity Assessment (MarESA) approach (Tyler-Walters *et al.,* 2018) found that benthic communities in both sandy and muddy estuarine sediments are typically considered to be tolerant to the deposition of up to 5 cm of fine material in a single event with burrowing species considered able to relocate to preferred depths through this level of deposition. Deposition of greater depths of fine sediment could result in some mortality although evidence suggests that some characterising species are likely to be able to reposition. Bivalve and polychaete species have been reported to migrate through depositions of sediment greater than 30 cm (De-Bastos, 2016a; De-Bastos, 2016b; Ashley, 2016; Tillin, 2016). A previous review by the University of Hull also concluded that benthic invertebrates in sediments are able to adapt and readjust if sediment laid is placed as thin veneers over several days although they can also tolerate moderate amounts (20 cm) of material being deposited at one time (IECS, 2001).

Summary of effects

4.4.30 Sediment changes that are predicted to occur as a result of the capital dredge are considered in more detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). In summary, however, it has been concluded that maximum siltation as a result of the capital dredge within about 100 m up and down the estuary from the edge of the dredge pocket is predicted to be 7 to 8 mm reducing to around 3 mm within approximately 500 m from the dredged pocket. Beyond these areas, deposition levels are predicted to be less than 1 mm. Furthermore, once on the bed, the deposited material will return to the background system i.e., it will be put back into suspension on subsequent peak flood or ebb tides to be further dispersed.

4.4.31 The project-specific intertidal survey (see Section 1.3 of Appendix A of this HRA)and Appendix 9.1 to the ES (Application Document Reference number 8.4.9 (a))) recorded a community characterised by nematodes, the oligochaetes *Tubificoides benedii* and *Enchytraeidae* spp., the mud shrimp *Corophium volutator*, the gastropod mudsnail *Peringia ulvae*, Baltic tellin *Limecola balthica* and the polychaetes *Hediste diversicolor* and *Pygospio elegans*. The subtidal survey generally recorded an impoverished benthic community (which is likely to reflect the existing high levels of physical disturbance in the area due to strong near bed tidal currents, sediment transport and ongoing maintenance dredging) characterised by nematodes, the mudshrimp *Corophium volutator,* polychaetes (such as *Streblospio shrubsolii Polydora cornuta Tharyx spp. and Nephtys spp.*), oligochaetes *Tubificoides* spp. and barnacle *Amphibalanus improvises*. These characterising species dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at most of the sample stations. All the species recorded were considered commonly occurring and not protected.

4.4.32 The benthic species occurring within and near to the dredge area typically consist of burrowing infauna (such as polychaetes, oligochaetes or bivalves), which are considered tolerant to some sediment deposition. Based on evidence provided in relevant Marine Evidence based Sensitivity Assessment (MarESA) assessments, the specific species characterising the subtidal and intertidal benthic samples collected as part of the project-specific intertidal survey (Section 1.3 of Appendix A of this HRA and Appendix 9.1 of the ES) are considered tolerant to deposition of at least 50 mm with many species considered capable of burrowing through much greater levels of sediment deposition. On this basis they are not considered to be sensitive to the the predicted millimetric changes in deposition.

4.4.33 In addition, the species recorded in the benthic invertebrate surveys are fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than 1-2 years and for some species within a few months (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016).

4.4.34 Deposition of sediment as a result of capital dredging will be highly localised and similar to background variability. Based on the evidence provided above the intertidal and subtidal habitats within the vicinity of the proposed works are considered to have low sensitivity to smothering. The subtidal and intertidal benthic communities present are well adapted to survival under fluctuating sediment conditions and have high recoverability rates.

Mitigation

4.4.35 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.4.36 Based on the evidence provided above and the rationale provided in Table 13, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 13. The potential for an AEOI due to changes to qualifying habitats as a result of sediment deposition during capital dredging

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, sediment deposition during capital dredging will be highly localised and similar to background variability away from the direct vicinity of the dredge. Benthic species in the area are considered commonly occurring and also well adapted to survival under fluctuating sediment conditions. These species are also considered to have high recoverability rates. On this basis sediment deposition is not expected to cause a change to the '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species'* conservation objective. Deposition will also, therefore, not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	H1140: Mudflats and sandflats not covered by seawater at low tide		
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

The potential effects of changes to qualifying habitats as a result of sediment deposition during capital dredge disposal

General scientific context

4.4.37 Scientific evidence on this impact pathway is provided in Paragraphs 4.4.26 to 4.4.29.

Summary of effects

4.4.38 The requirement for disposal of dredged material at sea associated with the proposed development would be fulfilled at licensed disposal sites HU056 and HU060 (see Chapters 2 and 3 of the ES (Application Document Reference numbers 8.2.2 and 9.2.3 respectively)).

4.4.39 An assessment of the sediment changes that are predicted to occur as a result of the capital dredging is presented in more detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). In summary, sedimentation resulting from the disposal plume is predicted to be generally in the range of 4 to 6 mm at distances of several hundred metres from the disposal sites to within approximately 4 km. Further up and down estuary, maximum sedimentation as a result of the disposal activities is generally predicted to be less than 1 to 2 mm.

4.4.40 The disposal sites are located in the mid channel and are subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. These disposal sites are also used regularly for the disposal of maintenance dredge arisings (for example millions of wet tonnes of dredge sediment are disposed of at HU060 annually) which will also cause some disturbance due to sediment deposition. This is reflected in a generally impoverished assemblage at both disposal sites.

4.4.41 The benthic species recorded within and adjacent to the disposal sites include mobile infauna (such as errant polychaetes e.g., *Arenicola* spp. and amphipods) which are able to burrow through sediment. They are, therefore, considered tolerant to some sediment deposition. In addition, characterising species typically have opportunistic life history strategies, with short life histories (typically two years or less), rapid maturation and the production of large numbers of small propagules which makes them capable of rapid recoverability should mortality as a result of smothering occur (Ashley and Budd, 2020; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016; Tyler-Walters and Garrard, 2019). On this basis, any effects are considered to be temporary and short term.

4.4.42 In summary, deposition in the wider area surrounding the disposal ground is expected to be in the order of millimetres based on the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). Sedimentation of this scale is unlikely to result in significant smothering effects to most faunal species with recoverability expected to be high.

Mitigation

4.4.43 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.4.44 Based on the evidence provided above and the rationale provided in Table 14, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 14. The potential for an AEOI due to changes to qualifying habitats as a result of sediment deposition during capital dredge disposal

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1110: Sandbanks which are slightly covered by sea water all the time	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, sediment deposition during dredge disposal will be highly localised and similar to background variability away from the direct vicinity of disposal. Benthic species in the area are considered commonly occurring and also well adapted to survival under fluctuating sediment conditions with have high recoverability rates. On this basis sediment deposition is not expected to cause a change to the '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species'* conservation objective. Deposition will also, therefore, not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
Humber Estuary Ramsar site	H1130: Estuaries Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

The potential effects of changes to qualifying habitats as result of the removal of seabed material during maintenance dredging

General scientific context

4.4.45 Scientific evidence on this impact pathway is provided in Paragraphs 4.4.2 to 4.4.4.

Summary of effects

4.4.46 Maintenance dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site.

4.4.47 As summarised in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7), the level of maintenance dredging and disposal required at IERRT during the operational phase is anticipated to be required around three to four times a year (though this will be dependent on a range of factors - see Chapter 3 of the ES (Application Document Reference number 8.2.3)). Volumes of material from maintenance dredging (up to 120,000 m³ annually, to be dredged as required) of the IERRT berth pocket will be lower than those from the original capital dredge (190,000 m³).

4.4.48 Maintenance dredging will create similar seabed sedimentary conditions to that occurring following capital dredging due to sediment accretion. Accretion will return the surface layer of the seabed in the dredge footprint to its existing sediment character (i.e., fine sediment with a high silt content) which would then be expected to start to recolonise relatively rapidly by a similar assemblage to baseline conditions. Regular maintenance dredging (i.e., occurring every 3-4 months) is anticipated to be restricted to a relatively small proportion of the total maintenance dredge area (i.e. focused around the finger pier piles and adjacent areas of the berth pockets and pontoons). The remainder of the area will only be required to be dredged much more periodically (frequency in these areas will be dictated by operational requirements but dredging is anticipated to be required approximately every 1-2 years or more). On this basis, given the expected frequency of dredging, a comparable macrofaunal community to pre dredge conditions would be expected to occur over much of the maintenance dredging area between maintenance dredging campaigns[16]. Furthermore, the project-specific subtidal survey (see Section 1.3 of Appendix A of this HRA and Appendix 9.1

4.4.11 [16] The project-specific subtidal survey (Section 9.6 and Appendix 9.1 of the ES) recorded a benthic community characterised by nematodes, the mudshrimp *Corophium volutator,* polychaetes (such as *Streblospio shrubsolii Polydora cornuta Tharyx spp and Nephtys spp.*), oligochaetes *Tubificoides spp.* and barnacle *Amphibalanus improvises*. These characterising species dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at most of the sample stations. These species are typically fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than 1-2 years and for some species within a few months (De-Bastos and Hill, 2016; De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016).

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ES (Application Document Reference number 8.4.9 (a))) recorded a generally impoverished benthic community which is likely to reflect the existing high levels of physical disturbance in the area due to strong near bed tidal currents and sediment transport.

4.4.49 All the species recorded are considered commonly occurring and not protected with the faunal assemblage recorded being considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary (ABPmer, 2009; IECS, 2010; Able UK Limited, 2021). Subtidal habitats in the area around the Port of Immingham are also considered to be typically of limited ecological value.

4.4.50 Subtidal habitats subject to disturbance by maintenance dredging are of low ecological value and the benthic community has low sensitivity to seabed disturbance given the high recoverability rates.

Mitigation

4.4.51 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.4.52 Based on the evidence provided above and the rationale provided in Table 15, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 15. The potential for an AEOI due to changes to qualifying habitats as a result of as result of the removal of seabed material during maintenance dredging

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	The maintenance dredge will not cause a change in habitat type (i.e., it will remain subtidal habitat with a similar substrate type) and therefore '*the extent and distribution of qualifying natural habitats*' conservation objective will not change. Following dredging, the subtidal habitat would be expected to start being recolonised relatively rapidly with a comparable macrofaunal community to pre dredge conditions expected to occur over much of the maintenance dredging area between maintenance dredging campaigns. In addition, existing communities are generally impoverished and subject to regular seabed disturbance due to strong near bed currents and sediment transport. Furthermore, the seabed in this area is generally considered to be of low ecological value and the scale of the maintenance dredging as a result of the proposed development will not affect the overall functioning of subtidal habitats in the region. On this basis, any change to the '*structure and function (including typical species) of qualifying natural habitats'* conservation objective would be expected to be negligible. Any 'Supporting processes on which qualifying natural habitats and habitats of qualifying species rely' is not expected to change as a direct result of sediment removal.
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

The potential effects of changes to qualifying intertidal habitats as a result of the movement of Ro-Ro vessels during operation

General scientific context

4.4.53 Intertidal mudflats are subjected to successive periods of erosion and sedimentation which are controlled by sediment supply and hydrodynamic factors such as tides, fluvial discharge and wind (Dyer, 1994; O'Brien *et al*., 2000). This erosion and sedimentation can often be intensified by boat traffic (Verney *et al*., 2007).

4.4.54 A vessel travelling through water generates a combination of both short period waves (referred to as a wake, which propagate from the bow and stern sections of the vessel) and long-period waves, which result in surface 'drawdown.' The net effect of these waves, along with propeller-induced turbulence, is referred to as 'shipwash.' Studies have shown shipwash to generate large bottom shear stress values, enhancing the erosion of mudflats (Parchure *et al*., 2001; Verney *et al*., 2007). The severity of these erosion processes is dependent on several factors, including the speed of the vessel, the size of the vessel and the distance between the vessel and ecological features, since the energy in waves is a function of speed and displacement (UK Marine SACs Project, 2001).

4.4.55 Large, fast moving vessels can cause, what are referred to as, high energy events (HEEs), which can result in major erosion processes (erosion of more than 5 mm thickness) (Soulsby *et al*., 1993; Grant and Madsen, 1979; Verney *et al*., 2007). These events increase bottom shear which can result in bed elevation, changes in the sediment type of the seabed and, in severe cases, the loss of habitats and marine benthic communities (Parchure *et al*., 2001; Deloffre *et al*., 2005; Verney *et al*., 2007; Cundy *et al*., 2005). HEEs are observed most frequently under specific conditions such as low water height and amplitude waves (Verney *et al*., 2007). Low-amplitude erosion processes are often observed at very shallow water depths at the beginning of a flood tide and at the end of the ebb tide (Verney *et al*., 2007). The amplitudes and severity of these HEEs demonstrate the importance vessel traffic plays in mudflat dynamics and sediment fluxes.

4.4.56 Additionally, for vessels moving at finite depth in confined channels, depression wakes, or Bernoulli wakes, can become more important at influencing mudflat erosion than other perturbations (Soomere, 2006; Aage *et al*., 2003; Parnell *et al*., 2015). These wakes are often generated by displacement type vessels, such as trawlers and large sailing vessels, and their amplitude increases with an increase in the blocking coefficient (the ratio of the product of the ship width and draught to the cross-sectional area of the channel) and ship velocity. Depression wakes can impact mudflats through morphological changes (Erirf and Soomere, 2004; Zaggia *et al*., 2017).

Summary of effects

4.4.57 There is potential for physical disturbance and erosion to the foreshore nearby to the proposed development as a result of the movement of Ro-Ro vessels and other ships using the berths.

4.4.58 Foreshore erosion can cause a change in elevation and the sediment type of the seabed (e.g., if erosion removes accreted mudflat sediment and exposes coarser sediment) or result in the loss of a habitat in more severe cases (e.g., if the foreshore is completely eroded below a sea wall or other coastal defence).

4.4.59 Vessels approaching the floating pontoons will be approaching at very slow speeds in order to allow berthing. This will keep any shipwash to a minimum. In addition, this section of the Humber Estuary is already subject to high. Albeit slow moving, vessel traffic levels with vessels regularly berthing at jetties close to intertidal areas with no known significant erosional effects recorded.

4.4.60 On this basis the effect is considered to be negligible and there are no measurable effects on intertidal habitats from the movement of Ro-Ro vessels during operation.

Mitigation

4.4.61 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.4.62 Based on the evidence provided above and the rationale provided in Table 16, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 16. The potential for an AEOI due to changes to qualifying intertidal habitats as a result of the movement of Ro-Ro vessels during operation

<table>
<tr><th>Site</th><th>Features</th><th>Potential AEOI</th><th>Justification</th></tr>
<tr><td rowspan="2">Humber Estuary SAC</td><td>H1130: Estuaries</td><td rowspan="3">In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.</td><td rowspan="3">Based on the information provided above only negligible changes to intertidal mudflats in the vicinity of the berths are expected to occur as a result of physical disturbance due to vessels berthing during operation. On this basis, this pathway is not expected to cause a change to the 'the extent and distribution of qualifying natural habitats and habitats of the qualifying species' conservation objective. This pathway will also, therefore, not cause any changes to the 'the structure and function of qualifying natural habitats' or cause modifications to 'the supporting processes on which qualifying natural habitats rely' conservation objectives.</td></tr>
<tr><td>H1140: Mudflats and sandflats not covered by seawater at low tide</td></tr>
<tr><td>Humber Estuary Ramsar site</td><td>Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.</td></tr>
</table>

4.5 Physical loss or damage of habitat through alterations in physical processes

Indirect loss or change to qualifying habitats and species as a result of changes to hydrodynamic and sedimentary processes as a result of the marine works

General scientific context

4.5.1 Port or harbour structures (such as piles, breakwaters, coastal defences, jetties or quay walls) can cause changes to hydrodynamics (flow speeds, flow direction, waves, water levels) and seabed morphology (Prum and Iglesis, 2016; Mohanty *et al*., 2012; Kudale, 2010). Such changes have the potential to affect habitat quality and result in changes to the diversity, abundance and biomass of intertidal and subtidal species.

4.5.2 Dredging can cause direct habitat changes resulting from seabed removal and sediment deposition, as well as indirect habitat changes linked to hydrodynamic and sedimentary processes. Deepening or widening of channels during dredging can change seabed bathymetry and potentially alter flow patterns (speed/direction), wave exposure and cause tidal amplification (Van Dijk *et al*., 2019; Bradbury *et al*., 2003; Cox *et al.,* 2003).

4.5.3 These hydrodynamic changes can lead to changes in sediment transport and also patterns of emersion/immersion as well as erosion/accretion of marine sedimentary habitats such as mudflats and sandbanks (Van Dijk *et al.,* 2019). For example, Cox *et al.* (2003) found that saltmarsh retreat was related to an increase in the tidal prism brought about by dredging operations to maintain or increase the depth of the main navigable channel of the Westerschelde Estuary in the Netherlands. The consequent greater frequency with which the high tides reached the edge of the fringing marshes increased the risk of erosion.

4.5.4 Increased flow rates can also increase scouring and bed disturbance of subtidal habitats which can cause a reduction in diversity and an increase in more opportunistic species. In addition, reductions in water flow could increase siltation levels which could change the habitat type of a seabed and lead to sedimentation (Ashley and Budd, 2020). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges of physiological stresses caused by exposure and tidal elevation. This can lead to ‘zonation’ (Peterson, 1991). Bathymetric changes caused by dredging could, therefore, change the vertical distribution of marine habitats if post-dredging water depths were outside the range at which specific biotopes exist.

Summary of effects

4.5.5 An assessment of the hydrodynamic and sediment regime changes that are predicted to occur as a result of the marine works are considered in more detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). It should be noted that predicted changes are primarily as a result of the capital dredging with the effects due to the presence of the piles having a negligible, localised effect.

4.5.6 Slight increases to local peak ebb current speed landward of the berth pocket are predicted to cause a limited amount of erosion of the bed along part of the lower intertidal (at the elevation of MLWS) beneath the landward ends of the proposed jetty (Figure 7.18 of the ES (Application Document Reference number 8.3.7)). This will result in a potential indirect loss in the intertidal area (approximately 0.01 ha). The assessment indicates that once the softer upper layer is removed, the harder, more consolidated, underlayer of bed material is unlikely to erode further. This calculation represents a worst-case assessment of potential elevation changes and has been considered on a precautionary basis. The level of predicted change is at the limit of the accuracy of the modelled data and, in real terms, is likely to be immeasurable against the context of natural variability (as a result of storm events, for example).

4.5.7 The combined intertidal habitat loss as a result of the capital dredge and piling represents approximately 0.000027 % the Humber Estuary SAC and approximately 0.000107 % of the 'mudflats and sandflats not covered by seawater at low tide' feature of the Humber Estuary SAC[17].

4.5.8 This loss also represents 0.000027 % of the Humber Estuary SPA/Ramsar[18]. When considering this in the context of intertidal area, the area of loss represents approximately 0.000113 % of intertidal foreshore habitats[19] and approximately 0.000157 % of mudflat[20] within the SPA.

4.5.9 The predicted intertidal loss, albeit assessed on a worst case basis, also consists of a very narrow strip on the lower shore around the sublittoral fringe. This predicted loss would be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g., due to seasonal patterns in accretion and erosion or following storm events). It is not considered that this *de minimis* (i.e., negligible and ecologically inconsequential) change in mudflat extent will change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary.

1.1.10 [17] Based on the extents given in the Standard Data Form on the JNCC website (JNCC, 2022a)

1.1.11 [18] Based on the extents given in the Standard Data Form on the JNCC website (JNCC, 2022b)

1.1.12 [19] Based on using the 'Intertidal Substrate Foreshore (England and Scotland)' data layer (https://magic.defra.gov.uk/Metadata_for_MAGIC/SPIRE%20intertidal%20substrate%20fores hore.pdf

1.1.13 [20] Based on using mudflat data layer of the Priority Habitat Inventory (England) (https://data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england).

4.5.10 In terms of functional value, the foreshore in the Port of Immingham area is used by a range of species for feeding including Black-tailed Godwit, Dunlin, Redshank, Shelduck, Oystercatcher, Curlew, Teal and Mallard (Table 9.19 and Table 9.20 in (see Section 1.4 of Appendix A of this HRA). Many of these birds feed clustered around the tideline and will follow the tideline as it pushes up and down the shore on flood and ebb tides respectively. These species

could, therefore, be potentially feeding in the in the predicted areas of habitat loss during low water periods. However, the predicted indirect areas of intertidal habitat loss are only exposed during low water spring tidal phases (remaining underwater during neap tidal phases) under current (pre-dredge) conditions. As a consequence, these very small areas already largely remain inundated with water and are only uncovered for a very short duration.

4.5.11 To put this into context, consideration has been given to the proportion of time that the areas of loss are available to feed over the course of a year.. Based on tide gauge data at Immingham in 2020, the area of indirect loss were completely submerged for 99 % of the time. The area of indirect loss, therefore, currently provides almost no feeding opportunities for coastal waterbirds. Furthermore, the spatial extent of loss represents a barely measurable and inconsequential reduction in available habitat for these mobile species even at a local scale.

4.5.12 On this basis, it can be concluded that any change to prey resources for birds feeding in the local area will be negligible and individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) will not be affected.

Mitigation

4.5.13 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.5.14 Based on the evidence provided above and the rationale provided in Table 17, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 17. The potential for an AEOI due to indirect changes to qualifying habitats and species as a result of changes to hydrodynamic and sedimentary processes as a result of the marine works

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, magnitude of change on marine habitats and species from these highly localised and small scale predicted effects on the hydrodynamic and sedimentary processes is considered to be negligible. On this basis the potential effects are not expected to cause a change to '*the extent and distribution of qualifying natural habitats and* habitats of the qualifying species' conservation objective. The potential effects will also, therefore, not cause any changes to the '*the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	H1140: Mudflats and sandflats not covered by seawater at low tide	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, magnitude of change on marine habitats and species from these highly localised and small scale predicted effects on the hydrodynamic and sedimentary processes is considered to be negligible including predicted erosion on nearby intertidal habitats. On this basis changes to hydrodynamic and sedimentary processes are not expected to cause a change to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species'* conservation objective. The potential effects will also not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely*' conservation objectives.
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	In the context of the site's conservation	The potential effects have been considered in the context of the site's conservation objectives.

	A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	objectives, there is considered to be no potential AEOI on the qualifying interest features.	The predicted intertidal habitat loss will not cause changes to '*the populations of each of the qualifying features*' conservation objective. This is because the scale of loss is not considered to be of a magnitude that would cause changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected. The '*distribution of the qualifying features within the site*' conservation objective will not be affected as the predicted loss is *de minimis* (i.e., negligible and ecologically inconsequential) in extent and of a scale that would not causes changes in local distribution. The footprint of predicted habitat loss under pre-dredge conditions already provides very limited feeding opportunities due to the low elevation on the shore and *de minimis* (i.e., negligible and ecologically inconsequential) extent. This loss is considered negligible in the context of available feeding habitat even at a local scale along the eastern frontage of the port. The effects of the habitat loss will also be highly limited in terms of the overall wider functionality of the local mudflats for feeding birds. On this basis, any change to the '*structure and function of the habitats of the qualifying features'* conservation objective is considered inconsequential.

			The loss in intertidal habitat is considered negligible in the context of the amount of similar habitat in the region (and as a proportion of the SPA/Ramsar). On this basis any change to the '*extent and distribution of the habitats of the qualifying features'* conservation objectives is considered inconsequential.
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, magnitude of change on marine habitats and species from these highly localised and small scale predicted effects on the hydrodynamic and sedimentary processes is considered to be negligible including predicted erosion on nearby intertidal habitats. On this basis changes to hydrodynamic and sedimentary processes are not expected to cause a change to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species'* conservation objective. The potential effects will also not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely*' conservation objectives.
	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)		The potential effects have been considered in the context of the site's conservation objectives. The predicted intertidal habitat loss will not cause changes to '*the populations of each of the qualifying features*' conservation objective. This is because the scale of loss is not considered to be of a magnitude that would cause
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit,		changes to the diet or prey consumption of species so that individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) are affected.

	Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		The '*distribution of the qualifying features within the site*' conservation objective will not be affected as the predicted loss is *de minimis* (i.e., negligible and ecologically inconsequential) in extent and of a scale that would not causes changes in local distribution. The footprint of predicted habitat loss under pre-dredge conditions already provides very limited feeding opportunities due to the low elevation on the shore and *de minimis* (i.e., negligible and ecologically inconsequential) extent. This loss is considered negligible in the context of available feeding habitat even at a local scale along the eastern frontage of the port. The effects of the habitat loss will also be highly limited in terms of the overall wider functionality of the local mudflats for feeding birds. On this basis, any change to the '*structure and function of the habitats of the qualifying features'* conservation objective is considered inconsequential. The loss in intertidal habitat is considered negligible in the context of the amount of similar habitat in the region (and as a proportion of the SPA/Ramsar). On this basis any change to the '*extent and distribution of the habitats of the qualifying features'* conservation objectives is considered inconsequential.

Indirect changes to qualifying habitats as a result of changes to hydrodynamic and sedimentary processes during capital dredge disposal

General scientific context

4.5.15 Scientific evidence on this impact pathway is provided in Paragraphs 4.5.1 to 4.5.4.

Summary of effects

4.5.16 An assessment of the hydrodynamic and sediment regime changes that are predicted to occur as a result of the disposal are considered in more detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7).

4.5.17 Local changes to the bathymetry (as a result of material disposal to the bed) within the disposal site will be small in the context of the existing depths. Disposal activity will be targeted to the deeper areas within the site, ensuring that bed level changes are not excessive in any one area, thus, minimising the overall change. As a result, associated changes to the local hydrodynamics (and sediment transport pathways) will be negligible.

4.5.18 These changes are not likely to result in any significant changes to local sediment transport in the region although some localised changes to seabed bathymetry and morphology could occur.

4.5.19 In addition, the predicted changes in flow rates and subtidal seabed morphology are not expected to modify existing subtidal habitat types found in the area (i.e., mobile sand habitats characterised by an impoverished infaunal assemblage).

4.5.20 The indirect loss and changes to subtidal habitats due to changes in hydrodynamic and sedimentary processes as a result of the capital dredge disposal are highly localised and small scale. The subtidal habitats which will be potentially affected are of low ecological value and are considered to be tolerant to the level of change in conditions expected and on this basis the effect is considered to be negligible.

Mitigation

4.5.21 Mitigation is not relevant to this impact pathway and is, as a consequence, not required.

Assessment of the potential for an AEOI

4.5.22 Based on the evidence provided above and the rationale provided in Table 18, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 18. The potential for an AEOI due to indirect changes to qualifying habitats as a result of changes to hydrodynamic and sedimentary processes during capital dredge disposal

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1110: Sandbanks which are slightly covered by sea water all the time	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, magnitude of change on marine habitats and species from these highly localised and small scale predicted effects on the hydrodynamic and sedimentary processes is considered to be negligible. Negligible changes in erosion and accretion are predicted to occur on nearby intertidal habitats. On this basis the potential effects are not expected to cause a change to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. The potential effects will also not cause any changes to '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	H1130: Estuaries		
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

4.6 Physical change of habitat and associated species beneath marine infrastructure due to shading

Direct changes to qualifying habitats beneath marine infrastructure due to shading

General scientific context

4.6.1 Artificial shading such as due to pontoons or jetty/pier decking has the potential to cause localised changes to the structure and functioning of biological communities in natural ecosystems (Van Colen *et al*., 2015; Pardal- Souza *et al*., 2017; Tolhurst *et al*., 2020).

4.6.2 In sedimentary habitats microphytobenthos, macrofauna, sediment erodibility and biogeochemical sediment properties are often found to differ significantly between shaded and unshaded sediments (Defew *et al*., 2004; Thrush *et al*., 2014; Tolhurst *et al*., 2020). Microphytobenthos are significant drivers of ecosystem functioning in benthic habitats influencing biogeochemical properties of sediment, food web dynamics (Byers and Grabowski, 2014) and sediment erodibility (Grabowksi *et al*., 2011)). Heavy shading alters microphytobenthos assemblages causing a variety of responses, including changes in biomass, pigment ratios, species richness and diversity (Defew *et al*., 2004; Tolhurst *et al*., 2020). These changes can therefore have cascading effects on the sediments they inhabit and associated faunal assemblages (Thrush *et al*., 2014; Van Colen *et al*., 2015; Tolhurst *et al*., 2020). For example, Tolhurst *et al*. (2020) found heavy shading of an intertidal mudflat caused directional responses in sediment properties, in line with a decrease in microphytobenthos, including reductions in chlorophyll *a*, colloidal carbohydrate, erosion threshold and total carbohydrate; and increased erosion rate and water retention. This resulted in significant changes in the faunal assemblage, driven by large decreases in oligochaetes and sabellid polychaetes – likely to be a direct response to the reduction of food; either the amount of microphytobenthos, or perhaps bacteria, or meiofauna (Tolhurst *et al*., 2020).

4.6.3 Shading of hard substrates, such as rocky shores and seawalls, can often alleviate stressful conditions associated with temperature and desiccation, caused by emersion during low tide (Blockley, 2007). However, this can also cause shifts in the structure and diversity of biological communities, by reducing macroalgae cover (Blockley and Chapman, 2006; Blockley 2007), increasing the abundance of filter feeding invertebrates and mobile consumers (Takada, 1999; Blockley, 2007), altering sessile assemblages (Williams, 1994) and influencing larval recruitment (Blockley and Chapman, 2006; Pardal-Souza *et al*., 2017). For example, Pardal-Souza *et al*. (2017) found shading to consistently affect the biological community of rocky shores, such that the biomass and cover of macroalgae, and the size of most sedentary grazers, were smaller. Additionally, in the infralittoral fringe there was a shift in dominance from macroalgae to invertebrate filter feeders (Pardal-Souza *et al*., 2017). Larval recruitment was also affected, with oysters and barnacles recruiting more in shaded habitats (Pardal-Souza *et al*., 2017).

Summary of effects

4.6.4 Changes in sunlight levels as a result of shading have the potential to cause changes to the benthic communities leading to a change in habitat quality. In particular, shading can reduce the amount of light available for species that perform photosynthesis such as macroalgae species (seaweeds), macrophytes (such as saltmarsh plants) and microphytobenthos.

4.6.5 The floating pontoons are inevitably likely to cause some shading of subtidal habitats. The project-specific benthic data suggests that a relatively impoverished invertebrate community, consisting predominantly of estuarine oligochaete worms, polychaetes and mobile crustaceans such as amphipods is present in the area. These characterising species live on the seabed or infaunally (in the sediment) and are not directly reliant on light levels to feed (e.g., species are suspension feeders, deposit feeders and predators). However, there may be changes in microphytobenthos abundance on the sediment surface and within the sediment as a result of shading. This could alter food supply and sediment cohesion to deposit feeding species. On this basis, some changes to the benthic community may be observed in terms of a reduction in productivity but the broad faunal assemblage is likely to persist. Furthermore, the highly turbid conditions in the Humber Estuary generally limits the amount of sunlight reaching the seabed in any case and the area impacted will also be highly localised.

4.6.6 The open piled approach jetty and linkspan could cause some shading to intertidal mudflat habitat. Given that these structures will be located several metres above the seabed, however, some natural light would be expected to reach the mudflat from either side of these structures at different times of day. Shading at the level predicted would only be expected to cause negligible changes to the growth rates of macroalgae species (seaweeds) and microphytobenthos occurring on the foreshore. Furthermore, no saltmarsh and only limited macroalgae occurs on mudflats in this area.

4.6.7 The subtidal and intertidal habitats and associated benthic communities are commonly occurring in the region and the effect of shading will be highly localised.

Mitigation

4.6.8 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.6.9 Based on the evidence provided above and the rationale provided in Table 19, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 19. The potential for an AEOI due to direct changes to qualifying habitats beneath marine infrastructure due to shading

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, potential shading effects are considered to be negligible. On this basis the potential effects are not expected to cause a change to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Shading on this scale will also not cause any changes to the *'the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely*' conservation objectives.
	H1140: Mudflats and sandflats not covered by seawater at low tide		
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

4.7 Physical change to habitats resulting from the deposition of airborne pollutants

Physical change to qualifying habitats from dust emissions resulting in smothering to qualifying habitats during construction

Summary of effects

4.7.1 The potential for likely significant effects to the marine habitat H1140 'mudflats and sandflats not covered by seawater at low tide' as a result of dust smothering during construction was identified at Stage 1.

4.7.2 This habitat type is within the footprint of the jetty and jetty access road construction. However, it is subject to regular tidal inundation and as such any habitats or species present would not be reasonably expected to be detrimentally affected by dust deposition, since any deposited dust would be washed away at high water and would therefore only be present for a short period of time. Furthermore, the implementation of standard dust suppression measures during construction to minimise fugitive dust emissions will further reduce the magnitude and extent of any dust emissions during construction. It is therefore concluded that this pathway would not result in any adverse effects on habitats and thus the integrity of the designated site.

Mitigation

4.7.3 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.7.4 Based on the evidence provided above and the rationale provided in Table 20, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 20. The potential for an AEOI due to physical change to qualifying habitats resulting from dust deposition during construction.

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1140 Mudflats and sandflats not covered by seawater at low tide	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Although there may be some fugitive dust emissions during construction, with the implementation of standard dust suppression measures during construction this will be limited in nature. The regular tidal inundation of the mudflats and sandflats habitat will wash away any deposited dust, and no adverse effects on habitats are predicted due to dust smothering. There would therefore be no conflict with the conservation objectives for the SAC, and it is reasonable to conclude there would be no adverse effect on the integrity of the SAC.

Physical change to qualifying habitats resulting from the deposition of N and NOx from marine vessel and road vehicle emissions during operation

General scientific context

4.7.5 Exhaust emissions from marine vessels and road traffic emissions during the operational phase have the potential to impact on local air quality, with the emission of NO_X (mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere) being the main pollutants of concern in relation to coastal saltmarsh. The majority of these emissions result from marine vessel movements.

4.7.6 Coastal saltmarsh is sensitive to effects from nitrogen deposition as vegetation is nitrogen limited (Mitsch and Gosselink, 2000) and is therefore potentially vulnerable to eutrophication. Effects may be observed as increased graminoid (grasses) biomass, with potentially adverse effects on forbs (APIS, 2022).

4.7.7 The Air Pollution Information System (APIS) defines site-specific Critical Loads relevant to each European site for nitrogen deposition. For the 'H1130 estuaries' and 'H1330 Atlantic salt meadows' qualifying features of the Humber Estuary SAC, the relevant nitrogen Critical Load class is 'Pioneer, low-mid, mid-upper saltmarshes', with a Critical Load of 20 – 30 kg N/ha/yr (APIS, 2022). This assessment refer to the most stringent (i.e., lower) Critical Load).

4.7.8 The critical load for 'H1130 estuaries' provided on APIS is simply that for saltmarsh, as this represents the most sensitive estuarine habitat. APIS states that the Critical Load for estuary habitat "*applies to the saltmarsh component of the feature*", and therefore this value has been used in the screening. However, this habitat feature, along with 'H1110 sandbanks which are slightly covered by sea water all the time', is not susceptible to the effects of nitrogen and NH3 deposition and these habitats were therefore screened out at Stage 1 because no pathway for likely significant effects due to nitrogen and ammonia deposition were identified.

4.7.9 Similarly, for the 'H1140 mudflats and sandflats' there are no critical loads that are based on the effects of nitrogen deposition on sediment infaunal communities, and therefore there is no appropriate proxy critical load for unvegetated mudflat and sandflat habitats. The critical levels for NOx and NH3 are based on studies into the effects of these chemicals on rooted macrophytes and are therefore not appropriate to entirely unvegetated habitats i.e., areas of the estuary that are not saltmarsh.

4.7.10 Environment Agency guidance (2016) that states that impacts may be considered insignificant ('not significant') where:

- The short-term impact is less than 10% of environmental assessment level for the nature conservation site; and
- The long-term impact is less than 1% of the long-term air quality objective or environmental assessment level for the nature conservation site.

4.7.11 Where the long-term impact at a nature conservation receptor exceeds these criteria, it may also be considered insignificant ('not significant') where:

- The long-term total concentration after the impact is <70% of the air quality objective or environmental assessment level for the nature conservation site.

Summary of effects

4.7.12 The assessment of operational effects on air quality has been carried out in line with the Institute of Air Quality Management (IAQM) 'Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites' (Holman *et al*., 2020) and the methodology is detailed in Chapter 13 (Air Quality) of the ES (Application Document Reference number 8.2.13). The assessment considered both onsite and offsite sources, however only the onsite emissions are relevant to coastal saltmarsh. The emissions sources included vessel, land-tug and road traffic emissions.

4.7.13 There is no saltmarsh habitat within 200 m of any public roads used by IERRT road traffic during construction or operation (the nearest is Queens Road, which is approximately 500 m from the SPA/ SAC/ Ramsar), and therefore this pathway was screened out at Stage 1. However, the modelling and assessment has considered the NH3 emissions from operational traffic using the IERRT jetty and jetty approach road, which are within 200 m of the Humber Estuary SAC.

4.7.14 Operational N deposition and NO_x was predicted at five receptors within the SAC (i.e., the five nearest sensitive saltmarsh habitats to the Site) as shown in Table 21. The locations of the five ecological receptors are illustrated in Figure 13.3 (a) to the ES (Application Document Reference number 8.3.13 (g)).

Table 21. Predicted operational pollutant statistics from onsite sources.

~~[2] **Bold** values denote and exceedance of the relevant air quality standard.~~

4.7.15 Operational conditions at the nature conservation sensitive receptors within and adjacent to the IERRT project are summarised as follows:

- Annual mean NO_X concentrations predicted are below the air quality objective at the saltmarsh habitats within the SAC;
- The impact of operational onsite emissions is greater than 1% of the air quality objective for annual mean NO_X at some sections of saltmarsh habitat within the SAC (receptor ID SAC3, SAC4 and SAC5). These impacts cannot be screened as insignificant;

- Nitrogen deposition rates at the saltmarsh habitat within the SAC are close to or are above the relevant Critical Load for that habitat (Exceeds at SAC1 only); and
- The impact of operational onsite emissions is less than 1% of the Critical Load for nitrogen deposition at the saltmarsh habitat within the SAC.

4.7.16 The assessment of onsite emissions sources during the operational phase has demonstrated that the effect of combined emissions is below the air quality objective but exceeds the 1% threshold at three locations. However, the annual mean NO_X concentrations remain below 70% of the air quality standard and therefore the effect of emissions on coastal saltmarsh with the Humber Estuary SAC is considered negligible. Nitrogen deposition should also be considered within the context of nutrient loadings from river and tidal inputs which are likely to be of significantly greater importance for these systems (APIS, 2022).

4.7.17 Where airborne NOx impacts are >1% of the CL, total Nox concentrations are <58% of the critical load. Airborne Nox concentrations are falling year on year across most areas of the UK (with the exception of some urban centres), primarily because of improved emissions technology. This is therefore factored into the air quality modelling and assessment.

4.7.18 IERRT will generate 1 additional vessel movement through the estuary per day. Emissions from that vessel will be transient as it passes through the estuary and will only impact on a specific sensitive location for a period of minutes per day. Given the location of the Humber Navigational Channel within the watercourse, the transient emissions source will never be closer than 1.5km of an air quality sensitive habitat.

4.7.19 It is noted that predicted NH_3 and NH_3 derived N deposition at the same five SAC receptors are presented in Table 13.16 in Chapter 13 (Air Quality) of the ES (Application Document Reference number 8.2.13). The predicted NH_3 concentrations are below 1% of the Critical Level threshold at all receptors and likely significant effects were therefore screened out at Stage1.

Mitigation

4.7.20 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.7.21 Based on the evidence provided above and the rationale provided in Table 22, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 22. The potential for an AEOI due to physical change to qualifying habitats resulting from the deposition of N and NOx from marine vessel and road vehicle emissions during operation.

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on the information provided above, air quality effects are considered to be negligible. On this basis the potential effects are not expected to cause a change to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Air quality effects on this scale will also not cause any changes to the *'the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely*' conservation objectives.
	H1140 Mudflats and sandflats not covered by seawater at low tide		
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

4.8 Non-toxic contamination through elevated suspended sediment concentrations

The potential effects of elevated SSC during capital dredging on qualifying habitats and species

General scientific context

Elevated SSC: implications for benthic habitats and species

4.8.1 Dredging activities result in the suspension of disturbed sediment (Newell *et al.,* 1998). Macrofauna living in estuarine systems which are subject to naturally high levels of SSCs are considered well adapted to living in highly turbid conditions. An increased level of suspended sediments may result in an increase in food availability and therefore growth and reproduction for surface deposit feeders (such as certain polychaetes) within estuarine environments that rely on a supply of nutrients at the sediment surface. However, food availability would only increase if the additional suspended sediment contained a significant proportion of organic matter, and the population would only be enhanced if food was previously limiting (De-Bastos, 2016b).

4.8.2 Greater energetic costs for benthic species could occur as a result of higher particle loads due to elevated suspended sediments stimulating the secretion of mucus to protect branchial or feeding structures of filter feeding organisms (Perry, 2016). SSCs have been found to have a negative linear relationship with sub-surface light attenuation. Light availability and water turbidity are principal factors in determining depth range at which kelp and other algae are recorded. In addition, certain mobile epistrate feeders (such as the amphipod *Bathyporeia* spp.) feed on diatoms within the sand grains and an increase in suspended solids that consequently reduced light penetration could alter food supply (Tillin *et al*., 2019). However, longer-term changes in turbidity levels rather than temporary elevations are likely to be required to elicit any measurable changes in these species.

4.8.3 Elevated suspended sediment levels can also cause increased scouring and damage of epifaunal species due to the potentially abrasive action of the suspended sediment in flowing water.

4.8.4 Increased suspended sediments may favour the development of suspension feeders such as bivalves over other species. However, it should be noted that many benthic invertebrates can switch feeding modes depending on environmental conditions. The negative effects of suspended sediment may be particularly important during larval settlement in spring, with settling stages potentially being more sensitive to effects such as scour. However, this is generally thought to be of less concern where fauna are adapted to naturally high levels of suspended sediments (Boyd *et al*., 2004).

4.8.5 In addition, the resuspension of sediments containing organic material can cause oxygen depletion within the water column and the subsequent settling of this organic rich sediment can deplete sediment oxygen levels, potentially affecting benthic species. Reductions in dissolved oxygen from suspended sediments as a result of dredging are generally considered to be minimal and short-lived. However, potential effects can be more pronounced if dredging causes the disturbance of high levels of oxygen-depleting substances and nutrients present in some very fine-grained sediment deposits and where a great portion originate from waste water (Cefas, 2012).

4.8.6 Oxygen depletion in severe situations can lead to hypoxia with most research on the effects of reductions in dissolved oxygen on benthic fauna during hypoxic conditions. This occurs when oxygen is consumed (e.g., by decomposing organic matter, respiration and oxidation of reduced chemical species) faster than it is replenished (e.g., via air-water oxygen transfer, photosynthesis, and mixing) (Larsen *et al*., 2019). Coastal and estuarine waters can be particularly susceptible to low oxygen conditions as sediments are organic-rich and impose high sediment oxygen demands. Highly stratified estuaries, in which surface and bottom waters do not mix, are more prone to hypoxia (Larsen *et al*., 2019). Coastal areas are more likely to experience hypoxia during summer when high temperatures strengthen salinity stratification (Levin *et al*., 2009). Severe anoxic events can deplete the benthic invertebrate communities and cause a shift in community composition, through attrition of intolerant species and elevated dominance, as well as reductions in body size (Tweedley *et al*., 2015). In general, crustaceans and echinoderms are typically more sensitive to hypoxia, with lower oxygen thresholds, than annelids, molluscs and cnidarians (Levin *et al*., 2009).

Elevated SSC: implications for fish

4.8.7 Increased suspended sediments can lead to physiological effects in adult finfish resulting from the abrasion of sediment particles on gill tissues, causing reduced gill function and possible mortality (Wenger *et al*., 2017; Kjelland *et al*., 2015). Such effects on fish are considered to occur at suspended sediment levels of around 10,000 mg/l (Britwell, 2000). High SSC levels may impact spawning and nursery grounds through damage to eggs and planktonic larvae, as well as causing abrasion or clogging of the fragile gills of larval and juvenile fish, resulting in mortality or reduced growth rates.

4.8.8 Because turbidity often impairs visual acuity, activities and processes that require vision can be inhibited, leading to behavioural responses. For example, foraging in both planktivorous and piscivorous fish can be negatively affected by suspended sediments. Piscivores are especially sensitive to increasing turbidity because many are visual hunters that detect prey from a distance. An increase in suspended sediment reduces both light and contrast, decreasing encounter distances between predator and prey (Wenger *et al*., 2017).

4.8.9 Elevated suspended sediments can also influence the movements and migration of fish with some species have been observed actively avoiding moving through areas with suspended sediment plumes (Wenger *et al*., 2017;

Kjelland *et al*., 2015). However, such responses can cease if fish become acclimatised. Fish in high latitude coastal areas typically have to contend with variable turbidity and often poor visual conditions, resulting from fluctuations in ambient light levels, suspended sediments and in the light transmission properties of the water. For example, concentrations as high as 9,000 mg/l have been recorded in the path of salmon runs in the Usk Estuary (Alabaster, 1993). Similarly, lamprey and shad species have been known to successfully pass through estuaries with extremely high suspended sediments and, therefore, can be considered tolerant of turbid conditions (Scottish Government, 2010). The mobile nature of fish species generally allows avoidance of areas of adverse conditions which are unlikely to significantly affect a population provided such conditions are temporary.

4.8.10 The resuspension of sediments containing organic material can cause oxygen depletion within the water column. The subsequent settling of this organic rich sediment can deplete the sediments of oxygen and affect benthic prey items used by fish (Paragraphs 4.8.5 and 4.8.6). The response of fish to low concentrations of dissolved oxygen is determined by a range of factors, including the duration of exposure, water temperature and the presence of other pollutants (Wenger *et al*., 2017). The duration of any low dissolved oxygen event is a key factor in determining its effect. Most fish would survive an extremely low concentration of dissolved oxygen, such as 2 mg/l, for a few minutes, but a longer exposure would start to have sub-lethal and eventually lethal effects (ABP Research, 2000).

Summary of effects

Effects on benthic habitats and species

4.8.11 The changes in SSC that are predicted to occur as a result of the capital dredge are presented in detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). The modelling results show that the predicted increases in SSC due to the capital dredging will be localised and temporary.

4.8.12 Naturally very high SSC typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides (Uncles *et al.,* 2006; Cefas, 2016). The estuarine benthic communities recorded on mudflats and the shallow mud occur commonly in this region and are considered tolerant to this highly turbid environment (De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). The predicted SSCs are within the range that can frequently occur naturally and also as a result of ongoing dredge and disposal activity (see Chapter 7 of the ES (Application Document Reference number 8.2.7)).

4.8.13 With respect to dissolved oxygen, increases in SSC will be brief and localised and there is not expected to be a significant reduction in dissolved oxygen nor therefore any implications for benthic species and habitats.

Effects on fish

4.8.14 As highlighted above, migratory fish including lamprey are known to migrate through estuaries with high SSC to get to spawning areas (including the Humber Estuary which is considered one of the estuaries in the UK with the highest levels of SSCs) (Scottish Government, 2010; Wenger *et al*., 2017; Kjelland *et al*., 2015; Uncles *et al.,* 2006; Cefas, 2016). Elevated SSCs due to dredging are considered to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal.

4.8.15 Sediment plumes resulting from dredging will be relatively localised (in the context of the entire width of the estuary). It is considered that they will dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle) as described in more detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). It follows, therefore, that salmonids and other migratory fish will also be able to avoid the temporary sediment plumes. Based on these factors there is considered to be limited potential for migrating fish to be adversely affected by the predicted changes in SSC.

4.8.16 Given that elevated SSCs due to dredge are considered to be in the range of variability that can occur naturally in the Humber Estuary (which has very high SSCs year-round, particularly during the winter months) as well as due to ongoing maintenance dredging/disposal and that plumes will be temporary in nature, sensitive life stages of fish occurring in the region such as larvae and juvenile fish are considered unlikely to be adversely affected by the dredging.

4.8.17 With respect to dissolved oxygen, increases in SSC will be brief and localised and there is not expected to be a reduction in dissolved oxygen and therefore a response by fish is not anticipated.

Mitigation

4.8.18 Mitigation is not relevant to this impact pathway and is, therefore, not required.

Assessment of the potential for an AEOI

4.8.19 Based on the evidence provided above and the rationale provided in Table 23, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 23. The potential for an AEOI on qualifying habitats and species due to elevated SSC during capital dredging

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Benthic habitats and species within the local area are considered to be well adapted to high suspended sediment conditions. Elevated SSCs due to dredging are predicted to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated SSCs of this magnitude will also, therefore, not cause any changes to the *'the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Lamprey regularly migrate through estuaries with very high SSC (including the Humber Estuary). In addition, the elevated SSCs due to dredging are predicted to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site'* conservation objectives
			This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance:	In the context of the site's conservation	Benthic habitats and species within the local area are considered to be well adapted to high suspended sediment conditions. Elevated SSCs due to dredging are predicted to

	The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	objectives, there is considered to be no potential AEOI on the qualifying interest features.	be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated SSCs of this magnitude will also, therefore, not cause any changes to the *'the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Lamprey regularly migrate through estuaries with very high SSC (including the Humber Estuary). In addition, the elevated SSCs due to dredging are predicted to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site*' conservation objectives This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.

The potential effects of elevated SSC during capital dredge disposal on qualifying habitats and species

General scientific context

4.8.20 Scientific evidence on this impact pathway is provided in Paragraphs 4.8.1 to 4.8.10.

Summary of effects

Effects on benthic habitats and species

4.8.21 The changes in SSC that are predicted to occur as a result of the capital dredge disposal are presented in detail in the Physical Processes assessment set out in Chapter 7 of the ES (Application Document Reference number 8.2.7). In summary, the dredge disposal is predicted to produce peak SSC of around 600 to 800 mg/l above background at the disposal site, reducing to typically 100 to 200 mg/l within a distance of around 7 km from the source. These peak increases are predicted to persist at any given location for a single modelled timestep (10 minutes) before the tidal forcing carries the plume further up or down estuary on the respective flood or ebb tide. SSCs of this magnitude are considered to regularly occur naturally or as a result of ongoing maintenance dredging/disposal. Upstream of Hull and downstream (within the outer estuary), maximum SSC levels are lower; generally, between 20 and 100 mg/l above background, as the tidal excursion from the disposal site limits the extent of the resultant plume. However, in reality due to the existing high SSC that typically occurs in the Humber Estuary, the predicted increase in concentrations resulting from the disposal is likely to become immeasurable (against background) within approximately 1 km of the disposal site. The measurable plume from each disposal operation is also only likely to persist for a single tidal cycle (less than 6 hours from disposal) as after this time the dispersion under the peak flood or ebb tidal flows means concentrations will have reverted to background levels.

4.8.22 Naturally very high SSCs typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides. The estuarine benthic communities recorded within the disposal ground and surrounding area were found to be of low ecological value but are considered characteristic of the ‘Sandbanks which are slightly covered by sea water all the time’ feature. The benthic communities have low sensitivity to increases in suspended sediments and are considered tolerant to this highly turbid environment (De-Bastos and Hiscock, 2016; Tillin, 2016; Ashley, 2016). The predicted SSCs are within the range that can frequently occur naturally and also as a result of ongoing dredge and disposal activity (see Chapter 7 of the ES (Application Document Reference number 8.2.7)).

4.8.23 The disposal of sediment will temporarily increase SSC, however, due to the strong hydrodynamic conditions in the area, these temporary elevations in SSC are expected to dissipate rapidly to background concentrations. With respect to dissolved oxygen, increases in SSC will be brief and localised and there is not expected to be a significant reduction in dissolved oxygen nor therefore any implications for benthic species and habitats.

Effects on fish

4.8.24 The changes in SSC are described in 4.8.21. Migratory species including lamprey are known to migrate through estuaries with high SSC (including the Humber Estuary which is considered one of the estuaries in the UK with the highest levels of SSC) (Uncles *et al*., 2006) and the predicted SSC are within the range that can frequently occur naturally and also as a result of ongoing dredge and disposal activity. Sediment plumes resulting from disposal will also be relatively localised in the context of the entire width of the estuary. Therefore, salmonids and other migratory fish would also be able to avoid the temporary sediment plumes and sensitive life stages of fish occurring in the region such as larvae and juvenile fish are considered unlikely to be adversely affected by the dredging

Mitigation

4.8.25 Mitigation is not relevant to this impact pathway and is not, as a consequence, required.

Assessment of the potential for an AEOI

4.8.26 Based on the evidence provided above and the rationale provided in Table 24, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 24. The potential for an AEOI on qualifying habitats and species due to elevated SSC during capital dredge disposal

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Benthic habitats and species within the local area are considered well adapted to high suspended sediment conditions. Elevated SSCs due to dredging are predicted to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated SSCs of this magnitude will also, therefore, not cause any changes to the *'the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Lamprey regularly migrate through estuaries with high SSC (including the Humber Estuary). In addition, the elevated SSCs due to dredge disposal are considered to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site*' conservation objectives
			This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.
Humber Estuary	Criterion 1 – natural wetland habitats that are of international	In the context of the site's	Benthic habitats and species within the local area are considered well adapted to high suspended sediment

Ramsar site	importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	conditions. Elevated SSCs due to dredging are predicted to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated SSCs of this magnitude will also, therefore, not cause any changes to the *'the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Lamprey regularly migrate through estuaries with high SSC (including the Humber Estuary). In addition, the elevated SSCs due to dredge disposal are considered to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. On this basis the localised and temporary effects are not considered to cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site'* conservation objectives This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.

4.9 Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases

The potential effects of the release of contaminants during capital dredging on qualifying habitats and species

General scientific context

Release of contaminants: implications for benthic habitats and species

4.9.1 Benthic habitats and species are sensitive to toxic contamination (where concentrations of contaminants exceed sensitivity thresholds). Toxic contamination during construction can occur as a result of the release of synthetic contaminants such as fuels and oils or through the resuspension of sediment as a result of the disturbance of the seabed which can lead to the release and mobilisation of sediment-bound contaminants into the water column. These include both toxic contaminants, such as heavy metals, pesticides and hydrocarbons, and non-toxic contaminants, such as nutrients. In particular, there is a risk that any uncontrolled releases of materials or sediments into the water column could make contaminants temporarily available for uptake by marine organisms. Over the longer-term any such releases could also become stored in the surface sediments of benthic habitats for future benthic uptake.

4.9.2 Suspension-feeding organisms may be particularly vulnerable to pollutants in the water column due to their dependence on filtration (Tillin *et al*., 2019). High levels of chemical contaminants can potentially cause genetic, reproductive and morphological disorders in marine species. Contaminants may also have combined effects. Studies have suggested links between contamination with polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCBs), amines and metals and a range of disorders (MacDonald and Ingersoll, 2010). Increased incidence of tumours, neoplasia, deoxyribonucleic acid (DNA) damage, polyploidy, hypoploidy, hermaphroditism and reduced immune response have all been reported in marine invertebrates in areas of high levels of pollution (Hannam *et al.,* 2010; Catalano *et al.,* 2012; Hesselman *et al.,* 1988; Nacci and Jackim, 1989; Schaeffer, 1993; Barsiene, 1994). Another highly researched pollutant is Tributyltin (TBT), which has toxic effects in a wide variety of biota, whereas inorganic tin is less toxic. TBT effects include lethal toxicity and effects on growth, reproduction, physiology, and behaviour. Several of the negative effects are due to interferences with the endocrine function, as occurs in the phenomenon imposex. Imposex is the superimposition of male organs onto females of gastropods, which are normally a dioecious species (Borja *et al.,* 2012).

4.9.3 Sub-lethal effects of chemical contamination on marine invertebrates can reduce the fitness of individual species. Lethal effects may allow a shift in community composition to one dominated by pollution-tolerant species such as oligochaete worms (Elliott *et al.,* 1998). A reduction in community species richness is associated with elevated levels of pollutants. Contamination with

PAHs, for example, leads to high levels of mortality in amphipod and shrimp species, and decreased benthic diversity (Long *et al.,* 1995). Similar reductions in diversity are linked with heavy metal contamination (Dauvin, 2008). Polychaete worms are thought to be quite tolerant of heavy metal contamination, whereas crustaceans and bivalves are considered to be intolerant (Rayment, 2002).

Release of contaminants: implications for fish

4.9.4 The potential release of contaminants during construction and dredging activities may result in those contaminants becoming available for uptake by any fish in the water column or on surface sediments. There is an indirect risk to some finfish species as sediment-bound contaminants may temporarily bioaccumulate in the tissues of certain fish prey, such as polychaete worms and marine bivalves, and made available for uptake by feeding fish.

4.9.5 The influence of contaminated sediments is considered to have a greater impact on fish than elevated SSC with a range of evidence suggesting that direct exposure to contaminants negatively effects fish (Wenger *et al*., 2017). Hydrophobic contaminants (such as legacy persistent organic pollutants including PCBs and organochlorine pesticides) as well as high-molecular weight polyaromatic and aliphatic hydrocarbons (such as PAHs), are closely associated with organic material in sediments. These contaminants have been linked to a range of potential reproductive impacts on adult fish (e.g., steroidogenesis, vitellogenesis, gamete production or spawning success) as well as lethal and non-lethal developmental (spinal and organ development, growth) impacts on embryos and larvae (Johnson *et al.,* 2014).

4.9.6 Demersal fish species, such as dab and flounder, which remain close to the seabed and feed mainly on benthic organisms, would experience a higher exposure to contaminated sediments than pelagic fish such as herring.

Summary of effects

Effects on benthic habitats and species

4.9.7 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere. However, it should be noted that the majority of material disturbed during capital dredging works will be lifted from the bed to the hopper/barge, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the draghead/bucket).

4.9.8 Sampling and subsequent chemical analysis has been undertaken in accordance with the agreed MMO sample plan. The results of this analysis are summarised in more detail in Chapter 8 of the ES (Application Document Reference number 8.2.8) and show the majority of contaminants in the sediments of the proposed dredge area are at relatively low concentrations, mostly below, or marginally exceeding, Cefas Action Level 1 (AL1). There were no exceedances of Action level 2 (AL2) in any sediment samples analysed.

4.9.9 Based on the chemical analysis, there are low levels of contamination in sediments in the proposed dredge area. Only a small proportion of disturbed material is expected to be raised into suspension and this material will be rapidly dispersed by strong tidal currents in the area. Significant elevations in the water column contamination are, therefore, not anticipated. Based on these factors, the benthic communities would have no or very limited exposure to contaminants and not at concentrations of contaminants that would constitute a lethal or sub-lethal effect. The effects on subtidal and intertidal benthic communities from the release of contaminants during capital dredging is considered inconsequential.

Effects on fish

4.9.10 As described in Paragraph 4.9.8 low levels of contamination were found in the sediment contamination samples. Significant elevations in the concentrations of contaminants within the water column are not anticipated. Based on these factors, it is unlikely that fish including lamprey species would be exposed to elevated levels of contaminants during capital dredging and therefore effects on fish species are unlikely.

Mitigation

4.9.11 Mitigation is not relevant to this impact pathway and is not, as a consequence, required.

Assessment of the potential for an AEOI

4.9.12 Based on the evidence provided above and the rationale provided in Table 25 the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 25. The potential for an AEOI on qualifying habitats and species the release of contaminants during capital dredging

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on existing available information summarised above, the overall level of contamination in the proposed dredge area is considered to be low with only a small proportion of disturbed material expected to be raised into suspension. This material will be rapidly dispersed by strong tidal currents in the area. Significant elevations in the water column contamination are, therefore, not anticipated. Based on these factors, the magnitude of change to marine habitats and species is considered to be negligible. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated contamination levels of this magnitude will also not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on existing available information summarised above, the localised and temporary potential changes are considered to cause negligible effects in lamprey and will not cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site'* conservation objectives. This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.
Humber Estuary	Criterion 1 – natural wetland habitats that are of	In the context of the site's	Based on existing available information summarised above, the overall level of contamination in the proposed dredge

Ramsar site	international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	area is considered to be low with only a small proportion of disturbed material expected to be raised into suspension. This material will be rapidly dispersed by strong tidal currents in the area. Significant elevations in the water column contamination are, therefore, not anticipated. Based on these factors, the magnitude of change to marine habitats and species is considered to be negligible. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated contamination levels of this magnitude will also not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to '*the supporting processes on which qualifying natural habitats rely'* conservation objectives.
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on existing available information summarised above, the localised and temporary potential changes are considered to cause negligible effects in lamprey and will not cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site'* conservation objectives. This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.

The potential effects of the release of contaminants during capital dredge disposal on qualifying habitats and species

General scientific context

4.9.13 Scientific evidence on this impact pathway is provided in Paragraphs 4.9.1 to 4.9.6.

Summary of effects

Effects on benthic habitats and species

4.9.14 As described in Paragraph 4.9.8 low levels of contamination were found in the sediment contamination samples and there is no reason to believe the sediment will be unsuitable for disposal in the marine environment.

4.9.15 During disposal, sediment will be rapidly dispersed in the water column. Therefore, the already low levels of contaminants in the dredged sediments will be dispersed further. The probability of changes in water quality occurring at the disposal site is considered to be low. The material will be rapidly dispersed by strong tidal currents in the area. Significant elevations in the water column contamination are, therefore, not anticipated. Based on these factors, the benthic communities at the disposal site would have no or very limited exposure to contaminants and not at concentrations of contaminants that would constitute a lethal or sub-lethal effect. The effects on subtidal and intertidal benthic communities from the release of contaminants during capital dredge disposal is considered inconsequential.

Effects on fish

4.9.16 Significant elevations in the concentrations of contaminants within the water column are not anticipated (Paragraph 4.9.14). Based on these factors, it is unlikely that fish would be exposed to elevated levels of contaminants during capital dredge disposal and therefore effects on fish species are unlikely.

Mitigation

4.9.17 Mitigation is not relevant to this impact pathway and as a consequence, is not required.

Assessment of the potential for an AEOI

4.9.18 Based on the evidence provided above and the rationale provided in Table 26, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 26. The potential for an AEOI on qualifying habitats and species the release of contaminants during capital dredging disposal

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Given the low levels of contamination found in the samples and the high level of dispersal expected as the disposal sites, subtidal habitats and species found in the vicinity of the disposal sites are not expected to be vulnerable to the potential release of sediment bound contaminants which could occur as a result of the disposal of the capital dredged arisings. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated contamination levels of this magnitude will also not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to 'the supporting processes on which qualifying natural habitats rely' conservation objectives.
	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on existing available information summarised above, the localised and temporary potential changes are considered to cause negligible effects in lamprey and will not cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site'* conservation objectives. This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.

Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Given the low levels of contamination found in the samples and the high level of dispersal expected as the disposal sites, subtidal habitats and species found in the vicinity of the disposal sites are not expected to be vulnerable to the potential release of sediment bound contaminants which could occur as a result of the disposal of the capital dredged arisings. On this basis the localised and temporary effects are not considered to cause changes to '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species*' conservation objective. Elevated contamination levels of this magnitude will also not cause any changes to the '*the structure and function of qualifying natural habitats*' or cause modifications to 'the supporting processes on which qualifying natural habitats rely' conservation objectives.
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Based on existing available information summarised above, the localised and temporary potential changes are considered to cause negligible effects in lamprey and will not cause changes to '*the population of each of the qualifying features'* or the '*distribution of the qualifying features within the site'* conservation objectives. This pathway would also not cause any changes to '*the extent and distribution of the habitats of the qualifying features'* or the '*supporting processes on which the habitats of the qualifying features rely'* conservation objectives.

4.10 Airborne noise and visual disturbance

The potential effects of airborne noise and visual disturbance during construction on qualifying species

General scientific context

Introduction

4.10.1 Disturbance can cause birds to cease feeding, which can decrease the total amount of time available for feeding, as well as disrupting other behaviour such as breeding (Coleman *et al*., 2003; Martín *et al*., 2014). Where disturbance causes birds to take flight, it can increase energy demands and may increase food consumption by decreasing the available habitat area (Goss-Custard, 2020; Linssen *et al*., 2019; Stillman *et al*., 2007). Repetitive disturbance events can result in possible long-term effects such as loss of weight, condition and a reduction in reproductive success, leading to population impacts (Durell *et al*., 2005; Goss-Custard *et al*., 2006; Belanger and Bedard, 1990). Birds typically show a dispersive response to disturbance with prolonged disturbance causing displacement (Goss-Custard, 2020; Dwyer, 2010; Navedo and Herrera, 2012).

4.10.2 Disturbance often occurs through a combination of simultaneous visual and noise stimuli, although some occurrences may be through separate visual or noise stimuli (Wright *et al*., 2013). Birds will also vary their response to human activities depending on the type of the activity, the noise produced, the speed and randomness of approach, the distance to which the disturbance factor approaches and the frequency of disturbance (Burton *et al*., 2002a., Rees *et al*., 2005; Liley *et al*., 2010; Coleman *et al*., 2003; Ruddock and Whitfield, 2007; Stillman *et al*., 2012).

Disturbance responses associated with construction activity

4.10.3 Construction activity in the coastal zone may lead to disturbance which has the potential to cause a reduction in foraging activity as well as temporary displacement from a localised area around the works (Burton *et al*., 2002a).

4.10.4 Overall, responses to construction noise and activity appear to initiate similar or less disturbance than that of human presence on the foreshore (e.g., recreation) (ERM, 1996; ABPmer, 2013; IECS, 1997; IECS, 2013). For example, while some localised disturbance was caused as a result of piling activity as part of the construction work for ABB Power Generation Ltd (Pyewipe, Grimsby), this was not considered to have a major effect on surrounding bird populations and was found to be no greater than the effect arising from third party disturbance, including walkers and stopped cyclists, which were unrelated to the ABB works (ERM, 1996). The greater effect of human presence as opposed to general construction works and machinery is also supported by IECS (1997), in that a person approaching feeding birds on the mudflat caused birds to fly when the person was approximately 300 m from the birds, whereas machinery could approach birds up to 50 m before the birds moved away.

4.10.5 Lower levels of disturbance for construction activities compared with other nearby human activity was also observed during bird monitoring as part of the marine licensing consent for a quay wall construction development at the Port of Southampton. The study evaluated the disturbance effects of the extension work on waterbird species using the mudflat habitat on Bury Marsh opposite the Port of Southampton (approximately 100 to 200 m away) during the overwinter period. No bird disturbance behaviour (such as startling, rapid flight or abruptly stopping foraging) was observed during periods of percussive piling activity. However, disturbance to waterbirds was observed on several occasions due to vessels and kayaks within 50 m of Bury Marsh (ABPmer, 2013).

4.10.6 Studies into the distances from activities that evoke a disturbance response (or flight initiation distance (FID)) suggest that for most coastal works and other foreshore activity in areas where birds are likely to be habituated to some extent to disturbance due to existing anthropogenic activity, disturbance behaviour is not typically observed when activities occur more than some 200 m away from a source with the reactions of many species occurring between 20 and 100 m (ABPmer, 2002; Ruddock and Whitfield, 2007; IECS, 2009a; Wilson, 2009; IECS, 2009b; Dwyer, 2010; IECS, 2013; Ross and Liley, 2014; Collop *et al*., 2016; Goodship and Furness, 2019; Goodship and Furness, 2022; ABPmer, 2013). This is discussed in more detail in Table 27 and Table 28.

4.10.7 Construction techniques which are known to cause loud source noise levels (such as piling) have been the subject of a number of disturbance monitoring studies which have investigated the relationship between activity source levels and the disturbance responses elicited by birds (IECS, 2009a; Xodus, 2012; Wright *et al.*, 2013; ABPmer, 2002; IECS, 2013). Research suggests that irregular construction noise at levels typically above 70 dB can cause behavioural responses in some waterbird species with flight responses generally occurring above 80 dB (Table 27). However, responses of birds will be dependent on a range of site-specific factors including ambient (background) noise levels, time of year, levels of existing activity and the species assemblage. In addition, visual disturbance associated with construction activity will often create a disturbance effect before any associated noise starts to have an effect (IECS, 2013).

4.10.8 Birds generally appear to habituate to continuous noise as long as there is no large amplitude ‘startling’ component (Hockin *et al.*, 1992). With specific respect to piling, it has been concluded that although piling has the potential to create most noise during construction; it often consists of rhythmic “bangs”, which birds might become accustomed to depending on the distance that birds are away from the piling (ABP Research, 2001). For example, observations as part of the construction work for ABB Power Generation Ltd (Pyewipe) suggested that it was the initial sudden bang during piling activities, which caused some localised disturbance, and that subsequent bangs typically resulted in reduced disturbance, demonstrating habituation (ERM, 1996).

Table 27. Summary of noise disturbance studies

Study	Summary
IECS, 2009a; IECS, 2009b	A study of coastal construction noise effects on the Humber Estuary was undertaken based around the measurement of noise levels while simultaneously monitoring the behavioural response by birds during flood defence works at Saltend. The defence works involved the use of a double hydraulic pile on site. The study noted a moderate to high behavioural response to irregular piling noise above 70 dB and a moderate response to regular piling noise below 70 dB. A flight response was noted to occur during works generating noise at between 80-85 dB. Behavioural responses, notably the down-shore movements of wildfowl were noted above 70 dB. Noise levels between 55 dB and 84 dB were generally accepted by birds. Other impacts associated with construction included a high response to personnel and plant equipment on the mudflat and a moderate to high response to personnel and plant equipment on the seaward toe and crest. Occasional movement of a crane jib and load resulted in a low to moderate response. Noises below 50 dB, long-term plant activities only on the crest and activity behind the flood bank elicited a low response.
Xodus, 2012	Monitoring of birds as part of the Grimsby River Terminal Project found that noise from construction (including piling) caused only 1 % of the disturbance events observed, with large disturbances mainly caused by the presence of raptors, aircraft and helicopters. The study concluded that percussive piling noise less than 66 dB LA_{max} F gave rise to no disturbance, whilst a mild behavioural response (such as heads up alert, short walk or swimming) was observed to occur in the range of 73 to 81 dB LA_{max} F. Percussive piling noise over 83 dB LA_{max} F was considered likely to evoke a flight response.
Wright *et al.*, 2013	The experimental study intentionally disturbed birds at a high tide roost site, on the south bank of the Humber estuary using an impulsive sound similar to that associated with noise from port and power generation construction such as percussive piling and recorded the behavioural responses. Lapwing appeared to be the species most sensitive to intentional disturbance, while Curlew was the most tolerant. The study recommended that impulsive noise limits should be restricted to < 69.9 dB at the site.
ABPmer , 2002	Disturbance monitoring of waterbirds in the vicinity of construction works (piling and dredging) at the ABP Teignmouth Quay Development concluded that sudden noise in the region of 80 dB appears to elicit a flight response in waders up to 250 m from the source, with levels of approximately 70 dB causing flight or anxiety behaviour in some species.

Species sensitivity and responses

4.10.9 The level of response to potential disturbance stimuli also varies considerably between species with some ducks (such as Shelduck) and larger waders such as Curlew and godwits generally showing stronger responses to disturbance stimuli than smaller waders (such as Turnstone and Dunlin) (Collop *et al*., 2016; Goodship and Furness, 2022; Calladine *et al*., 2006; IECS, 2013; Goodship and Furness, 2019; Davidson and Rothwell, (1993)). A detailed review of the responses and sensitivity of key waterbird species to noise and visual disturbance is presented in Table 28. This includes data on FID which is the distance at which a bird takes flight in response to a perceived danger and is used to help better understand the relative sensitivity of different species to disturbance.

4.10.10 The response to disturbance is also dependant on the previous experience of the birds to disturbance (i.e., level of habituation) as well as a range of other factors such as environmental conditions, their state at the time of the disturbance (e.g., hungry or satiated) and the quality of their alternative foraging sites (Gill *et al.*, 2001a; Mullner *et al.*, 2004; IECS, 2009a; Collop *et al.* 2016).

4.10.11 It is also important to understand potential behavioural responses of disturbance in the context of energetic costs, mortality and population consequences as some disturbance has been shown to have limited adverse effects on waterbirds. For example, Goss-Custard *et al*. (2006) used an individual-based behavioural model to establish critical thresholds for the frequency with which wading birds can be disturbed before they die of starvation. The model was tested on oystercatchers in the Baie de Somme, France, where birds were put to flight by disturbance up to 1.73 times/daylight hour. The modelling results showed that the birds could be disturbed up to~~1.0~~ 1.0 to 1.5 times/h before their fitness was reduced in winters with good feeding conditions (abundant cockles and mild weather) but only up to 0.2 to 0.5 times/h when feeding conditions were poor (scarce cockles and severe winter weather).

4.10.12 Collop *et al.* (2016) looked into the likely consequences of different frequencies of disturbance on various wading birds, using their data on mean flight time and mean total time lost. The authors found that a 5 % reduction in birds' daily available feeding time would be expected to result from responding to between 38 and 162 separate disturbance events (depending on species and tidal stage). The mean cost per individual flight response represented less than a tenth of a per cent of each species' daily energy requirements. The study concluded that the energetic costs of individual disturbance events were low relative to daily requirements and unlikely to be frequent enough to seriously limit foraging time.

Table 28. Summary of evidence of the sensitivity for different key species to noise and visual disturbance stimuli

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**
Shelduck	Shelduck are generally a wary species and are considered particularly sensitive to visual disturbance. Typically, they approach construction works no closer than 300 m and can be affected by visual disturbance up to 500 m away from source (IECS, 2013). Noise disturbance has been reported from 72 dB upwards for Shelduck. However, the species is subject to a high degree of habituation and further exposure to sounds of the same or greater level can lead to no response to stimuli. No response has been recorded for noise levels as high as 88 dB but this is likely to be an extreme 'no response' level and caution should be exercised at receptor levels over 70 dB. Observation of disturbance responses from flood protection works has suggested that Shelduck react to noise in approximately 30 % of exposure events to sudden noise above 60 dB or any noise above 70 dB (IECS, 2013). Goodship and Furness (2022) assessed Shelduck as having a high sensitivity to human disturbance with the range in mean FID from the literature reviewed of 36 m to 250 m as a result of the presence of people on or near the foreshore although FIDs up to 700 m have been recorded. Goodship and Furness (2019) undertook a disturbance literature review and assessed Shelduck as one of the species considered most sensitive to disturbance stimuli with the range in mean FID from the literature reviewed of 148 m to 250 m as a result of the presence of people on or near the foreshore.	Moderate to high
Curlew	Research evidence indicates that Curlew are a cautious species that does not habituate to works rapidly and are also particularly intolerant of people, allowing approach to a range of typically 120-300 m before flushing (IECS, 2013; Lausen *et al*.,2005). Goodship and Furness (2022) assessed Curlew as having a high sensitivity to human disturbance with the with the range in mean FID from the literature reviewed of 38 m to	Moderate to high
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**

	340 m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 140 m and motorised vehicles 188 m. Collop *et al., (*2016) recorded a minimum FID of 88 m and a maximum FID of 570 m (with a mean of 340 m) for this species through experimentally disturbing foraging birds (approaching a total of 39 times) as part of a research study. Goodship and Furness (2019) undertook a disturbance literature review and assessed Curlew as one of the species considered most sensitive to disturbance stimuli with the range in mean FID from the literature reviewed of 38 m to 340 m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 140 m.	
Black-tailed Godwit	Goodship and Furness (2022) found evidence of FIDs between 20 and 150 m as a result of presence of people on or near the foreshore from the literature reviewed in the study. This study also considered this species to have a relatively high tolerance towards human disturbance and appear to be able to habituate to human activities. The study concluded that a buffer zone of 100-200 m was considered appropriate with respect to disturbance in the non-breeding season. Burton *et al*., 2002b also considered overwintering Black-tailed Godwit to be one of the most tolerant species to potential disturbance with a 200 m zone recommended to avoid disturbance to this species (and other waterbirds). Gill *et al.,* 2001b found no evidence that human presence reduced the number of Black-tailed Godwits with the authors finding that the presence of infrastructure (as such as marinas/small ports or footpaths) did not impact the number of godwits supported by the food supply on the adjacent mudflats. This study compared marinas/ports against reference sites that contained similar sediment type and fauna but was far enough away (> 200 m) to be considered unaffected by human activity at a marina. A study investigating human disturbance on Black-tailed Godwit, Curlew and Teal in Co. Cork, Ireland, found that out of the three species, Black-tailed Godwits were the least affected by disturbance events and were likely to move <50 m from their original position when a disturbance event occurred (Sexton, 2017). Specifically on the	Moderate
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**
	Humber Estuary, Percival, 2011 found that Black-tailed godwits in the Humber Estuary appear to be tolerant of a relatively high disturbance environment. Black-tailed Godwits	

	roost at high tide on the North Killingholme Haven Pits which are located in an area adjacent to port infrastructure. There was no evidence found in this study that industrialisation had reduced the ability of the pits to support the godwit population.	
Bar-tailed Godwit	Bar-tailed Godwit can be a relatively disturbance tolerant species that habituates to works rapidly (allowing an approach range of as close as 40-100 m before flushing). However, despite this tolerance, Bar-tailed Godwits can abandon highly disturbed areas in favour of quieter areas to forage and roost. For example, direct observation of disturbance responses by the species to flood defence works found the species did not forage within 200 m of the activity, despite foraging being actively pursued beyond this range, suggesting that they had actively vacated the area close to the works. This is consistent with previous research findings (IECS, 2013). Collop *et al., (*2016) recorded a minimum FID of 32 m and a maximum FID of 225 m (with a mean of 84 m) for this species through experimentally disturbing foraging birds (approaching a total of 92 times) as part of a research study. Goodship and Furness (2019) and Goodship and Furness (2022) undertook disturbance literature reviews and assessed Bar-tailed Godwit as being of moderate sensitivity to disturbance stimuli with the range in mean FID from the literature reviewed of 22 m to 219 m as a result of the presence of people on or near the foreshore.	Moderate
Oystercatcher	Oystercatchers are relatively tolerant of disturbance stimuli and will habituate rapidly to ongoing activity. In undisturbed areas they will often flush at great ranges but in more disturbed locations such as a typical estuary, this figure reduces to typically between approximately 25-200 m dependent upon the stimuli (with people causing the most extreme reaction) (IECS, 2013).	Moderate
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**
	Collop *et al., (*2016) recorded a minimum FID of 30 m and a maximum FID of 228 m (with a mean of 97 m) for this species through experimentally disturbing foraging birds (approaching a total of 147 times) as part of a research study. Goodship and Furness (2019) and Goodship and Furness (2022) undertook disturbance literature reviews and assessed Oystercatcher as being of moderate sensitivity to disturbance stimuli with the range in mean FID from the literature reviewed of 26 m to	

	136 m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 74 m and motorised vehicles a mean FID of 106 m.	
Redshank	Redshank are considered a relatively tolerant species to visual stimuli (and will often approach much closer than 100 m before flushing (sometimes as close as 30-50 m)) but can be sensitive to noise stimuli, They are also considered to habituate to works rapidly (IECS, 2013). Collop *et al., (*2016) recorded a minimum FID of 28 m and a maximum FID of 187 m (with a mean of 80 m) for this species through experimentally disturbing foraging birds (approaching a total of 53 times) as part of a research study. Goodship and Furness (2022) assessed Redshank as having a moderate sensitivity to human disturbance with the range in mean FID from the literature reviewed of 4 to 150 m as a result of the presence of people on or near the foreshore. Goodship and Furness (2019) undertook a disturbance literature review and assessed Redshank as being relatively sensitive to disturbance stimuli with the range in mean FID from the literature reviewed of 24 m to 137 m as a result of the presence of people on or near the foreshore.	Low to moderate
Knot	Knot appear to be a species relatively tolerant to visual stimuli and are considered to habituate relatively rapidly to people although disturbance responses have been recorded within <75-100 m of visual stimuli. However, Knot are considered quite	Low to moderate
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**

	sensitive to noise stimuli, especially in conjunction with visual stimuli. Knot have been recorded foraging close to plant (<50 m) and to workers (>75 m), (IECS, 2013). Collop *et al., (*2016) recorded a minimum FID of 20 m and a maximum FID of 240 m (with a mean of 72 m) for this species through experimentally disturbing foraging birds (approaching a total of 78 times) as part of a research study. Goodship and Furness (2022) assessed Knot as having a moderate sensitivity to human disturbance with the range in mean FID from the literature reviewed of 21 to 74 m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 200 m.	
Mallard	Mallard are considered a relatively tolerant species and will habituate rapidly to activity with most responses considered to occur within 200 m or less. There is very little information on the effects of noise disturbance on Mallard but direct disturbance observation of piling recorded two incidents of Mallards reacting to noise (heads-up response) at levels of 69dB and 71dB although higher noise generation instances c. 80dB had no observed response to loafing and foraging birds in a moderately 'noisy' tidal freshwater site on a busy navigation (IECS, 2013). Goodship and Furness (2019) and Goodship and Furness (2022) undertook disturbance literature reviews and assessed Mallard as being of moderate sensitivity to disturbance stimuli with the range in mean FID from the literature reviewed of 13 m to 236 m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 110 m.	Low to moderate
Dunlin	Dunlin appear to be a species relatively tolerant to visual stimuli and are considered to habituate to people with most responses occurring in <75-100 m of visual stimuli. Dunlin have been recorded foraging extremely closely to plant (<50 m) and >75 m from worker. When foraging, they can be initially disturbed by activity start-up, with a flight response, but will then forage back towards construction works, approaching to within 25 m on	Low
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**
	~~but will then forage back towards construction works, approaching to within 25 m on~~ occasion, before sometimes flushing and moving away again, to repeat the process (IECS, 2013).	

	Collop *et al., (*2016) recorded a minimum FID of 9 m and a maximum FID of 194 m (with a mean of 44 m) for this species through experimentally disturbing foraging birds (approaching a total of 117 times) as part of a research study (IECS, 2013). Goodship and Furness (2019) and Goodship and Furness (2022) undertook disturbance literature reviews with the evidence reviewed suggesting that Dunlin is less sensitive to disturbance than many other waders with the range in mean FID from the literature reviewed of 39 m to 163 m as a result of the presence of people on or near the foreshore.	
Turnstone	Turnstone are considered not very sensitive to noise stimuli and habituate rapidly, especially in conjunction with visual stimuli. They are tolerant of people/workers and plant, allowing approach as close as 30-50 m before flushing. Direct observation of disturbance effects from works found Turnstone responses to be consistent with the expected high tolerance, with birds allowing approach to works to within 10 m before reacting. This was in a highly disturbed area with much public use of the foreshore and of 127 potential disturbance events observed, only 19 caused reaction of which only 3 were caused by the works with trucks flushing Turnstones at between 15-100m. Walkers (and dog walkers in particular) caused the greatest reactions. There was no evidence of reactions to noise, which reached levels above 90 dB due to piling (IECS, 2013). Collop *et al., (*2016) recorded a minimum FID of 5 m and a maximum FID of 75 m (with a mean of 32 m) for this species through experimentally disturbing foraging birds (approaching a total of 40 times) as part of a research study. Goodship and Furness (2019) undertook a disturbance literature review with the evidence suggesting that Turnstone is less sensitive to disturbance than many other waders with the range in mean FID from the literature reviewed of 12.5 m to 39 m as a result of the presence of people on or near the foreshore.	Low
	Evidence on the sensitivity to disturbance stimuli	**Sensitivity level[1]**
	~~the range in mean FID from the literature reviewed of 12.5 m to 39 m as a result of the presence of people on or near the foreshore.~~	
Ringed Plover	Ringed Plover are considered to be tolerant species to disturbance that habituates to	Low

	anthropogenic activities rapidly and appear not to be very sensitive to noise or visual stimuli (often allowing approach as close as 30-50 m to workers/people or plant before flushing) (Lausen *et al*.,2005; IECS, 2013). Research has found that at distances of over 100 m from activity, birds rarely showed any sign of disturbance and appeared often unperturbed when other species in their vicinity were reacting (IECS, 2013). Collop *et al.,* (2016) recorded a minimum FID of 29 m and a maximum FID of 74 m (with a mean of 41 m) for this species through experimentally disturbing foraging birds (approaching a total of 30 times) as part of a research study.	
1. The assigned sensitivity levels have been based on available evidence with respect to responses to disturbance stimuli. For some species a range in sensitivity has been presented where evidence suggests large variations in intraspecific responses due to various factors which could influence sensitivity (such as the type of activity, site specific factors such as habituation, environmental conditions and site fidelity etc). Where information is limited a precautionary sensitivity level has been assigned.		

Review summary

4.10.13 Within the construction site, the level of disturbance stimuli is dependent on the type of activity being undertaken. In general, human presence on or near the foreshore (e.g., walking) is considered to cause greater disturbance than vehicles or watercraft and waterbirds are more easily disturbed by irregular movements than the regular and defined presence of machinery, vessels and other vehicles (IECS, 1997; ABPmer, 2013; McLeod, *et al.* 2013; Guay *et al.* 2014; Glover *et al.* 2015). High level responses to noise (such as dispersal away from marine works) are typically associated with sudden or irregular noise over 70-80 dB (at the receiver (i.e., bird) location not the noise source) (IECS, 2009a; Xodus, 2012; Wright *et al*., 2013; ABPmer, 2002; IECS, 2013).

4.10.14 The specific responses that waterbirds will have to disturbance varies between species as well as between birds of the same species due to a range of factors including the level of habituation and environmental conditions (Gill *et al.,* 2001a; Mullner *et al.,* 2004; IECS, 2009a; Collop *et al.* 2016).

4.10.15 Distances over 300 m have been recorded more occasionally for some sensitive species such as Curlew or Shelduck (IECS, 2013; Collop *et al*. 2016; Goodship and Furness, 2019; Goodship and Furness, 2022). However, evidence from the detailed review above suggests that waterbirds generally show a flight response to anthropogenic activities such as construction and a presence of people (such as workers) on or near the foreshore at distances of typically less than 200 m (and more typically between 20 m and 100 m for certain species such as Turnstone or Dunlin) in areas where birds are likely to be habituated to some extent to disturbance due to existing human activity (ABPmer, 2002; Ruddock and Whitfield, 2007; IECS, 2009a; Wilson, 2009; IECS, 2009b; Dwyer, 2010; IECS, 2013; Ross and Liley, 2014; Goodship and Furness, 2022; Collop *et al*., 2016; Goodship and Furness, 2019; ABPmer, 2013; Gill *et al*., 2001b; Burton *et al.,* 2002b).

Summary of effects (without mitigation)

4.10.16 The bird data suggest that the foreshore immediately fronting the proposed development (i.e. the section of Sector B effectively representing that part of the port's frontage between the Inner Dock entrance and IOT Jetty) is regularly used by 500 to 800 birds for feeding during the winter months (October to March) (see Table A.8 and Figure A.7 in Appendix A of this HRA with the species recorded in the largest numbers in the context of estuary- wide numbers including Black-tailed Godwit, Dunlin, Redshank, Shelduck, Turnstone and Curlew (see Table 29). Other species recorded include Bar- tailed Godwit, Knot, Oystercatcher, Ringed Plover, Teal and Mallard (see Table A.8 and Figure A.7 in Appendix A of this HRA). Figure A.7 of Appendix A of this HRA shows the main areas used by roosting and feeding birds. The highest densities of feeding and roosting birds in Sector B typically occur on the intertidal mudflats in the eastern section of the foreshore fronting Immingham Docks (from the lock gate towards the IOT Jetty). On the mudflat in the 'feeding' area (shown as a blue hatched line) in

Figure A.7, the entire area is used for feeding with SPA qualifying species (such as Black- tailed Godwit, Shelduck, Redshank and Dunlin) moving between different patches in this area.

4.10.17 Very low numbers of waterbirds have been recorded west of the lock gate with flocks of Turnstone (which often show a preference for the sea defence/mud interface in this area) and occasional individuals of Dunlin, Curlew and Redshank recorded. It should also be noted that the foreshore to the east of the IOT jetty within approximately 300 m of the proposed development is also used by very low numbers of birds based on data collected as part of the IOH ornithological monitoring of Sector C (which overlaps with this area). Observations from these surveys has recorded typically less than a total of 10 birds with individuals or small flocks of mainly Redshank, Curlew and Oystercatcher occurring. The winter months is when the largest number of the most SPA qualifying species typically occur on the foreshore in this area. However, it is also noted that passage and summer months can also support important numbers (>1 % of estuary-wide numbers of some species (Section 1.4 of Appendix A of the HRA and Appendix E)

Table 29. The 5-year mean peak (2017/18 to 2021/22) for key species of birds in Sector B and % of the mean peak as a proportion of the current estuary-wide WeBS 5-year mean peak.

Species	Mean Peak	Mean peak as a % of the current estuary-wide WeBS 5-year mean peak [1]
Bar-tailed Godwit	15	< 1 %
Black-tailed Godwit	574	13 %
Curlew†	12	< 1 %
Dunlin	387	2%
Knot	8	< 1 %
Mallard†	5	< 1 %
Oystercatcher†	9	< 1 %
Redshank	171	6 %
Ringed Plover†	5	< 1 %
Shelduck	76	2 %
Teal†	14	< 1 %
Turnstone†	29	12 %

SPA qualifying species highlighted in **bold.** † Species with this symbol are included within the SPA waterfowl assemblage.

1. The latest Humber Estuary WeBS Core Counts 5-year average from 2015/16 to 2019/20 (Frost *et al*., 2021) has been used in this assessment. It should be noted that as a result of COVID- 19 lockdowns, the BTO were unable to undertake comprehensive counts and therefore produce robust data for 2020/21 at an estuary-wide scale and therefore the period 2015/16 to 2019/20 is the most recent 5 years of data available from the BTO.

4.10.18 The evidence reviewed above suggests that the response of waterbirds to disturbance stimuli is relatively limited at distances over 200 m (see Paragraphs 4.10.3 to 4.10.15), particularly in areas subject to already high levels of existing anthropogenic activity (as found in the Port of

Immingham area). This detailed review has considered an extensive amount of research and reviews on FID – the distance at which a bird takes flight in response to disturbance stimuli – as well as studies that have investigated the distance that birds respond to construction activity (or other analogous activities undertaken on the foreshore such as the construction of flood defence works). The use of a 200 m buffer zone has been considered appropriate when considering disturbance effects for a number of assessments and research studies (such as Burton *et al.,* 2002b for waterbirds generally including sensitive species such as Shelduck and also Gill *et al.,* 2001b and Goodship and Furness (2022) with specific respect to Black-tailed Godwit). Specifically for the Humber Estuary, Ross and Liley (2014) stated that based on previous studies, a distance of 200 m '*represents a distance well beyond the distance at which birds are likely to respond'*. This was considered applicable to both tolerant and sensitive species including Shelduck. The study also concluded that the probability of birds being flushed declined with distance (i.e. how far away the activity was from the bird), such that the probability of birds being flushed when activities are beyond 100 m away is very low. The study was focused on recreational activity but also recorded disturbance associated with other activities including industry. As stated in in the review above, recreational disturbance (such as dog walking) is considered to cause greater or similar responses to that of port related disturbance.

4.10.19 The conclusions reached are supported by site specific evidence which suggests that birds continue to feed in the Port of Immingham area within 200 m of relatively noisy port activity and visual stimuli without being displaced and direct observations of construction type activity occurring within the Immingham area. Recent (January to March 2023) disturbance monitoring of the IERRT Ground Investigation ("GI") works confirm that disturbance responses of waterbirds at distances of more than 200 m are limited, specifically for waterbirds on the Immingham foreshore. Bird numbers and distribution on the local foreshore were also broadly comparable to what has been recorded in ongoing waterbird surveys in this area over the last five years. These birds appear to be tolerant of disturbance stimuli. A jack-up barge was used during the GI works which will also be used for the Project during construction; therefore, the construction plant will be similar in terms of visual presence.

4.10.20 Coastal waterbird species (Dunlin, Redshank, Turnstone, Black tailed Godwit, Mallard, Shelduck, Herring Gull, Common Gull and Black-headed Gull) were all recorded actively feeding within 60 m of the jack-up-barge and closer on occasion. In addition, bird numbers and distribution in the eastern section of Sector B (i.e., the foreshore fronting Immingham Docks, from the lock gate towards the IOT Jetty) – where the IEERT development is proposed – over this period when GI works were undertaken were also broadly comparable to what has been recorded in ongoing waterbird surveys in this area over the last five years. Therefore, in summary, coastal waterbirds tolerated the noise and visual stimuli associated with the GI works with only very limited disturbance observed and birds continued to utilise the foreshore in Sector B in similar numbers to previous years.

4.10.21 With specific respect to noise stimuli, Natural England provided advice as part of the consultation for the IERRT project which stated that '*peak levels below 55 dBA can be regarded as not significant, while peak noise levels approaching 70dBA and greater are most likely to cause an adverse effect.' Therefore, levels over 65.5 dBA may cause disturbance to SPA birds. Birds may habituate to regular noise below 70 dBA, but irregular above 50 dBA should be avoided*'. It is also worth noting that visual disturbance associated with anthropogenic activity will in some situations create a disturbance effect before any associated noise starts to have an effect particularly in those species sensitive to visual stimuli (McLeod *et al.,* 2013; Smit and Visser, 1993; IECS, 2013).

4.10.22 Ambient noise levels on the foreshore around the Port of Immingham are shown in Table 14.20 in the Airborne Noise and Vibration assessment set out in Chapter 14 of the ES (Application Document Reference number 8.2.14). Unattended noise measurements over five days in July 2022 suggest a range of 42 to 58 dB *L*Aeq,1hr and the existing range of *L*max noise levels is 48 to 84 dB *L*max. During percussive piling associated with the proposed development, noise levels above 70 dB *L*max are predicted within approximately 1.8 km of the piling rigs and over 80 dB *L*max within approximately 600 m in the absence of noise reducing controls.

4.10.23 The assessment has been based on consideration of a 200 m potential disturbance zone and noise levels provided by Natural England described above.

4.10.24 During construction, disturbance could potentially occur as a result of the following activities:

- Capital dredging:
- Construction of the outer finger pier; and
- Construction of the approach jetty and inner finger pier.

4.10.25 Each one of these activities is described in more detail below. In order to better understand potential zones of disturbance, Figures 9.11, 9.12 and 9.13 to the ES (Application Document Reference numbers 8.3.9 (k), 8.3.9 (l) and 8.3.9 (m)) present a 200 m buffer zone which is considered relatively precautionary in terms of zones of potential effects. The figures also shows MLWS and MLWN so that the extent of foreshore within and outside of these buffers under different tidal states can be better understood.

Capital dredging

4.10.26 Evidence suggests most disturbance events from powered vessels have been recorded within 100 m of the receptor with vessels approaching at faster speeds eliciting higher disturbance (Rodgers and Schwikert, 2002; Burger and Gochfield, 1998; Schwemmer *et al*., 2011; Glover *et al*., 2015). The dredging vessel will be operating at slow speeds when undertaking the capital dredging. Most capital dredging will be undertaken in the vicinity of the outer berths (approximately 100 to 300 m from the lower shore during low water periods). The near shore environment in the Port of Immingham area is already subject to large numbers of vessel movements including maintenance dredging. Given the distance between the intertidal and the main dredge area and expected existing habituation to vessels operating at this distance from the foreshore, disturbance responses by birds are considered likely to be limited by dredging in this area.

4.10.27 Some capital dredging is also required nearer the intertidal (within approximately 50-100 m) and this could occur at any time of year (as a worst case). At these distances it is possible that visual and noise stimuli from the dredger (noise levels between 62 and 71 dB *LA*eq are predicted) could potentially cause disturbance responses. However, this will only be for a short duration of time (<one week) although some localised and intermittent disturbance responses (such as avoidance walking and short flights with birds rapidly resettling and resuming feeding near their original location) is possible. It should be noted that dredging activity is common in this area and to a large extent, the birds will already have become habituated to marine activities. It should also be noted that the existing slope in this area is similar in gradient to the 1 in 4 dredge slope that is proposed for the IERRT project (see Chapter 2 and Chapter 3 of the ES (Application Document Reference numbers 8.2.2 and 8.2.3 respectively)). Furthermore, the amount of material that needs to be dredged within the berth pocket in this location is limited. It is therefore likely that the existing slope will remain stable and will not require further dredging; it is included in the assessment as a worst case.

Construction of the outer finger pier (including connecting pontoon infrastructure)

4.10.28 Noise stimuli caused by the vibro and percussive piling activity and the presence of jack-up or crane barges (causing both potential noise and visual disturbance stimuli) as well as other construction machinery, construction workers and plant activity are all potential sources of disturbance associated with construction of the outer pier.

4.10.29 The construction zone for the outer finger pier including connecting pontoon infrastructure (i.e., outer pontoon and pontoon restraints) will be located approximately 200 m from the lowest part of the foreshore during low water periods (as shown in Figure 9.12 to the ES (Application Document Reference number 8.3.9 (l))). As a consequence, there will at all times be a substantial body of water separating the foreshore from construction activity. This will reduce the perceived threat of disturbance that the birds may have to construction activities. It follows, therefore, that while some disturbance of more sensitive species could occur on the lower shore (when exposed) during this element of the construction, the greater part of the foreshore fronting the Port of Immingham will be at distances of more than 200 m. At this distance, the potential for disturbance responses in even sensitive species will be limited with a large amount of the foreshore still available for feeding at locations and at distances in which responses are unlikely to occur. For example, approximately 92 % of the foreshore at low water between the Inner Dock entrance and the IOT (which is the mudflat habitat fronting the Port of Immingham supporting the highest numbers of birds as shown in Figure 9.10 to the ES (Application Document Reference

number
8.3.9 (j))) will be at distances of more than 200 m from the construction zone.

Construction of the approach jetty and inner pier

4.10.30 The approach jetty construction works will overlap directly with a part of the foreshore located close to the IOT jetty. In addition, the inner finger pier (and associated infrastructure such as the bankseat, linkspan and the inner pontoon) are located within approximately 50 to 200 m of the foreshore (Figure 9.13 to the ES (Application Document Reference number 8.3.9 (m)). Noise stimuli caused by the vibro and percussive piling activity and the presence of jack-up or crane barges (causing both potential noise and visual disturbance stimuli) as well as other construction machinery, construction workers and plant activity are all potential sources of disturbance associated with construction of the approach jetty and inner pier.

4.10.31 Waterbirds present in the area will be habituated to some extent to anthropogenic activities (due to existing port operations) near the foreshore such as vessel and vehicle movements, port related noise and human activity. Nevertheless, construction of the approach jetty and inner pier overlaps with some areas of highest bird use on the foreshore within Sector B, within which the proposed development is located (see Figure A.7 of Appendix A of this HRA) . Avoidance responses or dispersive disturbance events resulting in the redistribution of waterbird flocks to nearby areas may occur relatively frequently for the duration of the construction of these specific elements. On this basis, for species considered more sensitive to bird disturbance such as Curlew and Shelduck (see Table 28)), this could mean that as a worst case a relatively large proportion of the local populations occurring within this area (i.e. recorded in Count Sector B) (as shown in Tables 28 and A.8 of Appendix A of this HRA) could be potentially regularly disturbed or displaced as a result of construction activity associated with the approach jetty and inner finger pier. Less sensitive species such as Dunlin, Turnstone and gulls would be expected to be disturbed to a lesser degree and feed closer to construction activity.

4.10.32 It is not anticipated, however, that birds will be displaced from the local area completely, in that the birds would be expected to redistribute to nearby foreshore in the Immingham area and continue to feed and roost in these alternative locations following dispersal. In this respect, approximately 59 % of the foreshore at low water between the Inner Dock entrance and the IOT (which is the mudflat habitat fronting the Port of Immingham supporting the highest numbers of birds as shown in Figure A.7 of Appendix A of this HRA) will be available at distances of more than 200 m away. In addition, while energetic costs might be increased slightly due to disturbance, the research reviewed above suggests that the energetic costs of individual disturbance events is expected to be relatively low and even relatively frequent disturbance could potentially only cause a small reduction in the time available in a day for feeding. In addition, birds are known to forage nocturnally and might potentially change foraging patterns to utilise the area during nocturnal periods when limited construction activity is occurring.

4.10.33 It should also be noted that this zone of potential disturbance is also very small in the context of the Humber Estuary SPA/Ramsar. The 200 m buffer, for example only represents 0.023 % of the SPA/Ramsar and 0.10% of intertidal foreshore habitats and specifically 0.14 % of mudflat within the SPA. Furthermore, most species occur in numbers that represent only a very small proportion of the estuary-wide populations that typically occur. However, it is acknowledged that a greater proportion of the Humber Estuary population of Black-tailed Godwit, Redshank, Shelduck and Turnstone occur in this area on the foreshore and could be disturbed or temporarily displaced (see Table 29 of this HRA).

4.10.34 It is acknowledged, however, that wintering waterbirds can show a high level of site fidelity and utilise small home ranges (Mander *et al*., 2022). Site faithful waterbirds can sometimes either show reluctance to move to alternative sites or choose the nearest alternative site, despite potentially being of lower quality habitat (e.g., reduced prey resources and also subject to disturbance pressure) when compared to more optimal habitats further away) (Woodward *et al*. 2014; Wright *et al*., 2014; Méndez *et al*, 2018; Burton, 2000). The carrying capacity of adjacent areas of foreshore is inherently difficult to characterise due to the high degree of natural variability (in both prey availability and bird usage) and as such it is recognised that there is a degree of uncertainty as to whether such areas could accommodate displaced birds if this were to occur.

4.10.35 For all the construction activities, it is also recognised that during cold periods, coastal waterbirds are more susceptible to disturbance due to higher energetic costs and greater feeding requirements for thermoregulation. Furthermore, very cold winter weather can cause mudflats and adjacent functionally linked terrestrial habitats used for feeding (such as agricultural land and wet grassland) to freeze. In addition, cold conditions can cause an influx of waterbirds from continental Europe which have flown to Britain to escape from even colder conditions. This can further increase competition for feeding resources in an area. The increased difficulty obtaining enough food and greater energy required for thermoregulation can in some situations cause reduced survival rates and appear to make birds seem more tolerant to disturbance as birds avoid using excess energy reserves (Goss-Custard, *et al*., 2006; JNCC, 2021, RSPB, 2010; Collop *et al*., 2016; Davidson and Rothwell, 1993).

4.10.36 In summary, there is clearly a probability of noise and visual disturbance stimuli occurring during construction. As described above, frequent disturbance at a level which could cause dispersive responses and relatively localised displacement of coastal waterbirds is likely with respect to construction activity associated with the inner finger pier and approach jetty without mitigation. Only temporary and very localised responses, however, are anticipated during the construction of the outer finger pier. Limited responses are anticipated with regard to the capital dredging.

4.10.37 The extent of the effect varies with location and depends on the species present and their sensitivity to noise and visual disturbance stimuli. It is considered that the capital dredge works are unlikely to result in an AEOI. As regards the works on the outer finger pier (including the connecting pontoon infrastructure), inner finger pier and approach jetty the potential for an AEOI cannot be ruled out, particularly for higher sensitivity species (see Table 28). On this basis mitigation has been included.

Mitigation

4.10.38 In order to reduce the level of impact associated with noise and visual disturbance during construction a number of mitigation measures will be implemented. The effectiveness of these measured is described in more detail in Appendix E and specifically with respect to minimising the potential for AEOI on qualifying features in Table 30. These measures, which have been discussed with Natural England, will be secured through the DCO approval process and have been included in the CEMP (Application Document Reference number 9.2) and include the following:

- **Winter marine construction restriction from 1 October to 31 March** (**approach jetty and the inner finger pier):** In order to minimise potential disturbance effects on wintering populations of coastal waterbirds on the foreshore it is proposed that marine construction activity associated with the approach jetty, linkspan, innermost pontoon and the inner finger pier which are all located on or close (within approximately 200 m) to the intertidal mudflat is prohibited during the winter months of October to March (Figure 1.2 of the ES (Application Document Reference number~~8.3.1~~ 8.3.1 (b))). This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A). Construction activity associated with the seaward section of the approach jetty, linkspan, innermost pontoon and inner finger pier can also take place two hours before and two hours after high water, when works are approximately 200 m from the exposed mudflat. A noise suppression system will also be used for piling. The noise suppression system is predicted to reduce noise levels to <70 dB Lmax at distances greater than approximately 200 m from the piling which is in the range of existing background noise levels of operational port activities in the Port of Immingham area;

- **Noise suppression system for piling on the outer finger pier:** It is proposed that a noise suppression system (consisting of a piling sleeve with noise insulating properties) is used during all percussive piling activities for the outer finger pier to reduce noise levels on nearby foreshore areas;
- **Acoustic barrier/screening on marine construction barges**: To limit disturbance during construction, it is proposed that an acoustic barrier/screening is placed on the side of the floating barges closest to the foreshore and construction activity should only be undertaken from

the side of the barge facing away from the foreshore. This will be applied to floating barges used for all construction works including the outer finger pier during the over wintering period;

- **Soft starts:** Using soft starts (as outlined in the marine mammal and fish section above) will allow birds to become more tolerant to piling noise by allowing a more gradual increase in noise levels which will reduce the potential for birds to become startled. This will be applied to all percussive piling activity including the outer finger pier; and

- **Cold weather construction restriction**: Coastal waterbirds are considered particularly vulnerable to bird disturbance during periods of extreme winter weather[21]. On this basis, it is proposed that a temporary cessation of all construction activity is implemented following seven consecutive days of freezing (zero or sub-zero temperature) weather conditions. The restriction should not be lifted until after 24 hours of above freezing temperatures and also that Metrological Office weather forecasts indicate that freezing conditions will not return for the next five days. Similar measures have been implemented for other nearby developments and also as part of the JNCC scheme to reduce disturbance to waterfowl due to shooting activity during severe winter weather.

Assessment of the potential for an AEOI

4.10.39 Based on the evidence provided above with reference to the mitigation measures detailed and the rationale provided in Table 30, the predicted effects are not considered to compromise any of the conservation objectives, and as a consequence, this pathway will not create AEOI on the qualifying interest features.

- [21] It is recognised that during cold periods, coastal waterbirds are more susceptible to disturbance due to higher energetic costs and greater feeding requirements for thermoregulation. Furthermore, very cold winter weather can cause mudflats and adjacent functionally linked terrestrial habitats used for feeding (such as agricultural land and wet grassland) to freeze. In addition, cold conditions can also cause an influx of waterbirds from continental Europe which have flown to Britain to escape from even colder conditions in these areas. This can further increase competition for feeding resources in an area. The increased difficulty obtaining enough food and greater energy required for thermoregulation can in some situations cause reduced survival rates and appear to make birds seem more tolerant to disturbance as birds avoid using excess energy reserves (Goss-Custard, *et al*., 2006; JNCC, 2021, RSPB, 2010; Collop *et al*., 2016; Davidson and Rothwell,1993).

Table 30. The Potential for an AEOI on qualifying species due to potential airborne noise and visual disturbance during construction

Site	Features	Potential AEOI	Justification
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Common Shelduck have been regularly recorded on the foreshore in the area of the proposed development in locally important numbers (i.e. abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak) as summarised in Section 1.4 of Appendix A of this HRA). The largest numbers of this species in the Sector B typically occur in the winter months (Section 1.4 of Appendix A of the HRA and Appendix E). Based on the information provided above, Shelduck are known to be sensitive to anthropogenic disturbance. Without mitigation, evidence suggests that regular disturbance and avoidance responses (i.e., temporary displacement) within a zone of approximately 200 m around construction activities is considered possible. Any responses at greater distances would be expected to only occur infrequently. However, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1 October to 31 March will minimise disturbance during the colder winter months when waterbirds are considered vulnerable to the effects of disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater

			than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A) (which will also be less than existing background noise levels of operational port activities). These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter months with only very limited responses anticipated (involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding quickly in the local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be negligible and temporary with the proposed mitigation and
			the 'distribution of the qualifying features within the site' conservation objective is not considered to be compromised. The predicted disturbance responses are not expected to cause any changes to 'the population of each of the

			qualifying features' conservation objective. This is because any disturbance or displacement during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to impacts to individual energy budgets (i.e., increased energetic costs through disturbance and changes to available feeding resources or prey intake will all be negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
	A143: Red Knot (Non-breeding) *Calidris canutus*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Knot have been regularly recorded in low numbers (i.e., abundances in Sector B representing < 1% of the estuary wide population (based on the WeBS 5-year mean peak) as summarised in Section 1.4 of Appendix A of this HRA). However, this qualifying feature has been screened in on a precautionary basis as they have been regularly recorded on the foreshore in small flocks in some years. Based on the information provided above, Knot are known to be relatively tolerant to anthropogenic disturbance. Evidence suggests this species has been observed in relatively close proximity to potential disturbance stimuli before responses
			are recorded (often within 50-100 m or less of a disturbance sources). Nevertheless, any birds present could be susceptible to potential disturbance and displacement at these distances without mitigation. However, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1 October to 31 March will minimise disturbance during the colder winter

			months when waterbirds are considered vulnerable to the effects of disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A) (which will also be less than existing background noise levels of operational port activities).
			These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter months with only very limited responses anticipated (involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding quickly in local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be

			negligible and temporary with the proposed mitigation and the 'distribution of the qualifying features within the site' conservation objective is not considered to be compromised. The predicted disturbance responses are not expected to cause any changes to 'the population of each of the qualifying features' conservation objective. This is because any disturbance or displacement during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to impacts to individual energy budgets (i.e. increased energetic costs through disturbance and changes to available feeding resources or prey intake will all be
			negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
	A149: Dunlin *Calidris alpina alpina* (Non-breeding)	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Dunlin have been regularly recorded on the foreshore in the area of the proposed development in locally important numbers (i.e., abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak) as summarised in Section 1.4 of Appendix A of this HRA). The largest numbers of this species in the Sector B typically occur in the winter months (Section 1.4 of Appendix A of the HRA and Appendix E). Based on the information provided above, Dunlin are known to be relatively tolerant to anthropogenic disturbance. Evidence suggests this species has been observed in relatively close proximity to potential disturbance stimuli

			before responses are recorded (often within 50-100 m or less of a disturbance sources). Nevertheless, any birds present could be susceptible to potential distance and displacement at these distances without mitigation. However, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1 October to 31 March will minimise disturbance during the colder winter months when waterbirds are considered vulnerable to the effects of disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise
			suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A). These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to

			cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter months with only very limited responses anticipated (involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding quickly in local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be negligible and temporary with the proposed mitigation and
			the '*distribution of the qualifying features within the site*' conservation objective is not considered to be compromised.
			The predicted disturbance responses are not expected to cause any changes to '*the population of each of the qualifying features'* conservation objective. This is because any disturbance or displacement during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to impacts to individual energy budgets (i.e., increased energetic costs through disturbance and changes to available feeding resources or prey intake will all be negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
	A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)	In the context of the site's conservation objectives, there is considered to be no potential	Black-tailed Godwit have been regularly recorded on the foreshore in the area of the proposed development (in abundances in Sector B representing nationally or internationally important numbers as well regionally important numbers i.e., in abundances representing > 10% of the estuary wide population (based on the WeBS 5-year

		AEOI on the qualifying interest feature.	mean peak) as summarised in Section 1.4 of Appendix A of this HRA). The largest numbers of this species in the Sector B typically occur in the winter months (Section 1.4 of Appendix A of the HRA and Appendix E). Based on the information provided above, Black-tailed Godwit have the potential to be sensitive to anthropogenic
			disturbance. Without mitigation, evidence suggests that regular disturbance and avoidance responses (i.e., temporary displacement) within a zone of approximately 200 m around construction activities is considered possible. Any responses at greater distances would be expected to only occur infrequently. However, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1 October to 31 March will minimise disturbance during the colder winter months when waterbirds are considered vulnerable to the effects of disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers,

			noise levels on the intertidal mudflat will be less than 65 dB(A) (which will also be less than existing background noise levels of operational port activities). These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter months with only very limited responses anticipated (involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding quickly in local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be negligible and temporary with the proposed mitigation and the ‘distribution of the qualifying features within the site’ conservation objective is not considered to be compromised. The predicted disturbance responses are not expected to cause any changes to ‘the population of each of the qualifying features’ conservation objective. This is because any disturbance or displacement during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to impacts to individual energy budgets (i.e., increased energetic costs through disturbance and changes to

			available feeding resources or prey intake will all be negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
	A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Bar-tailed Godwit have been recorded in locally important numbers in some years in the area of the proposed development (i.e., in abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5- year mean peak as summarised in Section 1.4 of Appendix A of this HRA). However, count data suggests that during most winter months (as well as passage and summer months), numbers are much lower (representing <1% of the estuary wide population). Based on the information provided above, Bar-tailed Godwit have the potential to be sensitive to anthropogenic disturbance. Without mitigation, evidence suggests that regular disturbance and avoidance responses (i.e., temporary displacement) within a zone of approximately 200 m around construction activities is considered possible. Any responses at greater distances would be expected to only occur infrequently. However, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1 October to 31 March will minimise disturbance during the colder winter months when waterbirds are considered vulnerable to the effects of
			disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances

			greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A) (which will also be less than existing background noise levels of operational port activities). These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter months with only very limited responses anticipated
			(involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding quickly in local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be negligible and temporary with the proposed mitigation and the ‘distribution of the qualifying features within the site’ conservation objective is not considered to be compromised. The predicted disturbance responses are not expected to

			cause any changes to 'the population of each of the qualifying features' conservation objective. This is because any disturbance or displacement during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to impacts to individual energy budgets (i.e., increased energetic costs through disturbance and changes to available feeding resources or prey intake will all be negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
	A162: Common Redshank *Tringa totanus* (Non-breeding)	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Common Redshank have been regularly recorded locally important numbers on the foreshore in the area of the proposed development (i.e., abundances in Sector B representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak as summarised in Section 1.4 of Appendix A of this HRA). Redshank have been recorded in broadly comparable numbers that are considered locally important in most months (Section 1.4 of Appendix A of the HRA and Appendix E), Without mitigation, evidence suggests that regular disturbance and avoidance responses (i.e., temporary displacement) within a zone of approximately 200 m around construction activities is considered possible. However, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1 October to 31 March will minimise disturbance during the colder winter months when waterbirds are considered vulnerable to the

			effects of disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65
			dB(A) (which will also be less than existing background noise levels of operational port activities).. These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter months with only very limited responses anticipated (involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding quickly in local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be

			negligible and temporary with the proposed mitigation and the 'distribution of the qualifying features within the site' conservation objective is not considered to be compromised. The predicted disturbance responses are not expected to cause any changes to 'the population of each of the qualifying features' conservation objective. This is because any disturbance or displacement is during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to
			impacts to individual energy budgets (i.e. increased energetic costs through disturbance and changes to available feeding resources or prey intake will all be negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
	Waterbird assemblage	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	As well as the qualifying species listed above in this table, the foreshore in the vicinity of the proposed development also supports a range of other assemblage species. The rationale for screening in assemblage species is provided in Appendix B of this HRA. On this basis, Curlew, Oystercatcher, Teal, Turnstone, Ringed Plover and Mallard were the assemblage species screened into the assessment and have been recorded in the following abundances in Sector B (as summarised in Section 1.4 of Appendix A of this HRA): • Curlew: Recorded year-round in low numbers (<1 % of of the estuary wide population (based on the WeBS 5-year mean peak); • Oystercatcher: Recorded year-round in low

			numbers (<1 % of of the estuary wide population (based on the WeBS 5-year mean peak); • Teal: Recorded year-round in low numbers (<1 % of of the estuary wide population (based on the WeBS 5-year mean peak); • Turnstone; Recorded in locally or regionally important abundances (i.e representing > 1% and > 10% respectively of the estuary wide population (based on the WeBS 5-year mean peak))
			• Ringed Plover: Occasionally recorded in locally important numbers in some years (i.e., in abundances representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak)).; and • Mallard: Recorded year-round in low numbers (<1 % of of the estuary wide population (based on the WeBS 5-year mean peak); In summary, Teal, Oystercatcher, Mallard and Curlew have only been recorded in low numbers in the context of estuary- wide populations. With specific respect to Turnstone, this species has been recorded in relatively large numbers (as a proportion of SPA numbers) foraging on and near the seawall in the vicinity of the Project. However, this species is considered particularly tolerant to disturbance with evidence suggesting this species has been observed in very close proximity to potential disturbance stimuli before responses are recorded (often within 30-100 m or less of a disturbance sources). Furthermore, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects. The winter marine construction restriction from 1

			October to 31 March will minimise disturbance during the colder winter months when waterbirds are considered vulnerable to the effects of disturbance. This proposed mitigation restricts all construction activity including marine piling within a 200 m zone of exposed foreshore. The noise suppression system will be used for piling undertaken
			outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities. Consequently, piling noise on exposed intertidal in the 200 m zone will also be <70 dB LAmax and in the range of background noise. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A) (which will also be less than existing background noise levels of operational port activities) (which will also be less than existing background noise levels of operational port activities). These mitigation measures are considered effective at preventing waterbirds utilising mudflat habitat in this area from being exposed to close range visual stimuli and loud noise above typical port background levels (which are the types of stimuli which evidence suggests are most likely to cause regular, repeated disturbance and larger responses such as dispersive flights out of the local area). Instead, birds would be expected to be able to continue to feed on mudflat in the footprint of the Project during the winter

			months with only very limited responses anticipated (involving infrequent and mild responses i.e. at worst, very localised flight responses with birds resuming feeding
			quickly in local area). On this basis, any changes to the distribution of birds on the foreshore is expected to be negligible and temporary with the proposed mitigation and the 'distribution of the qualifying features within the site' conservation objective is not considered to be compromised. The predicted disturbance responses are not expected to cause any changes to 'the population of each of the qualifying features' conservation objective. This is because any disturbance or displacement during construction, with the proposed mitigation, is expected to be limited (with waterbirds able to continue feed in the same areas during winter as observed prior to construction). Therefore, the predicted residual effects with the proposed mitigation in place are considered inconsequential with respect to impacts to individual energy budgets (i.e. increased energetic costs through disturbance and changes to available feeding resources or prey intake will all be negligible). On this basis, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success will not occur.
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Summary information with respect to assemblage and individual qualifying species has been provided above in the table.

	at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		

The potential effects of airborne noise and visual disturbance during operation on qualifying species

General scientific context

4.10.40 Operational ports, wherever located, inevitably present as a potential source of disturbance in the coastal environment. Waterbird monitoring work in the vicinity of port locations (such as the Port of Southampton, Port of Mostyn and Port of Immingham) has generally recorded limited evidence of birds on nearby intertidal habitat being disturbed through regular land side port operations with birds often becoming habituated (such as the movement of vehicles, cranes and cargo containers) (ABPmer, 2013; ABPmer, 2015). For example, Cutts (2021) reported that most species of waterbird assemblages utilising estuarine habitats adjacent to major infrastructure (such as power stations, jetties, bridges, port facilities etc) appear to be tolerant and will both roost and forage within less than 50 m of the working infrastructure. Waterbirds have also been recorded regularly feeding under large industrial jetties as well as roosting on jetties and harbour walls.

4.10.41 Disturbance events have also been recorded as part of the ongoing IOH monitoring in the Port of Immingham area since winter 2005/06[22]. This includes any potential disturbance due to operational activities on various jetties (such as the Immingham Oil Terminal (which includes vehicle activity), Western Jetty, Eastern Jetty and Immingham Bulk Terminal). During the surveys the vast majority of the disturbance observed was caused due to either raptors (such as peregrine and sparrowhawk), recreational activities (angling or dog walking) or maintenance work on the seawall. Disturbance was also recorded on several occasions as a result of construction or maintenance work on several of the jetties. No disturbance, however, was recorded as a result of vessel movements or operational activity at or near the berths or jetties.

4.10.42 In general, human presence on the foreshore (e.g., walking) is considered to cause greater disturbance than vehicles (McLeod *et al.,* 2013; Guay *et al.,* 2014; IECS, 2009a). With specific respect to activity associated with commercial operations and works, observations from monitoring and other studies (including specifically on the Humber Estuary), suggests that disturbance responses are typically greater for personnel in the open, compared to when enclosed within a vehicle at the same distances (Cutts*,* 2021). Waterbirds are also considered more likely to habituate to vehicle movements which occur in a more predictable manner and in a spatially limited area compared to more erratic activity (such as quad bikes on the foreshore) (Burton *et al*., 2002b; Natural England, 2017; Cutts *et al.,* 2021).

4.10.43 Disturbance events from powered vessels have been recorded within 100 m of the receptor with vessels approaching at faster speeds eliciting higher disturbance. Predictability and randomness are factors of vessel traffic which can cause variation in waterbird response. Literature suggests that

4.10.27 [22] These surveys have been undertaken twice a month from October to March (see Section 9.3 for further information on these surveys).

large commercial vessels consistently using defined routes (such as ferries or cargo ships) elicit less of a disturbance response than recreational craft which are more unpredictable in terms of speed and course and thus their disturbance potential for birds may be enhanced (Rodgers and Schwikert, 2002; Burger and Gochfield, 1998; Schwemmer *et al*., 2011; Glover *et al*., 2015).Monitoring of potential disturbance due to the movements of vessels berthing at pontoons associated with offshore windfarm Operation and Maintenance (O&M) facilities in several port locations near to mudflats used by waterbirds recorded evidence of some mild and localised disturbance and avoidance although events were generally infrequent with larger disturbance events (causing bird to fly out of the area) only occurring more rarely. Consistent evidence of changes (reductions) in waterbird abundance in the local area which could be linked to the operational activities was not recorded (ABPmer, 2015; ABPmer, 2021).

Summary of effects

4.10.44 Operational disturbance stimuli could occur as a result of Ro-Ro vessel movements. The nearest berth during spring tide periods following completion of the capital dredge will be located approximately 40 to 150 m from intertidal mudflat used by coastal waterbirds, and greater distances away from roosting habitat described in Section 1.4 and Figure A.7 of Appendix A.

4.10.45 The Port of Immingham currently has over 118,000 transiting movements of vessels per year. Additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area on a typical day (six additional Ro-Ro vessel movements per day at the Port of Immingham, as well as tugs) which represents an approximate 3% annual increase in vessel traffic in the local area.

4.10.46 Hundreds of commercial vessel movements take place each year close to the location of the proposed new berths. Commercial vessel activity is, therefore, a relatively constant feature along the Immingham port frontage close to the foreshore – this is particularly the case in relation to vessels using the Eastern Jetty berth which is very close (low tens of metres) to lower shore mudflats. These mudflats are used extensively by feeding waterbirds around the tideline. The Eastern Jetty is a busy liquid bulks berth which regularly receives large vessels. At its eastern termination a floating pontoon also provides berthing for some of the port's tugs. However, as described above in the scientific context section, no disturbance events linked to vessel movements either at the Eastern Jetty or any other berthing facility in the Port of Immingham area has been recorded during the IOH bird surveys.

4.10.47 Disturbance could also occur as a result of people (such as workers) or vehicles on berthing infrastructure (floating pontoons, finger piers, approach jetty, linkspan) near the intertidal. The proposed development will see some activity of workers/personnel on the finger piers during vessel mooring and disembarkation. Outside these periods, movements of pedestrians will be minimal with almost all access to the vessels using motorised vehicles (HGVs and Ro-Ro tractors/trailers).

4.10.48 On a daily basis there will typically be a steady flow of vehicle movements coming and going from the Ro-Ro vessels throughout the day. The vehicle movements will, however, be undertaken at slow speeds (typically <12 miles per hour) and also in a predictable and consistent manner (i.e., producing the same type of visual/noise stimuli each time). Based on the evidence reviewed above, these are all attributes which support habituation and therefore are likely to limit disturbance responses. It should also be noted that many of the existing approach jetties in the Port of Immingham have some vehicular access. The IOT approach jetty in particular has regular vehicle movements with no disturbance associated with this activity recorded during the IOH bird surveys (as described in the general scientific context above).

4.10.49 Regarding engineering and maintenance works, this activity is expected to be limited and only required occasionally.

4.10.50 The level of response that waterbirds will have to the three new berths when operational will be dependent to some extent on the sensitivity they have to anthropogenic disturbance stimuli. For example, species such as Turnstone and Dunlin are typically more tolerant than Shelduck, Curlew and godwits as summarised in Table 28 of this HRA). The evidence presented above, however, suggests that birds are typically less affected by defined regular movements of people or vehicles near the shoreline (as occurs in port environments) than by random movements of people on the foreshore. Discussions with the ornithologists undertaking the bird monitoring has confirmed that all key SPA bird species recorded in the area (Redshank, Dunlin, Turnstone, Curlew, Shelduck and Black-tailed Godwit, Bar-tailed Godwit and Oystercatcher) are regularly recorded foraging <10-20 m of existing jetties in the Immingham area and appear tolerant to activities associated with these jetties.

4.10.51 It is acknowledged, however, that disturbance can occur as result of any human activity irrespective of habituation, if the activity occurs in sufficiently close proximity to a species so as to trigger a responsive reaction. Given that Ro-Ro vessels and human activity associated with operations will be occurring close to the foreshore (such as on the approach jetty), intermittent disturbance responses are, therefore, still possible. This may particularly be the case at first when birds are likely to be less habituated to the new activity or as a response to a more infrequent sporadic type of activity on a structure with which birds are less familiar (such as maintenance works which are likely to be highly infrequent). Responses for most species are expected typically to involve infrequent, mild behavioural responses in a localised area in the vicinity of the pontoon or approach jetty. The responses observed in birds are likely to range from increased vigilance to short flights with birds rapidly resettling and resuming feeding near their original location. More sensitive species could show localised avoidance and larger disturbance events (causing birds to flush and temporarily disperse from the vicinity of the proposed development). That said, rather than dispersing from the area completely, however, it is anticipated that the birds will temporarily redistribute within the local area to feed.

4.10.52 Based on the above, the probability of some disturbance occurring is considered to be high with some disturbance at a level which could cause dispersive responses and potentially short-term and localised displacement of coastal waterbirds. It is expected, however, that birds will become habituated relatively quickly which will limit any longer-term disturbance responses to a relatively localised area around berthing infrastructure. The sensitivity of coastal waterbirds in the area is considered to range from low to moderate depending on the species. This is because even species considered relatively sensitive to disturbance appear to show relatively limited responses to operational stimuli. It is acknowledged, however, that there is some uncertainty with respect to the extent and rate of habituation given the overlap of the berthing infrastructure with the foreshore. Therefore, taking a precautionary approach the potential for an AEOI cannot be ruled out and on this basis mitigation in the form of screening is proposed.

Mitigation

4.10.53 On a precautionary basis, in order to reduce potential visual disturbance stimuli to waterbirds on the foreshore, screening (see Paragraph 4.10.54) will be installed so that movements of workers or vehicles will not be as visible from the foreshore. This measure has been discussed with Natural England and will be secured through the DCO consent. The use of screens is considered likely to be most effective initially during operation when birds are less likely to be as habituated to the new sources of noise and visual disturbance stimuli. Over time as the birds would be expected to become habituated to such disturbance events and as such a phased removal of the screens is proposed after 2 years. This measure has been proposed simply to assist in habituation to the new infrastructure, but in the context of the location of the new berths within the port, it is not actually considered necessary.

4.10.54 Screens (such as fences and other barriers) are a widely used measure to help reduce potential disturbance to coastal waterbirds (Ikuta and Blumstein, 2003; Liley and Tyldesley, 2013; Hockin *et al*., 1992) and has been successfully applied as mitigation to reduce disturbance at a number of operational berthing facilities in port locations located near intertidal waterbird populations (GoBe Consultants Ltd, 2011, ABPmer, 2014; MMO, 2018).

4.10.55 Screening will be installed either side of the linkspan and approach jetty. These screens should be opaque or made out of material that distorts outlines of anthropogenic activity on the infrastructure. It is noted that some gaps might be required in the screens for engineering reasons and to allow for emergency sight lines and access.

4.10.56 Coastal waterbird monitoring will also be undertaken based on the same sectors and approach as the current IOH surveys for the first two years of operation (see Section 1.4 of Appendix A of the HRA). This will include recording any bird disturbance observed during the surveys. The results of these surveys will be summarised as part of an annual report with the data used to help inform the evidence base with respect to this impact pathway in future assessment work.

Assessment of the potential for an AEOI

4.10.57 Based on the evidence provided above with reference to the mitigation measures detailed and the rationale provided in Table 31, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

 Associated British Ports

Table 31. The Potential for an AEOI on qualifying species due to potential airborne noise and visual disturbance during operation

Site	Features	Potential AEOI	Justification
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Disturbance responses during operation are generally expected to be localised given the tolerance that coastal waterbirds typically show to existing port operations, the expected habituation to disturbance stimuli resulting directly from the proposed development that will occur and also considering the screening that will be installed. As a consequence, any change to '*the distribution of the qualifying features within the site'* conservation objective is expected to be negligible. The predicted disturbance responses of waterbirds are considered unlikely to cause any changes to '*the population of each of the qualifying features'* conservation objective. This is because any responses are considered to be relatively limited and will not cause birds to disperse out of the Humber Estuary to another region. Furthermore, based on the magnitude of disturbance effects and also taking into account the proposed mitigation measures, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success is considered highly unlikely.
	A143: Red Knot (Non-breeding) *Calidris canutus*		
	A149: Dunlin *Calidris alpina alpina* (Non-breeding)		
	A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)		
	A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*		
	A162: Common Redshank *Tringa totanus* (Non-breeding)		
	Waterbird assemblage		
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)		
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		

4.11 Disturbance through underwater noise and vibration

The potential effects of underwater noise and vibration during piling on qualifying species

General scientific context

Underwater noise and vibration: implications for fish

4.11.1 Elevated underwater noise and vibration levels during construction activities can potentially disturb fish by causing physiological damage and/or inducing adverse behavioural reactions. A detailed underwater noise assessment has been undertaken for the proposed development (Appendix 9.2 of the ES (Application Document Reference number 8.4.9 (b))).

4.11.2 For most piling activities, the main source of noise and vibration relates to where piles are hammered or vibrated into the ground. Percussive piling involves hammering the pile into the seabed resulting in an impact blow and high levels of noise. Vibro-piling produces lower levels of noise as piles are vibrated into the seabed.

4.11.3 There is a wide diversity in hearing structures in fish which leads to different auditory capabilities across species (Webb *et al*., 2008). All fish can sense the particle motion[23] component of an acoustic field via the inner ear as a result of whole-body accelerations (Radford *et al*., 2012), and noise detection ('hearing') becomes more specialised with the addition of further hearing structures. Particle motion is especially important for locating sound sources through directional hearing (Popper *et al*., 2014; Hawkins *et al*., 2015; Nedelec *et al*., 2016). Although many fish are also likely to detect sound pressure[24], particle motion is considered equally or potentially more important (Hawkins and Popper, 2017).

4.11.4 From the few studies of hearing capabilities in fish that have been conducted, it is evident that there are potentially substantial differences in auditory capabilities from one fish species to another (Hawkins and Popper, 2017). Popper *et al.* (2014) proposed the following three categories of fish which are described below:

- Fish with a swim bladder or air cavities that aid hearing;
- Fish with a swim bladder that does not aid hearing; and
- Fish with no swim bladder.

4.11.5 Sea lamprey *Petromyzon marinus* and River lamprey *Lampetra fluviatilis* fall

1.1.16 [23] Particle motion is a back and forth motion of the medium in a particular direction; it is a vector quantity that can only be fully described by specifying both the magnitude and direction of the motion, as well as its magnitude, temporal, and frequency characteristics.

1.1.17 [24] Pressure fluctuations in the medium above and below the local hydrostatic pressure; it acts in all directions and is a scalar quantity that can be described in terms of its magnitude and its temporal and frequency characteristics.

into the third category as they lack swim bladders and that are sensitive only

to sound particle motion and show sensitivity to only a narrow band of frequencies.

Underwater noise and vibration: implications for grey seal and common seal

4.11.6 Marine mammals are particularly sensitive to underwater noise at higher frequencies and generally have a wider range of hearing than other marine fauna, namely fish (i.e., their hearing ability spans a larger range of frequencies). The hearing sensitivity and frequency range of marine mammals varies between different species and is dependent on their physiology.

4.11.7 The National Oceanic and Atmospheric Administration (NOAA) (2018) provides technical guidance for assessing the effects of underwater anthropogenic (human-made) sound on the hearing of marine mammal species. Specifically, the received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to impulsive and non-impulsive underwater anthropogenic sound sources are provided. These thresholds update and replace the previously proposed criteria in Southall *et al.* (2007) for preventing auditory/physiological injuries in marine mammals. Further recommendations have recently been published regarding marine mammal noise exposure by Southall *et al.* (2019) which complement the NOAA (2018) thresholds and also look at a wider range of marine mammal species.

4.11.8 The NOAA (2018) and Southall *et al.* (2019) thresholds are categorised according to marine mammal hearing groups. According to NOAA (2018) grey and common seals are categorised as phocid pinniped (PW) (earless seals or “true seals”).

4.11.9 There are no equivalent Sound Pressure Level (SPL) behavioural response criteria that would represent the sources of underwater noise associated with the proposed development. Behavioural reactions to acoustic exposure are less predictable and difficult to quantify than effects of noise exposure on hearing or physiology as reactions are highly variable and context specific (Southall *et al*., 2007).

4.11.10 Few studies have documented responses of seals to underwater noise in the field (Cefas, 2020). Tracking studies found reactions of the grey seals to pile driving during the construction of windfarms were diverse (Aarts *et al*., 2017). These included altered surfacing or diving behaviour, and changes in swim direction including swimming away from the source, heading into shore or travelling perpendicular to the incoming sound, or coming to a halt. Also, in some cases no apparent changes in their diving behaviour or movement were observed. Of the different behavioural changes observed a decline in descent speed occurred most frequently, which suggests a transition from foraging (diving to the bottom), to more horizontal movement. These changes in behaviour were on average larger, and occurred more frequently, at smaller distances from the pile driving events, and such changes were statistically significantly different at least up to 36 km from the piling. In addition to changes in dive behaviour, also changes in movement were recorded. There was evidence that on average grey seals within 33 km were more likely to swim away from the pile driving. In some cases, seals exposed to pile-driving at close range, returned to the same area on subsequent trips. This suggests that some seals had an incentive to go to these areas, which was stronger than the deterring effect of the pile-driving.

4.11.11 A telemetry study found no overall significant displacement of common seal during construction of a wind farm in The Wash, south-east England (Russell, 2016). However, during piling, seal usage (abundance) was significantly reduced up to 25 km from the piling activity; within 25 km of the centre of the wind farm, there was a 19 to 83 % (95 % confidence intervals) decrease in usage compared to during breaks in piling, equating to a mean estimated displacement of 440 individuals. This amounts to significant displacement starting from predicted received levels of between 166 and 178 dB re 1 µPa (peak-peak). Displacement was limited to piling activity; within 2 hours of cessation of pile driving, seals were distributed as per the non-piling scenario.

4.11.12 Koschinski *et al.* (2003) conducted a playback experiment on harbour seals in which the recorded sound of an operational wind turbine was projected via a loudspeaker, resulting in modest displacement of seals from the source (median distance was 284 vs 239 m during control trials). Two further studies of ringed seals (*Phoca hispida*), which are closely related to both harbour and grey seals, have observed behaviour in response to anthropogenic noise: Harris *et al*., (2001) reported animals swimming away and avoidance within ~150 m of a seismic survey, while Moulton *et al*., (2003) found no discernible difference in seal densities in response to construction and drilling for an oil pipeline.

4.11.13 Another way to evaluate the responses of marine mammals and the likelihood of behavioural responses is by comparing the received sound level against species specific hearing threshold levels. Further information on the dB_{ht} metric and its limitations is provided in Section 7.3 of Appendix ~~9.2~~ 9.2 of the ES (Application Document Reference number 8.4.9 (b)).

Summary of effects

Effects on fish

4.11.14 The distances at which potential mortality/injury and behavioural effects in fish are predicted to occur as a result of the percussive piling and vibro-piling associated with the development are included in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.15 The predicted range (R) at which the Popper *et al.* (2014) quantitative instantaneous peak SPL thresholds for pile driving are reached indicates that there is a risk of mortality, potential mortal injury or recoverable injury within 10 m in fish with no swim bladder (lamprey). For vibro-piling, there is a risk of mortality, potential mortal injury or recoverable injury within 1 m in fish with no swim bladder.

4.11.16 The calculator developed by the United States National Marine Fisheries Service (NMFS) (NMFS, 2021) as a tool for assessing the potential effects to fish exposed to elevated levels of underwater sound produced during pile driving was used to calculate the range at which the cumulative SEL thresholds for pile driving (Popper *et al*., 2014) are reached. Based on the assumptions highlighted in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)), there is predicted to be a risk of mortality and potential mortal injury within 15 m in fish with no swim bladder (lamprey). The distance at which the received level of noise is within the limits of the recoverable injury threshold is within 23 m in fish without a swim bladder. For vibro-piling, there is predicted to be a risk of mortality and potential mortal injury within 8 m in fish with no swim bladder. The distance at which the received level of noise is within the limits of the recoverable injury threshold is within 12 m in fish without a swim bladder.

4.11.17 Given the mobility of fish, any individuals that might be present within the localised areas associated with potential mortality/injury during pile driving activities would be expected to easily move away and avoid harm. Furthermore, the area local to the proposed development is not considered a key foraging, spawning or nursery habitat for sea lamprey or river lamprey and, therefore, this localised zone of injury is unlikely to result in effect.

4.11.18 The range at which the Hawkins *et al*. (2014) quantitative instantaneous peak SPL behaviour thresholds for percussive pile driving are reached indicates that there is a risk of a behavioural response in fish within around 1.6 km from the impact piling. Behavioural reactions during impact piling are, therefore, anticipated to occur across 67 % width of the Humber Estuary at low water and 46 % of the estuary width at high water, potentially creating a partial temporary barrier to fish movements. For vibro-piling, there is a risk of a behavioural response in fish within around 1.1 km from the source which equates to 48 % of the width of the Humber Estuary at low water and 33 % of the estuary width at high water.

4.11.19 However, the scale of the behavioural response is partly dependent on the hearing sensitivity of the species. Fish without a swim bladder (e.g., river lamprey) are likely to show only very subtle changes in behaviour in this zone.

4.11.20 The scale of the behavioural effect is also dependent on the size of fish (which affects maximum swimming speed). Smaller fish, juveniles and fish larvae swim at slower speeds and are likely to move passively with the prevailing current. Larger fish are more likely to actively swim and, therefore, may be able to move out of the behavioural effects zone in less time, although it is recognised that the movement of fish is very complex and not possible to define with a high degree of certainty.

4.11.21 The effects of piling noise on fish also need to be considered in terms of the duration of exposure. It is anticipated that piling noise will take place over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed). However, piling will not take place continuously over that period as there will be periods of downtime, pile positioning and set up.

4.11.22 The piling works will be undertaken Monday to Sunday). The maximum impact piling scenario is for 4 tubular piles to be installed each day from either front (i.e., the land and water), involving approximately 180 minutes of impact piling per day and 20 minutes of vibro piling per day. It should be noted, however, that in terms of potential disturbance, four piles a day is very much a worst case scenario. Either way, there will clearly be significant periods over a 24-hour period when fish will not be disturbed by any piling noise. The actual proportion of piling is estimated to be at worst around 14 % (based on 180 minutes of impact piling and 20 minutes of vibro piling each working day) over any given construction week. In other words, any fish that remain within the predicted behavioural effects zone at the time of piling will be exposed a maximum of up to 14 % of the time on the assumption that four piles are driven in a given day – which is considered to be unlikely.

4.11.23 It is also important to consider the noise from piling against existing background or ambient noise conditions. The wider local area in which the construction will take place already experiences regular vessel operations and ongoing maintenance dredging, and, therefore, fish are likely to be habituated to a certain level of anthropogenic background noise.

4.11.24 Applying the standard impact assessment criteria, the probability of occurrence of underwater noise disturbance during piling is high. Given the uncertainty regarding the actual timing and programme for the piling, this assessment has been undertaken on the basis that the works could take place at any time of year as a worst case. There is the potential for piling to occur during the sensitive migratory periods of lamprey in the Humber Estuary. Both river and sea lamprey moving between the Humber Estuary and the sea could potentially pass near to the proposed marine works (with a risk of injury potentially occurring in very close proximity to the piling activity). In addition, behavioural response (e.g., displacement) or acoustic barrier could occur over the entire width of the Humber Estuary at low water and the majority of the estuary width at high water.

4.11.25 Although the effect of underwater noise and vibration from piling works is temporary and of short duration, there is uncertainty with respect to the timing of the works which could in the worst case scenario coincide with the migration periods of river and sea lamprey. The potential for an AEOI cannot, therefore, be ruled out and on this basis mitigation has been proposed.

Effects on grey seal and common seal (injury)

4.11.26 The distances at which permanent threshold shifts (PTS) and TTS effects in grey seals and common seals that are predicted to occur during impact piling and vibro-piling for the proposed development are included in

Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.27 There is predicted to be a risk of instantaneous PTS and TTS in seals within 5 m and 12 m respectively from the source of the percussive piling noise.

4.11.28 If the propagation of underwater noise from impact piling were unconstrained by any boundaries, the maximum theoretical distance at which the predicted cumulative SEL weighted levels of underwater noise during impact piling is within the limits of PTS and TTS in seals of 0.9 km and 6.5 km respectively. The maximum theoretical distance at which the predicted cumulative SEL weighted levels of underwater noise during vibro piling is within the limits of PTS and TTS in seals of 44 m and 581 m respectively.

4.11.29 Assuming a worst case of a lower swimming speed of 1.5 m/s for all marine mammal species (including both adults and juveniles), the maximum time that would take a grey seal or common seal to leave the centre of the cumulative SEL weighted PTS and TTS injury zones during impact piling is estimated to be 10 minutes and 1.2 hours respectively. This is less than 5 % of the time that would be required for an injury to occur and, therefore, assuming seals avoid the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during impact piling.

4.11.30 Assuming a worst case of a lower swimming speed of 1.5 m/s for all marine mammal species (including both adults and juveniles), the maximum time that would take a grey seal or common seal to leave the centre of the cumulative SEL weighted PTS and TTS injury zones during vibro piling is estimated to be 29 seconds and 6 minutes respectively. This is less than 0.4 % of the time that would be required for an injury to occur and, therefore, assuming seals evade the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during vibro piling.

4.11.31 The results indicate that if grey seals or common seals present in the Humber Estuary were to remain stationary within the cumulative SEL distances from the source of piling over a 24 hour period, it could result in temporary and/or permanent hearing injury. However, it is considered highly unlikely that any individual seal will in fact stay within this “injury zone” during the piling operations.

4.11.32 Impact piling is predicted to have the potential to cause instantaneous injury effects within close proximity to the activity. Assuming seals avoid the cumulative SEAL weighted PTS and TTS injury zone, they are not considered to be at risk of any permanent or temporary injury during piling. The potential for an AEOI cannot, however, be ruled out and on this basis mitigation has been proposed.

Effects on grey seal and common seal (disturbance)

4.11.33 Impact piling is predicted to have the potential to cause strong behavioural responses over a wider area although this will be constrained to within the outer section of the Humber Estuary between Hull and Cleethorpes.

4.11.34 Any grey seal or common seal present are likely to avoid the area. Behavioural responses could include movement away from a sound source, aggressive behaviour related to noise exposure (e.g., flipper slapping, abrupt directed movement), visible startle response and brief cessation of reproductive behaviour (Southall *et al*., 2007). Mild to moderate behavioural responses of any individuals within these zones could include movement away from a sound source and/or visible startle response (Southall *et al*., 2007).

4.11.35 Any evasive response could also lead to the potential temporary avoidance of the outer section of the Humber Estuary between Hull and Cleethorpes. There is therefore potential for the restriction of the movements of grey seal and common seal upstream and downstream (i.e., a barrier to movements). The Humber Estuary upstream of the proposed development is not known to be used as a breeding site for seals (with the nearest known breeding colony located over 25 km away at Donna Nook at the mouth of the estuary). However, seals are frequently recorded foraging in the Humber Estuary. Any barrier to movements causing by the noise during piling, however, would be temporary with significant periods during a 24-hour period when no piling will be undertaken (see below). This of itself will allow the unconstrained movements of seals through the Humber Estuary. Seals are also highly mobile and can undertake wide ranging seasonal movements over several thousand kilometres (McConnell *et al.,* 1999; Carter *et al.,* 2020; Russel, 2016). Seals tagged at Donna Nook were recorded undertaking wide ranging movements in the outer Humber Estuary and approaches as well as more widely in the North Sea (Russel, 2016). Therefore, seals are likely to be able to exploit a much wider area for foraging during any piling activity.

4.11.36 The behavioural effects of piling noise on grey seal and common seal also need to be considered in terms of the duration of exposure. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed). Piling will not take place continuously over that period as there will be periods of downtime, pile positioning and set up.

4.11.37 The piling works will be undertaken Monday to Sunday. At present, the maximum impact piling scenario is for 4 tubular piles to be installed each day from either front (i.e., the land and water), involving approximately 180 minutes of impact piling per day and 20 minutes of vibro piling per day. It should be noted, however, that in terms of potential disturbance, four piles a day is very much a worst case scenario. Either way, there will clearly be significant periods over a 24-hour period when seals will not be disturbed by any piling noise. The actual proportion of impact piling is estimated to be at worst around 14 % (based on 180 minutes of impact piling and 20 minutes of vibro piling each working day) over any given construction week. In other words, any seals that remain within the predicted behavioural effects zone at the time of percussive piling will be exposed a maximum of up to 14 % of the time on the assumption that four piles are driven in a given day – which is considered to be unlikely.

4.11.38 It is also important to consider the noise from piling against existing background or ambient noise conditions. The area in which the construction will take place already experiences constant vessel operations and ongoing maintenance dredging, and, therefore, marine mammals are likely to be habituated to a certain level of anthropogenic background noise.

4.11.39 The behavioural effects of underwater noise and vibration from piling works would be temporary and of short duration. Seals are also highly mobile and wide ranging, and therefore are likely to be able to exploit other areas for foraging during piling. It is therefore considered that behavioural effects on seals during the piling works are unlikely to result in an AEOI.

Mitigation

4.11.40 In order to reduce the level of impact associated with underwater noise and vibration on fish and seals during construction, the following mitigation measures will be implemented during piling (see the CEMP (Application Document reference number 9.2)). These measures, which have been discussed with Natural England, will be secured through the DCO consent and include the following:

- **Soft start:** The gradual increase of piling power, incrementally, until full operational power is achieved will be used as part of the piling methodology. This will give fish and marine mammals the opportunity to move away from the area before the onset of full impact strikes. The duration of the soft start is proposed to be 20 minutes in line with the JNCC piling protocol [25];

- **Vibro piling**: Vibro piling is proposed to be used where possible (which produces lower peak source noise levels than percussive piling). This will result in less displacement and a reduced acoustic barrier compared to percussive piling. The outcomes of the underwater noise assessment indicate that during vibro-piling, more than 50% width of the estuary will be available during all states of the tide for migratory fish and marine mammals to move freely;

- **Seasonal piling restrictions:** During percussive piling the following further restrictions are proposed:
  - No percussive piling is to take place within the waterbody between 1 April and 31 May inclusive in any calendar year. This will minimise the potential impact on the greatest number of different migratory fish in the Humber Estuary, including lamprey, in accordance with the periods identified in Section

[25] JNCC (2010). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise.

1.3 of Appendix A of this HRA and Table 9.16 in Chapter 9 (Application Document Reference number 8.2.9), and also the more vulnerable earlier life stages of a number of migratory fish species[26]. This restriction does not apply to percussive piling that can be undertaken outside the waterbody at periods of low water[27].

  - The duration of percussive piling is to be restricted within the waterbody from 1 June to 30 June and 1 August to 31 October inclusive in any year to minimise the impacts on fish migrating through Humber Estuary during this period such as silver eels, river lamprey and returning adult Atlantic salmon. This will limit the exposure of these species to underwater noise. The maximum amount of percussive piling permitted within any 4-week period must not exceed 140 hours where a single piling rig is in operation or a total of 196 hours where two or more rigs are in operation. The measurement of time during each work-block described above must begin at the start of each timeframe, roll throughout it, then cease at the end, where measurement will begin again at the start of the next timeframe, such process to be repeated until the end of piling works. This restriction does not apply to percussive piling that can be undertaken outside the waterbody at periods of low water. This approach has been developed in consultation with the MMO and Cefas.

- **Night time piling restriction:** The upstream migration of river lamprey takes place almost exclusively at night (Environment Agency, 2013). No percussive piling is to take place within the waterbody between 1 March to 31 March, 1 June to 30 June and 1 August to 31 October inclusive after sunset and before sunrise on any day. The restriction covering the period 1 August to 31 October will specifically benefit the nocturnal migratory periods of lamprey and will limit their exposure to underwater noise. Percussive piling operations that have already been initiated will, however, be completed where an immediate cessation of the activity would form an unsafe working practice. This restriction does not apply to percussive piling that can be undertaken outside the waterbody at

[26] Spring is the peak period when Atlantic salmon and sea trout smolts migrate downstream to the sea and it is also the peak migration period for European eel elvers moving into the estuary. In addition, it is the period when allis shad move into estuaries and when sea lamprey and twaite shad gather in estuaries and move up to spawn. It is also the period when the highest densities of smelt are present in the Humber Estuary.

[27] The force generated by piling outside the waterbody will be exerted on the ground at that location. The sound waves can travel outwards through the seabed or be reflected from deeper sediments. As these waves propagate, sound will also “leak” upwards contributing to the airborne sound wave. The underwater noise from piling outside the waterbody will, therefore, be considerably reduced (and negligible in scale) as a result of absorption of the sound by the ground and air, the interaction with the ground surface (reflection and scattering), and the interaction with and transmission through the ground.

periods of low water which will limit the potential effects of underwater piling noise on the nocturnal movements of river lamprey.

- **Marine Mammal Observer**: In addition, in order to further reduce the significance of the impact to marine mammals the JNCC "Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals during piling" (JNCC, 2010) will be followed during percussive piling. The key procedures highlighted in this document include the following:
    - Establishment of a 'mitigation zone' of 500 m from the piling locations, prior to any percussive piling. Within this mitigation zone, observations of marine mammals will be undertaken by a trained member of the construction team using marine mammal identification resources;
    - 30 minutes prior to the commencement of percussive piling, a search should be undertaken by the Marine Mammal Observer to determine that no marine mammals are within the mitigation zone. Percussive piling activity should not be commenced if marine mammals are detected within the mitigation zone or until 20 minutes after the last visual detection;
    - During percussive piling, the Marine Mammal Observer should observe the mitigation zone to determine that no marine mammals are within this area. Construction workers will be alerted if marine mammals are identified, and piling will cease whilst any marine mammals are within the mitigation zone. Piling can recommence when the marine mammal exits the mitigation zone and there is no further detection after 20 minutes; and
    - If there is a pause in percussive piling operations for any reason over an agreed period of time, then another search (and soft-start procedures for piling) should be repeated before activity recommences. If, however, the mitigation zone has been observed while piling has ceased and no marine mammals have entered the zone, piling activity can recommence immediately.

Assessment of the potential for an AEOI

4.11.41 Based on the evidence provided above with reference to the mitigation measures detailed and the rationale provided in Table 32, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 32. The Potential for an AEOI on qualifying species due to potential underwater noise and vibration during piling

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	S1095: Sea lamprey *Petromyzon marinus*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Based on the information highlighted above, underwater noise levels during piling have the potential to result in potential injury/mortality in lamprey species within a relatively localised area around the piling activity and behavioural reactions over a larger area. However, piling in the most sensitive period for migrating sea lamprey will be avoided as a result of the proposed piling restriction mitigation with the potential for injury effects on sea lamprey, therefore, considered to be limited. On this basis, underwater noise effects on sea lamprey during piling is considered unlikely to causes changes to *'The populations of qualifying species'* conservation objective. With the proposed mitigation measures in place, changes to the '*distribution of qualifying species within the site'* conservation objective is also considered unlikely as sea lamprey would be expected to continue to migrate through the estuary.
	S1099: River lamprey *Lampetra fluviatilis*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Based on the information highlighted above, underwater noise levels during piling have the potential to result in potential injury/mortality in lamprey species within a relatively localised area around the piling activity and behavioural reactions over a larger area. However, a seasonal restriction on piling at night will help minimise the potential for injury effects to river lamprey. On this basis, underwater noise effects on river lamprey during piling is considered unlikely to causes changes to
			'The populations of qualifying species' conservation objective.

			With the proposed mitigation measures in place, changes to the '*distribution of qualifying species within the site*' conservation objective is also considered unlikely as river lamprey would be expected to continue to migrate through the estuary.
	S1364: Grey seal *Halichoerus grypus*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Based on the information highlighted above, underwater noise might cause some temporary changes to the movement patterns of foraging grey seals with piling causing avoidance responses and intermittent barrier effects during piling operations. Therefore, short term changes in the local distribution of grey seals could occur but no permanent changes in the overall distribution of grey seals in the region will occur. On this basis, the *'distribution of qualifying species within the site'* conservation objective will therefore not be compromised. Potential injury or lethal effects to seals would be expected to be restricted to a very localised area in the direct vicinity of piling operations. However, with the proposed mitigation in place, the potential for injury effects on seals is considered to be limited. On this basis, underwater noise effects on grey seals during piling is considered unlikely to causes changes to '*The populations of qualifying species'* conservation objective.
Humber Estuary Ramsar site	Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Summary information with respect to the grey seal feature has been provided above in the table.

	breeding site on the east coast.		
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	Summary information with respect to lamprey features has been provided above in the table.
The Wash and North Norfolk Coast	1365: Harbour seal *Phoca vitulina*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the	It is acknowledged that there could be potentially connectivity between the Wash and North Norfolk Coast SAC and the Humber Estuary with respect to common seal movements. Common seals have been recorded foraging over 200 km from haul out sites outs including from sites in the Wash (Tollit *et al.*1998; Sharples *et al.,* 2008; Sharples *et al.,* 2012). The Wash and North Norfolk Coast SAC is located
		qualifying interest feature.	over 75 km from the proposed development. However, evidence suggest that harbour seals typically forage within 40-50 km of their haul out sites (SCOS, 2022) which is reflected in high predicted at-sea densities of common seals in the Wash and along the North Norfolk and Lincolnshire coasts and much lower predicted densities in the Humber Estuary or north of Spurn Point (Carter *et al.,* 2020). On this basis, the Immingham area is not considered to be key foraging habitat for common seals of the Wash and North Norfolk Coast SAC population although it is acknowledged that it's possible that individuals from this population could infrequently forage in this area.

			Based on the information highlighted above, any potential behavioural zone of influence associated with underwater noise will not be in an area considered part of the core range of common seals of the Wash and North Norfolk Coast SAC population and the '*distribution of qualifying species within the site'* conservation objective will therefore not be compromised. Potential injury or lethal effects to seals would be expected to be restricted to a very localised area in the direct vicinity of marine piling operations. However, with the proposed mitigation in place, the potential for injury effects on seals is considered to be limited. On this basis, underwater noise effects on grey seals during marine piling is considered unlikely to causes changes to *'The populations of qualifying specie*s' conservation objective.

The potential effects of underwater noise and vibration during capital and maintenance dredging and disposal as well as operational vessel movements on qualifying species

General scientific context

4.11.42 As described in Paragraph 4.11.1, elevated underwater noise and vibration levels during construction activities can potentially disturb fish and marine mammals by causing physiological damage and/or inducing adverse behavioural reactions. A detailed underwater noise assessment has been undertaken for the proposed development (Appendix 9.2 of the ES (Application Document Reference number 8.4.9 (b))).

4.11.43 Scientific evidence on this impact pathway is provided in Paragraphs 4.11.3 to 4.11.5 in relation to lamprey and in Paragraphs 4.11.6 to 4.11.13 in relation to marine mammals (grey seal and common seal).

4.11.44 The dredging process involves a variety of sound generating activities which can be broadly divided into sediment excavation, transport and placement of the dredged material at the disposal site (CEDA, 2011; WODA, 2013; Jones and Marten, 2016). For most dredging activities, the main source of sound relates to the vessel engine noise.

Summary of effects: Capital dredging

4.11.45 The dredging requirements for the proposed development will involve the use of a backhoe dredger and trailing suction hopper dredger (TSHD).

4.11.46 The dredgers are anticipated to generate SLs of up to 188 dB re 1 μPa m (CEDA, 2011). Capital dredge operations will be continuous (24/7) over the programme of dredging.

Effects on fish

4.11.47 The worst case source level (SL) generated by capital dredging is below the Popper *et al*. (2014) quantitative instantaneous peak SPL and cumulative SEL thresholds for pile driving, which indicates that there is no risk of mortality, potential mortal injury or recoverable injury in all categories of fish even at the very source of the dredger noise. This appears to correlate with the Popper *et al*. (2014) recommended qualitative guidelines for continuous noise sources which consider that the risk of mortality and potential mortal injury in all fish is low in the near, intermediate and far-field.

4.11.48 According to Popper *et al.* (2014), the risk of recoverable injury is considered lower for fish with no swim bladder (lamprey) compared to fish where the swim bladder is involved in hearing (e.g., herring). For the latter group whereby a cumulative noise exposure threshold is recommended (170 dB rms for 48 h), the distance at which recoverable injury is predicted as a result of the capital dredging is 10 m, and therefore the distance to recoverable injury in lamprey is less than 10 m.

4.11.49 Popper *et al*. (2014) advise that there is a moderate risk of temporary threshold shifts (TTS) occurring in the nearfield (i.e., tens of metres from the source) in fish with no swim bladder (lamprey) and a low risk in the intermediate and far-field. There is a greater risk of TTS in fish where the swim bladder is involved in hearing (e.g., herring) when a cumulative noise exposure threshold is recommended (158 dB rms for 12 h). The distance at which TTS is predicted in these fish as a result of the capital dredging is 46 m and therefore the distance to TTS in lamprey is less than 46 m.

4.11.50 Popper *et al.* (2014) guidelines suggest that there is considered to be a moderate risk of potential behavioural responses occurring in the nearfield (i.e., tens of metres from the source) for fish species with no swim bladder (lamprey). At intermediate distances (i.e., hundreds of metres from the source), there is considered to be a moderate risk of potential behavioural responses in all fish and in the farfield (i.e., thousands of metres from the source) there is considered to be a low risk of a response in all fish.

4.11.51 Overall, there is considered to be a low risk of any injury in lamprey as a result of the underwater noise generated by capital dredging. The level of exposure will depend on the position of the fish with respect to the source, the propagation conditions, and the individual’s behaviour over time. However, it is unlikely that a fish would remain in the vicinity of a dredger for extended periods given the distances at which recoverable injury or TTS are predicted in lamprey as a result of the capital dredging, as explained in Paragraph 4.11.49. Behavioural responses are anticipated to be spatially negligible in scale and lamprey will be able to move away and avoid the source of the noise as required. Furthermore, the period of dredging will be short term (approximately 80 days (11 weeks) in total). Based on the above considerations, the effect of underwater noise on river and sea lamprey due to dredging and disposal activities is considered to be negligible.

Effects on grey seal and common seal

4.11.52 The distances at which PTS, TTS and behavioural effects in marine mammals that occur in the study area are predicted to occur as a result of the capital dredging and movements to and from the disposal sites associated with the proposed development are included in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.53 NOAA’s user spreadsheet tool (NOAA, 2021) has been used to predict the range at which the weighted cumulative SEL acoustic thresholds (NOAA, 2018) for PTS and TTS are reached during the proposed dredging and disposal activity based on the assumptions highlighted in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.54 There is predicted to be no risk of PTS in seals and the risk of TTS is limited to within 12 m from the capital dredging activity.

4.11.55 Overall, there is not considered to be any risk of injury or significant disturbance to grey seal from the capital dredging activities that are proposed at the Port of Immingham.

4.11.56 Hearing damage is unlikely to occur and the main effect that could be expected in the vicinity of the dredgers would be short-term mild behavioural avoidance. Based on these factors, the effect of underwater noise on grey seal due to dredging and disposal activities is considered to be negligible.

Summary of effects: Maintenance dredging

4.11.57 The level of maintenance dredging and disposal required at IERRT during the operational phase is anticipated to be required around three to four times a year (though this will be dependent on a range of factors - see Chapter 3 of the ES (Application Document Reference number 8.2.3)).

4.11.58 The frequency and volume of material deposited at the disposal site from each load will not change compared with current maintenance dredging activities as the same plant and methods are proposed to be used. Furthermore, the volume of material that will need to be maintenance dredged from the IERRT berth pocket will be lower than the volumes of capital dredge material.

4.11.59 In this context maintenance dredging, is already an ongoing activity in the main navigation channel and berths at the Port of Immingham and forms part of the baseline soundscape of the estuary. Underwater noise impacts associated with maintenance dredging and dredge disposal as a result of the proposed development are therefore within the range of existing ambient levels in this part of the Humber Estuary.

4.11.60 TSHD is the method that is predominantly used for existing maintenance dredge activities within the Port of Immingham and its approaches and will continue to be used in the future.

4.11.61 Maintenance dredging by TSHD is anticipated to generate SLs of up to 188 dB re 1 µPa m (CEDA, 2011). Continuous (24/7) noise generation from maintenance dredging operations has been assumed and as such, provides a precautionary assessment.

Effects on fish

4.11.62 The worst case source level (SL) generated by maintenance dredging is below the Popper *et al*. (2014) quantitative instantaneous peak SPL and cumulative SEL thresholds for pile driving, which indicates that there is no risk of mortality, potential mortal injury or recoverable injury in all categories of fish even at the very source of the dredger noise. This appears to correlate with the Popper *et al*. (2014) recommended qualitative guidelines for continuous noise sources which consider that the risk of mortality and potential mortal injury in all fish is low in the near, intermediate and far-field.

4.11.63 According to Popper *et al.* (2014), the risk of recoverable injury is considered lower for fish with no swim bladder (lamprey) compared to fish where the swim bladder is involved in hearing (e.g., herring). For the latter group whereby a cumulative noise exposure threshold is recommended (170 dB rms for 48 h), the distance at which recoverable injury is predicted as a result of the maintenance dredging is 10 m, and therefore the distance to recoverable injury in lamprey is less than 10 m.

4.11.64 Popper *et al*. (2014) advise that there is a moderate risk of temporary threshold shifts (TTS) occurring in the nearfield (i.e., tens of metres from the source) in fish with no swim bladder (lamprey) and a low risk in the intermediate and far-field. There is a greater risk of TTS in fish where the swim bladder is involved in hearing (e.g., herring) when a cumulative noise exposure threshold is recommended (158 dB rms for 12 h). The distance at which TTS is predicted in these fish as a result of the maintenance dredging is 46 m and therefore the distance to TTS in lamprey is less than 46 m.

4.11.65 Popper *et al.* (2014) guidelines suggest that there is considered to be a moderate risk of potential behavioural responses occurring in the nearfield (i.e., tens of metres from the source) for fish species with no swim bladder (lamprey). At intermediate distances (i.e., hundreds of metres from the source), there is considered to be a moderate risk of potential behavioural responses in all fish and in the farfield (i.e., thousands of metres from the source) there is considered to be a low risk of a response in all fish.

4.11.66 Overall, there is considered to be a low risk of any injury in lamprey as a result of the underwater noise generated by maintenance dredging. The level of exposure will depend on the position of the fish with respect to the source, the propagation conditions, and the individual's behaviour over time. However, it is unlikely that a fish would remain in the vicinity of a dredger for extended periods given the distances at which recoverable injury or TTS are predicted in lamprey as a result of the maintenance dredging, as explained in Paragraph 4.11.49. Behavioural responses are anticipated to be spatially negligible in scale and lamprey will be able to move away and avoid the source of the noise as required. Based on the above considerations, the effect of underwater noise on river and sea lamprey due to dredging and disposal activities is considered to be negligible.

Effects on grey seal and common seal

4.11.67 The distances at which PTS, TTS and behavioural effects in marine mammals that occur in the study area are predicted to occur as a result of the maintenance dredging and movements to and from the associated disposal site are included in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.68 NOAA's user spreadsheet tool (NOAA, 2021) has been used to predict the range at which the weighted cumulative SEL acoustic thresholds (NOAA, 2018) for PTS and TTS are reached during the proposed dredging and disposal activity based on the assumptions highlighted in Appendix 9.2 to the ES (Application Document Reference number 8.4.9

(b)).

4.11.69 There is predicted to be no risk of PTS in seals and the risk of TTS is limited to within 12 m from the maintenance dredging activity.

4.11.70 Overall, there is not considered to be any risk of injury or significant disturbance to grey seal from the maintenance dredging activities that are proposed at the Port of Immingham even if the dredging were to take place continuously 24/7.

4.11.71 Hearing damage is unlikely to occur and the main effect that could be expected in the vicinity of the maintenance dredge vessels would be short- term mild behavioural avoidance. Based on these factors, the effect of underwater noise on grey seal due to maintenance dredging and disposal activities is considered to be negligible.

Summary of effects: Operational vessel movements

4.11.72 The Port of Immingham currently has over 118,000 transiting movements of vessels per year. Additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area on a typical day (six additional Ro-Ro vessel movements per day at the Port of Immingham, as well as tugs) which represents an approximate 3% annual increase in vessel traffic in the local area.

4.11.73 During operation, the new facility is designed to service the embarkation and disembarkation of principally commercial cargo. The ro-ro vessels involved during the operation of the new facility will produce RMS SLs in the region of 178 to 184 dB re 1μPa m (McKenna et al., 2012; MMO, 2015).

4.11.74 Overall, the vessels involved in the operation of the proposed development are anticipated to generate worst case unweighted RMS SLs of up to 188 dB re 1 μPa m. Continuous (24/7) noise generation from vessel activities has been assumed and as such, provides a precautionary assessment.

Effects on fish

4.11.75 The worst case source level (SL) generated by operational vessel movements is below the Popper *et al*. (2014) quantitative instantaneous peak SPL and cumulative SEL thresholds for pile driving, which indicates that there is no risk of mortality, potential mortal injury or recoverable injury in all categories of fish even at the very source of the vessel noise. This appears to correlate with the Popper *et al*. (2014) recommended qualitative guidelines for continuous noise sources which consider that the risk of mortality and potential mortal injury in all fish is low in the near, intermediate and far-field.

4.11.76 According to Popper *et al.* (2014), the risk of recoverable injury is considered lower for fish with no swim bladder (lamprey) compared to fish where the swim bladder is involved in hearing (e.g., herring). For the latter group whereby a cumulative noise exposure threshold is recommended (170 dB rms for 48 h), the distance at which recoverable injury is predicted as a result of the vessel movements is 10 m, and therefore the distance to recoverable injury in lamprey is less than 10 m.

4.11.77 Popper *et al*. (2014) advise that there is a moderate risk of temporary threshold shifts (TTS) occurring in the nearfield (i.e., tens of metres from the source) in fish with no swim bladder (lamprey) and a low risk in the intermediate and far-field. There is a greater risk of TTS in fish where the swim bladder is involved in hearing (e.g., herring) when a cumulative noise exposure threshold is recommended (158 dB rms for 12 h). The distance at which TTS is predicted in these fish as a result of the vessel movements is 46 m and therefore the distance to TTS in lamprey is less than 46 m.

4.11.78 Popper *et al.* (2014) guidelines suggest that there is considered to be a moderate risk of potential behavioural responses occurring in the nearfield (i.e., tens of metres from the source) for fish species with no swim bladder (lamprey). At intermediate distances (i.e., hundreds of metres from the source), there is considered to be a moderate risk of potential behavioural responses in all fish and in the farfield (i.e., thousands of metres from the source) there is considered to be a low risk of a response in all fish.

4.11.79 Overall, there is considered to be a low risk of any injury in lamprey as a result of the underwater noise generated by vessel movements. The level of exposure will depend on the position of the fish with respect to the source, the propagation conditions, and the individual's behaviour over time. However, it is unlikely that a fish would remain in the vicinity of a moving vessel for extended periods. Behavioural responses are anticipated to be spatially negligible in scale and lamprey will be able to move away and avoid the source of the noise as required. Based on the above considerations, the effect of underwater noise on river and sea lamprey due to operational vessel movements is considered to be negligible.

Effects on grey seal and common seal

4.11.80 The distances at which PTS, TTS and behavioural effects in marine mammals that occur in the study area are predicted to occur as a result of operational vessel movements associated with the proposed development are included in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.81 NOAA's user spreadsheet tool (NOAA, 2021) has been used to predict the range at which the weighted cumulative SEL acoustic thresholds (NOAA, 2018) for PTS and TTS are reached during the vessel movements based on the assumptions highlighted in Appendix 9.2 to the ES (Application Document Reference number 8.4.9 (b)).

4.11.82 There is predicted to be no risk of PTS in seals and the risk of TTS is limited to within 12 m from the vessel activity.

4.11.83 Overall, there is not considered to be any risk of injury or significant disturbance to grey seal from the operational vessel activities that are proposed at the Port of Immingham even if the movements were to take place continuously 24/7.

4.11.84 Hearing damage is unlikely to occur and the main effect that could be expected in the vicinity of the vessels would be short-term mild behavioural avoidance. Based on these factors, the effect of underwater noise on grey seal due to operational vessel activities is considered to be negligible.

Mitigation

4.11.85 Mitigation is not relevant to this impact pathway and is not required.

Assessment of the potential for an AEOI

4.11.86 Based on the evidence provided above and the rationale provided in Table 33, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Table 33. The potential for an AEOI on qualifying species due to potential underwater noise and vibration during dredging (capital and maintence) and operational vessel movements

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	S1095: Sea lamprey *Petromyzon marinus*	In the context of the site's conservation	The risk of injury to fish as result of dredging noise and vessel movements is considered to be very low. Behavioural responses are only predicted in a highly
	S1099: River lamprey *Lampetra fluviatilis*	objectives, there is considered to be no potential AEOI on the qualifying interest feature.	localised area near to the dredging vessel with lamprey able to easily move away and avoid the source of noise. Dredging noise and operational vessel movements will therefore not affect the migratory movements of lamprey or causes changes to '*The populations of qualifying species*' or the '*distribution of qualifying species within the site*' conservation objectives.
	S1364: Grey seal *Halichoerus grypus*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	The risk of injury to grey seal as a result of dredging noise is considered very low. Behavioural responses are only predicted in a highly localised area near to the dredging vessel with grey seals able to easily move away and avoid the source of noise. The capital dredging noise and operational vessel movements will, therefore, not causes changes to 'The populations of qualifying species' or the 'distribution of qualifying species within the site' conservation objectives.
The Wash and North Norfolk Coast	S1365 Harbour seal *Phoca vitulina*	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest feature.	The risk of injury to common seal as a result of dredging noise and vessel movements is considered very low. Behavioural responses are only predicted in a highly localised area near to the dredging vessel with grey seals able to easily move away and avoid the source of noise. Dredging noise and operational vessel movements will, therefore, not causes changes to 'The populations of qualifying species' or the 'distribution of qualifying species within the site' conservation objectives.
Humber Estuary	Criterion 3 – supports populations of plants and/or	In the context of the site's	Summary information with respect to the grey seal feature has been provided above in the table.

Ramsar site	animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	Summary information with respect to lamprey features has been provided above in the table.

4.12 Biological disturbance due to potential introduction and spread of non-native species

The potential effects of the introduction and spread of non-native species during construction on qualifying habitats

General scientific context

4.12.1 Non-native, or invasive, species are described as ‘organisms introduced into places outside of their natural range of distribution, where they become established and disperse, generating a negative impact on the local ecosystem and species’ (International Union for Conservation of Nature (IUCN, 2011). The ecological impacts of such ‘biological invasions’ are considered to be the second largest threat to biodiversity worldwide, after habitat loss and destruction. In the last few decades marine and freshwater systems have been impacted by invasive species, largely as a result of increased global shipping (Carlton and Geller, 1993).

4.12.2 The introduction and spread of non-native species can occur either accidentally or by intentional movement of species as a consequence of human activity (Ruiz and Carlton, 2003 cited in Pearce *et al.,* 2012). The main pathway for the potential introduction of non-native species is via fouling of vessels’ hulls, transport of species in ballast or bilge water and the accidental imports from materials brought into the system during development activities. Pathways involving vessel movements (fouling of hulls and ballast water) have been identified as the highest potential risk routes for the introduction of non-native species (Carlton, 1992; Pearce *et al.,* 2012), particularly from different biogeographical regions, which agrees with the fact that areas with a high volume of shipping traffic are hotspots for non-native species in British waters (Pearce *et al.,* 2012).

4.12.3 The fouling of a vessel hull and other below-water surfaces can be reduced through the use of protective coatings. These coatings usually contain a toxic chemical (such as copper) or an irritant (such as pepper) that discourages organisms from attaching. Other coatings, such as those that are silicone-based, provide a surface that is more difficult to adhere to firmly, making cleaning of the hull less laborious. The type and concentration of coatings that can be applied to a boat hull is regulated and can vary between countries. Maintenance of hulls through regular cleaning will minimise the number of fouling organisms present. Hull cleaning can take place on land or in-water. In both cases, care needs to be taken to prevent the organisms and coating particles from being released into the water. By following best management practices, the impact of the cleaning procedure on the environment can be minimised.

4.12.4 Non-native invasive species also have the potential to be transported via ship ballast water. Seawater may be drawn into tanks when the ship is not carrying cargo, for stability, and expelled when it is no longer required. This provides a vector whereby organisms may be transported long distances. In 2004, the International Maritime Organisation (IMO) adopted the ‘International

Convention for the Control and Management of Ships' Ballast Water and Sediments', which introduced two performance standards seeking to limit the risk of non-native invasive species being imported (including distances for ballast water exchange and standards for ballast water treatment). The Convention came into force internationally in September 2017.

4.12.5 The UK is bound by international agreements such as the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979), the Convention on the Conservation of European Wildlife and Natural Habitat (Berne Convention, 1979) and the Habitats and Birds Directives. All of these include provisions requiring measures to prevent the introduction of, or control of, non-native species, especially those that threaten native or protected species (JNCC, 2004). Additionally, Section 14(1) of the Wildlife and Countryside Act (WCA) makes it illegal to release, or allow to escape into the wild, any animal which is not ordinarily resident in Great Britain and is not a regular visitor to Great Britain in a wild state or is listed in Schedule 9 to the WCA.

Summary of effects

4.12.6 As discussed above, non-native species have the potential to be transported into the study area on ships' hulls during capital dredging and construction activity (such as crane barges used in piling). Non-native invasive species also have the potential to be transported via ship ballast water. Seawater may be drawn into the dredger tanks or hopper when the ship is not carrying cargo, for stability, and expelled when it is no longer required. This provides a vector whereby organisms may be transported long distances.

4.12.7 Within England and Wales, best practice guidance has been developed on how to manage marine biosecurity risks at sites and when undertaking activities through the preparation and implementation of biosecurity plans (Cook *et al.,* 2014). This guidance will be followed when developing biosecurity control measures to minimise the risk of the introduction and spread of non-native species during construction of the scheme. These measures will be included within the CEMP (Application Document reference number 9.2). On this basis, the probability of the introduction and spread of non-native species from the construction phase is considered to be low.

Mitigation

4.12.8 No additional mitigation has been identified in relation to this pathway, however the assessment is based on the application of standard best practice measures in the form of robust biosecurity management procedures.

4.12.9 Biosecurity control measures during construction will be included within the CEMP (Application Document reference number 9.2).

Assessment of the potential for an AEOI

4.12.10 Based on the evidence provided above and the rationale provided in Table 34, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 34. The potential for an AEOI on qualifying habitats due to the potential introduction and spread of non-native species during construction

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1110: Sandbanks which are slightly covered by sea water all the time	In the context of the site's conservation objectives, there is no potential AEOI on qualifying interest features.	Taking into account the considerations highlighted above and the proposed biosecurity measures, the probability of the introduction and spread of non-native species from the construction phase is considered to be low. On this basis, this pathway is not expected to cause a change to the '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species'* conservation objective. This pathway will also not cause any changes to the '*the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely*' conservation objectives.
	H1130: Estuaries		
	H1140: Mudflats and sandflats not covered by seawater at low tide		
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.		

The potential effects of the introduction and spread of non-native species during operation on qualifying habitats

General scientific context

4.12.11 Scientific evidence on this impact pathway is provided in Paragraphs 4.12.1 to 4.12.5.

Summary of effects

4.12.12 Non-native species have the potential to be transported into the study area on ships' hulls during maintenance dredging and through operational vessels. Non-native invasive species also have the potential to be transported via ship ballast water. Seawater may be drawn into tanks when the ship is not carrying cargo, for stability, and expelled when it is no longer required. This provides a vector whereby organisms may be transported long distances.

4.12.13 In view of current legislation (described in Paragraph 4.12.7) and the fact that potential biosecurity risks are managed through ABP's existing biosecurity management procedures, the probability of the introduction and spread of non-native species from operational phase is considered to be low.

Mitigation

4.12.14 No additional mitigation has been identified in relation to this pathway, however there is a requirement to ensure the application of standard best practice measures in the form of robust biosecurity management procedures.

4.12.15 ABP’s existing biosecurity management procedures will be followed during operation.

Assessment of the potential for an AEOI

4.12.16 Based on the evidence provided above and the rationale provided in Table 35, the predicted effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features as a result of this pathway.

Associated British Ports

Table 35. The potential for an AEOI on qualifying habitats due to the potential introduction and spread of non-native species during operation

Site	Features	Potential AEOI	Justification
Humber Estuary SAC	H1110: Sandbanks which are slightly covered by sea water all the time	In the context of the site's conservation objectives, there is no potential AEOI on qualifying interest features.	Taking into account the considerations highlighted above and the proposed biosecurity measures, the probability of the introduction and spread of non-native species from the operational phase is considered to be low. On this basis, this pathway is not expected to cause a change to the '*the extent and distribution of qualifying natural habitats and habitats of the qualifying species'* conservation objective. This pathway will also not cause any changes to the '*the structure and function of qualifying natural habitats'* or cause modifications to '*the supporting processes on which qualifying natural habitats rely*' conservation objectives.
	H1130: Estuaries		
	H1140: Mudflats and sandflats not covered by seawater at low tide		
Humber Estuary Ramsar site	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	In the context of the site's conservation objectives, there is considered to be no potential AEOI on the qualifying interest features.	

4.13 Consideration of combined effects

4.13.1 The potential impact pathways have also been considered collectively. The assessment of intra-project effects involves the consideration of where two or more different types of effect arising from the IERRT project could interact or combine to influence the same qualifying interest feature and whether this combined effect could potentially undermine the conservation objectives of the European Site.

4.13.2 Potential intra-project effects were identified for the features of the Humber Estuary SAC, SPA and Ramsar considering all impact pathways screened into the assessment (see Section 4.2). The following potential effects which could interact or combine were identified:

- During construction there are potential combined effects on Humber Estuary SAC habitats (sandbanks which are slightly covered by sea water all the time; estuaries; and mudflats and sandflats not covered by seawater at low tide) from habitat loss. damage, contamination and biological disturbance;
- During operation there are potential combined effects on Humber Estuary SAC habitats from habitat loss/damage and biological disturbance;
- During construction there are potential combined effects on Humber Estuary SAC species sea lamprey and river lamprey from contamination and disturbance through underwater noise and vibration; and
- During construction there are potential combined effects on features of the Humber Estuary SPA (Common Shelduck, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Common Redshank and the waterbird assemblage) from habitat loss/damage and airborne noise and visual disturbance.

4.13.3 Multiple impact pathways were similarly identified for the Humber Estuary Ramsar with potential effects relating to the following:

- Criterion 1: Habitat loss/damage, contamination and disturbance during construction and habitat loss/damage and disturbance during operation 1;
- Criterion 5 and Criterion 6: Habitat loss/damage and disturbance in both construction and operation; and
- Criterion 8: Contamination and disturbance during construction[28].

4.13.4 The combined intra-project effects of all impact pathways have been considered in relation to each feature and in the context of the sites' conservation objectives. The majority of effects are small scale and are assessed as negligible and ecologically inconsequential/*de minimis* magnitude and it is concluded that there are no intra-project effects that

- [28] JNCC (2007). Information Sheet on Ramsar Wetlands - Humber Estuary. Available at: https://jncc.gov.uk/jncc-assets/RIS/UK11031.pdf (accessed 2 January 2023).

would result in an AEOI of the Humber SAC, SPA or Ramsar.

4.13.5 It is noted that for two instances there is a reliance on mitigation measures to enable a conclusion of no AEOI to be reached. This relates to mitigation measures that are required during construction to minimise the effects due to airborne noise and visual disturbance and from underwater noise and vibration which are discussed in more detail below.

4.13.6 During construction coastal waterbirds which are features of the Humber Estuary SPA (Common Shelduck, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Common Redshank and the waterbird assemblage) will be subject to effects from airborne noise and visual disturbance as well as loss of intertidal mudflat which is a feeding resource. In theory these effects could combine to result in a synergistic effect if birds which are displaced as a result of noise are also limited by the availability of food resource. However, in reality the direct loss of a very small area of lower shore intertidal mudflat (0.003 ha) and the indirect loss from alterations to physical processes (0.01ha) are within the scale of natural variability and is expected to be immeasurable in real terms when taking account of the variation in water levels, wave climate and accuracy of the modelled bathymetry. The combined loss of intertidal mudflat is considered inconsequential to these mobile coastal waterbird species even at a local scale (see Section 4.3). Based on the evidence provided in Section 4.9 in relation to airborne noise and visual disturbance during construction and with reference to the mitigation measures, the predicted combined effects are not considered to compromise any of the conservation objectives, and it concluded that there is no potential for AEOI on qualifying interest features of the Humber Estuary SPA.

4.13.7 During construction there are potential combined effects on Humber Estuary SAC species sea lamprey and river lamprey from contamination and disturbance through underwater noise and vibration. There are no anticipated effects on fish from toxic and non-toxic contamination pathways. Based on modelling the sediment plumes resulting from dredging will be relatively localised and will dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle. There are generally low levels of contamination in the sediment contamination samples and elevations in the concentrations of contaminants within the water column are not anticipated. Based on the evidence provided in Section 4.10 in relation to disturbance from underwater noise and vibration during construction and with reference to the mitigation measures, the predicted combined effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features of the Humber Estuary SAC.

4.14 In-combination assessment

4.14.1 The Habitats Regulations require an assessment of the potential in-combination effects of the proposed works on European/Ramsar sites with other plans and projects. These refer to effects, which may or may not interact with each other, but which could affect the same interest feature.

4.14.2 Potential in-combination effects on interest features of European/Ramsar sites that have been screened into the AA (see Section 3) have been considered in this section.

4.14.3 Proposed plans or projects in the Humber Estuary which have the potential to cause potential cumulative/in-combination effects with marine ecology features are discussed in more detail in the cumulative and in-combination effects assessment (Chapter 20 of the ES (Application Document Reference number 8.2.20)). Those plans or projects which overlap with the zone of influence of potential effects on marine ecology receptors as a result of the IERRT project and are assessed in Chapter 20 have been taken forward for this HRA in-combination assessment. The details of each short-listed application including a description of the project, the application and approval status and project timescales are provided in Table 20.5 in Chapter 20 of the ES. The projects and pathways relevant to the HRA in-combination assessment are detailed in Table 36 and shown in Figure 5. Potential in-combination effects are then considered in detail in Table 37 (Humber Estuary SAC), Table 38 (Humber Estuary SPA) and Table 39 (Humber Estuary Ramsar) in the context of the sites' conservation objectives.

4.14.4 In summary, none of the ongoing activities, plans and projects are anticipated to result in in-combination effects of a scale that would change the existing condition status of the interest features recognised within the European/Ramsar sites screened into the AA. On this basis, the proposed development is considered to result in no potential for an AEOI on any interest features of European/Ramsar sites in-combination with other plans, projects and activities.

Table 36. Identification of projects and impact pathways relevant to the in-combination assessment.

ID	Project	Distance From IERRT Project	Impact Pathways Relevant to the HRA In-combination Assessment
1.	Maintenance dredge disposal at Grimsby, Immingham and Sunk Dredged Channel	Approx. 0.1 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance** • Disturbance through underwater noise and vibration • Airborne noise and visual disturbance
2.	Humber International Terminal (HIT) berth 2: adaptation for car carriers	Approx. 2.5 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance**

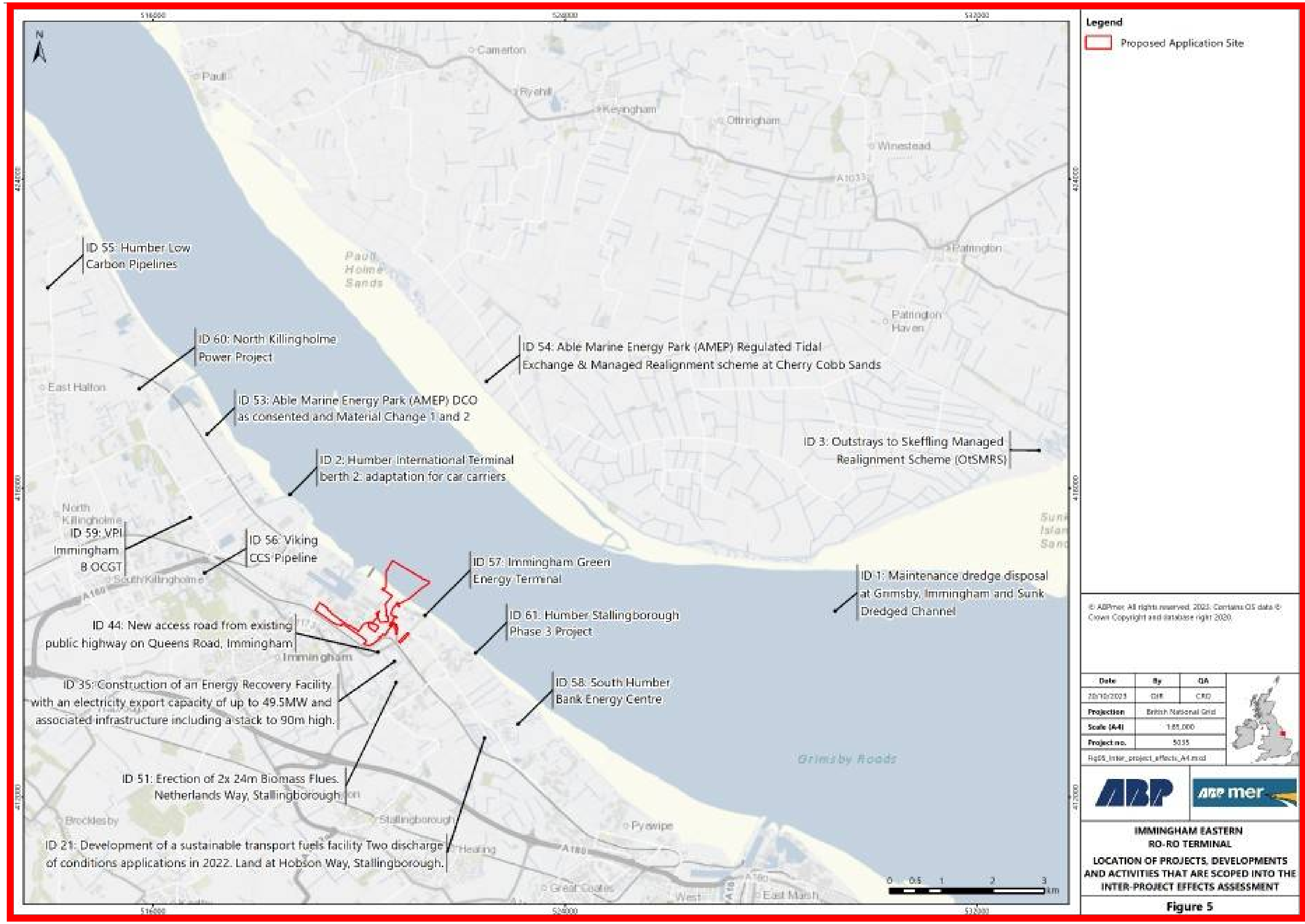
			• Disturbance through underwater noise and vibration • Airborne noise and visual disturbance
3.	Outstrays to Skeffling Managed Realignment Scheme (OtSMRS)	Approx.10 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance** • Airborne noise and visual disturbance
21.	Development of a sustainable transport fuels facility Two discharge of conditions applications in 2022. Land at Hobson Way, Stallingborough (DM/0664/19/FUL)	Approx. 2.2 km	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants
35.	Construction of an Energy Recovery Facility with an electricity export capacity of up to 49.5MW and associated infrastructure	Approx . 177 m	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants **Disturbance** • Airborne noise and visual disturbance

	including a stack to 90m high (DM/0026/18/FUL)		
44.	New access road from existing public highway on Queens Road, Immingham (DM/0294/21/FUL)	Approx. 0.25 km	**Disturbance** • Airborne noise and visual disturbance
51.	Erection of 2x 24m Biomass Flues. Netherlands Way, Stallingborough	Approx . 840 m	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants
53.	Able Marine Energy Park (AMEP) DCO as consented and Material Change 1 and 2	Approx. 2.8 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance** • Disturbance through underwater noise and vibration • Airborne noise and visual disturbance
54.	Able Marine Energy Park (AMEP) Regulated Tidal Exchange & Managed Realignment scheme at Cherry Cobb Sands	Approx. 3.5 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss or damage of habitat through alterations in physical processes **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases

			Disturbance • Airborne noise and visual disturbance
55.	Humber Low Carbon Pipelines	Current proposal within 10 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance** • Disturbance through underwater noise and vibration • Airborne noise and visual disturbance
56.	Viking CCS Pipeline	Current proposal within 4 km	**Disturbance** • Airborne noise and visual disturbance
57.	Immingham Green Energy Terminal	Approx. 0.1 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance** • Disturbance through underwater noise and vibration

			• Airborne noise and visual disturbance
58.	South Humber Bank Energy Centre	Approx. 3.8 km	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants **Disturbance** • Airborne noise and visual disturbance
59.	VPI Immingham B OCGT	Approx. 5 km	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants
60.	North Killingholme Power Project	Approx. 8 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases **Disturbance** • Disturbance through underwater noise and vibration • Airborne noise and visual disturbance
61.	Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme	Approx. ~~2~~2.7 km	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases

			Disturbance • Disturbance through underwater noise and vibration • Airborne noise and visual disturbance
62.	Immingham Onshore Wind	Approx. 2 km	**Disturbance (including collision risk)** • Airborne noise and visual disturbance


Legend
Proposed Application Site
ID 55: Humber Low Carbon Pipelines
ID 60: North Killingholme Power Project
ID 54: Able Marine Energy Park (AMEP) Regulated Tidal Exchange & Managed Realignment scheme at Cherry Cobb Sands
ID 53: Able Marine Energy Park (AMEP) DCO as consented and Material Change 1 and 2
ID 3: Outstrays to Skeffling Managed Realignment Scheme (OtSMRS)
ID 2: Humber International Terminal berth 2: adaptation for car carriers
ID 59: VPI Immingham B OCGT
ID 56: Viking CCS Pipeline
ID 57: Immingham Green Energy Terminal
ID 1: Maintenance dredge disposal at Grimsby, Immingham and Sunk Dredged Channel
ID 61: Humber Stallingborough Phase 3 Project
ID 44: New access road from existing public highway on Queens Road, Immingham
ID 35: Construction of an Energy Recovery Facility with an electricity export capacity of up to 49.5MW and associated infrastructure including a stack to 90m high.
ID 58: South Humber Bank Energy Centre
ID 51: Erection of 2x 24m Biomass Flues. Netherlands Way, Stallingborough.
ID 21: Development of a sustainable transport fuels facility Two discharge of conditions applications in 2022. Land at Hobson Way, Stallingborough.
Camerton
Paull
Ryehill
Keyingham
Ottringham
Winestead
Patrington
Patrington Haven
Paull Holme Sands
East Halton
North Killingholme
South Killingholme
Immingham
Brocklesby
Stallingborough
Healing
Pyewipe
Great Coates
East Marsh
Grimsby Roads
A1033
A180
0 0.5 1 2 3 km
IMMINGHAM EASTERN RO-RO TERMINAL
LOCATION OF PROJECTS, DEVELOPMENTS AND ACTIVITIES THAT ARE SCOPED INTO THE INTER-PROJECT EFFECTS ASSESSMENT
Figure 5

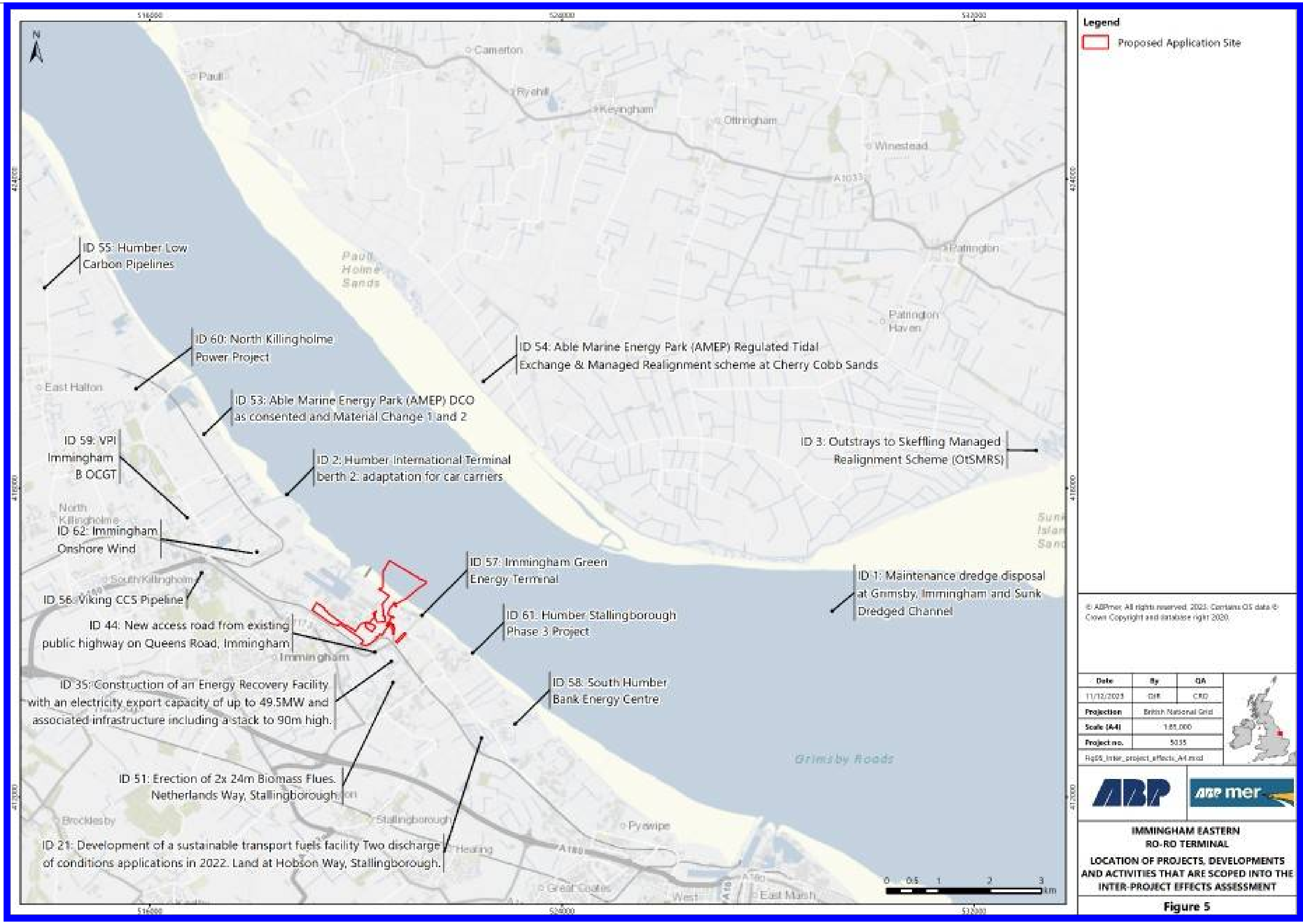


Figure 5. Location of projects, developments and activities that are relevant to the in-combination assessment

Table 37. The potential for an AEOI on qualifying habitats and species of the Humber Estuary SAC due to in-combination effects.

ID	Plan/Project	Features	Summary of potential effects	Potential for AEOI
1.	Maintenance dredge disposal at Grimsby, Immingham and Sunk Dredged Channel (MLA/2014/00431)	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The habitats in the area are already subject to considerable seabed disturbance as a result of the existing maintenance dredging regime. The variations proposed to this existing maintenance dredge licence will not change the volumes of material to be dredged from the Port of Immingham area. The marine habitats and species occurring in the area are also considered to be commonly occurring and of low conservation value. Changes during dredging as a result of the IERRT project are considered to be localised (i.e., limited in spatial extent) and low magnitude and in-combination with this maintenance dredging project will result in only a small increase in the potential maintenance dredge commitment for the Immingham area and disposal site. **Contamination** There is the potential for cumulative effects with respect to increased SSC as a result of maintenance dredging and disposal of material from Grimsby, Immingham, and Sunk Dredged Channel. The assessment of the potential future maintenance dredging requirements for the IERRT indicates an increase of 3-6% on the existing average annual maintenance dredge (between 2004 and 2020) rate across the existing Immingham berths (or a 2-4% increase on the average annual disposal volume at the HU060 site since 2004). In-combination effects from dredge or disposal plumes from adjacent sites will only exist for a short period of time (a matter of hours) when activities are taking place concurrently. Once the next peak tide (ebb or flood) has dispersed the plume across the wider study area, the increased SSC values are unlikely to be distinguishable from the existing background concentrations. It is also considered likely that the availability of dredging plant (servicing the ports and approaches across the wider Humber, including Goole, Hull and Grimsby) will mean the potential for dredging to be taking place at adjacent locations and at the same time is limited. In relation to the release of sediment -bound contaminants, the Marine Licence requires sediment samples to be tested in line with OSPAR requirements prior to disposal which minimises the potential for mobilisation of contaminants. In addition, this project is concerned with the disposal of recently accreted sediment which is less likely to comprise a source of historic contamination and therefore this is unlikely to result in a cumulative effect. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	There is the potential for cumulative effects on local air quality. Activities associated with MLA/2014/00431 may have emissions to air that could coincide with proposed IERRT emissions and effect shared receptors. Due to the location of MLA/2014/00431 emission sources, shared receptors are limited to air quality sensitive habitats within the Humber Estuary SAC, namely the closet areas of saltmarsh. The proposed IERRT project does not impact on the nearest saltmarsh habitats to the extent that the effect is significant. Any emissions associated with MLA/2014/00431 will be limited due to the number of emission sources and intermittent operation of those sources over the course of a year. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it concluded that there is no potential for AEOI on qualifying interest features.
		S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	**Disturbance** • Disturbance through underwater noise and vibration	There is the potential for cumulative effects on lamprey and grey seal features if the dredging activities associated with MLA/2014/00431 occur at the same time as construction and maintenance dredging as part of IERRT. The noise associated with MLA/2014/00431 is likely to be similar to the dredging operations for IERRT and will be limited due the intermittent operation over the course of a year. It is also considered likely that the availability of dredging plant (servicing the ports and approaches across the wider Humber, including Goole, Hull and Grimsby) will mean the potential for dredging to be taking place at adjacent locations and at the same time is limited. However, dredging for both projects is only expected to cause behavioural reactions (at most) in a relatively localised (i.e., limited in spatial extent) area in the vicinity of the dredger. Therefore, assuming the proposed
				mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential

				for AEOI on qualifying interest features.
2.	Humber International Terminal (HIT) berth 2: adaptation for car carriers	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The piles required for the HIT berth 2 works will result in a *de minimis* (i.e., negligible and ecologically inconsequential) loss of subtidal habitat. In addition, sedimentation due to the localised resuspension of sediment as a result of seabed disturbance during piling and changes to hydrodynamic and sedimentary processes due to the presence of the piles including potential scouring directly around piles effects are anticipated to be negligible and highly localised (i.e., very limited in spatial extent). Furthermore, the benthic community is expected to recover relatively rapidly from any localised (i.e., very limited in spatial extent) physical disturbance with subtidal species known to occur in the area typically considered fast growing and/or have rapid reproductive rates. The cumulative effects of physical loss of habitat are considered negligible. **Contamination** In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance during piling. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with HIT berth 2 works have the potential to result in cumulative effects on lamprey and grey seal features of the Humber Estuary SAC. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Both projects~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. Both IERRT and HIT Projects will require similar mitigation to help minimise potential adverse effects (such as soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is therefore concluded that there is no potential for AEOI on qualifying interest features.
3.	Outstrays to Skeffling Managed Realignment Scheme (OtSMRS)	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC ~~• Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases~~	The proposed OtSMRS is located approximately 10 km from the IERRT project. The managed realignment site works has the potential to result in highly localised (i.e., very limited in spatial extent) effects on physical processes elements (such as local flows and elevated suspended sediment levels and sediment deposition) as a result of the breaching. The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the hydrodynamic or sedimentary effects as a result of the IERRT project. Effects on water quality are also predicted to be highly localised quality (such as due to elevated suspended sediment levels and changes to dissolved oxygen and chemical water quality). The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the water quality effects as a result of the IERRT project. ~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
			• Toxic contamination through	Considering all pathways, the predicted in-combination effects are not considered to compromise any of the

			release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
21.	Development of a sustainable transport fuels facility Two discharge of conditions applications in 2022. Land at Hobson Way, Stallingborough (DM/0664/19/FUL)	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Potential for cumulative effects in relation to operational effects from emissions. In terms of impacts from DM/0664/19/FUL on the Humber Estuary, with respect to annual mean NOx, annual mean ammonia and annual mean sulphur dioxide; total concentrations will be below the relevant critical levels. With respect to 24-hour mean NOx, nutrient nitrogen deposition and acid deposition, baseline concentrations currently exceed the critical level or load and as the predicted process contributions exceed 1%/10% of the relevant critical levels and critical loads, significant impacts cannot be discounted The proposed DM/0664/19/FUL development will operate in accordance with Best Available Techniques (BAT) and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for DM/0664/19/FUL. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
35.	Construction of an Energy Recovery Facility with an electricity export capacity of up to 49.5 MW and associated infrastructure including a stack to 90 m high (DM/0026/18/FUL)	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Potential for cumulative effects in relation to operational effects from emissions. In terms of impacts from DM/0026/18/FUL on the Humber Estuary, with respect to annual mean NOx, annual mean ammonia and annual mean sulphur dioxide total concentrations will be below the relevant critical levels. There is a small magnitude increase in oxides of nitrogen levels and nitrogen deposition on saltmarsh habitats and this is assessed as not significant. The proposed DM/0026/18/FUL development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
~~22.~~44.	New access road from existing public highway on Queens Road, Immingham (DM/0294/21/FUL)	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	The potential impacts on air quality relate to construction dust and it is reasonable to assume that the planning application process has identified a proportionate level of mitigation relating to this effect. There are no predicted impacts in relation to nitrogen deposition and therefore no in-combination effects and no potential for AEOI.
51.	Erection of 2 x 24 m Biomass Flues. Netherlands Way, Stallingborough (DM/1056/20/FUL)	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Potential for cumulative effects from emissions. The air quality assessment for DM/1056/20/FUL concluded that the effects were insignificant at all receptors and given the scale of the project there are no anticipated cumulative effects and it is concluded that there is no potential for AEOI on qualifying interest features.
~~24.~~53.	Able Marine Energy Park (AMEP) DCO as consented and Material Change 1 and 2	H1110: Sandbanks which are slightly covered by sea water all the time	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** Both the AMEP and IERRT project have the potential to result in changes to marine habitats as a result of capital dredging due to physical disturbance during sediment removal, sediment deposition and indirectly as a result of changes to hydrodynamic and sedimentary processes. These potential effects were assessed as not significant both projects. The subtidal habitats around the Port of Immingham are typically impoverished and of low ecological value reflecting the existing high levels of physical disturbance in the area due to strong near bed tidal currents and sediment transport. Deposition of sediment as a result of dredging for both projects were predicted to be localised and similar to background variability away from the dredge pockets with species occurring in the local area considered tolerant to some sediment deposition. The cumulative effects of change on marine habitats and species from the highly localised (i.e., very limited in spatial extent) and small scale predicted effects due to hydrodynamic and sedimentary processes are considered negligible for both projects. The AMEP project will result in a direct loss of intertidal habitat (mudflat and saltmarsh) as a result of the reclamation of the proposed quay (33 ha). Compensation for this loss will be provided at the Cherry Cobb Sands compensation site. Direct loss of intertidal as a result of the proposed IERRT development will be *de minimis* (i.e., negligible and ecologically inconsequential) and therefore, with the provision of the compensatory habitat required for AMEP project, there is no additional cumulative effect from the IERRT project that could compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. ~~**Contamination**~~ ~~In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed~~

		H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide		~~disturbance. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible.~~ ~~In relation to the release of sediment -bound contaminants, the level of contamination in the proposed dredge areas for both projects was considered to be low with material expected be rapidly dispersed by strong tidal currents in the area.~~ ~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
				Contamination In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. In relation to the release of sediment -bound contaminants, the level of contamination in the proposed dredge areas for both projects was considered to be low with material expected be rapidly dispersed by strong tidal currents in the area. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	The traffic data used to inform the air quality assessment for the proposed IERRT project is inherently cumulative with regards to the Consent Order for the AMEP. There are no predicted in-combination effects and it is concluded that there is no potential for AEOI on qualifying interest features.
		S1095: Sea lamprey *Petromyzon marinus*	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with the AMEP works have the potential to result in cumulative effects on lamprey and grey seal features of the Humber Estuary SAC. Dredging for both projects is only expected to cause behavioural reactions in a relatively localised area in the vicinity of the dredger for both fish and marine mammals. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Both projects~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the

		S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*		IERRT Project on marine mammal features to a minor adverse effect. Both IERRT and AMEP Projects will require similar mitigation to help minimise potential adverse effects (such as soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
~~21.~~	~~Development of a sustainable transport fuels facility Two discharge of conditions applications in 2022. Land at Hobson Way, Stallingborough (DM/0664/19/FUL)~~	~~H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)~~	~~**Habitat loss/damage**~~ • ~~Physical change to habitats resulting from the deposition of airborne pollutants~~	~~Potential for cumulative effects in relation to operational effects from emissions.~~ ~~In terms of impacts from DM/0664/19/FUL on the Humber Estuary, with respect to annual mean NOx, annual mean ammonia and annual mean sulphur dioxide; total concentrations will be below the relevant critical levels. With respect to 24-hour mean NOx, nutrient nitrogen deposition and acid deposition, baseline concentrations currently exceed the critical level or load and as the predicted process contributions exceed 1%/10% of the relevant critical levels and critical loads, significant impacts cannot be discounted~~ ~~The proposed DM/0664/19/FUL development will operate in accordance with Best Available Techniques (BAT) and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for DM/0664/19/FUL. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
~~35.~~	~~Construction of an Energy Recovery Facility with an electricity export capacity of up to 49.5MW and associated infrastructure including a stack to 90m high (DM/0026/18/FUL)~~	~~H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)~~	~~**Habitat loss/damage**~~ • ~~Physical change to habitats resulting from the deposition of airborne pollutants~~	~~Potential for cumulative effects in relation to operational effects from emissions.~~ ~~In terms of impacts from DM/0026/18/FUL on the Humber Estuary, with respect to annual mean NOx, annual mean ammonia and annual mean sulphur dioxide total concentrations will be below the relevant critical levels. There is a small magnitude increase in oxides of nitrogen levels and nitrogen deposition on saltmarsh habitats and this is assessed as not significant.~~ ~~The proposed DM/0026/18/FUL development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
~~44.~~	~~New access road from existing public highway on Queens Road, Immingham (DM/0294/21/FUL)~~	~~No effects on SAC features.~~	~~N/A~~	~~N/A~~
~~51.~~	~~Erection of 2x 24m Biomass Flues. Netherlands Way, Stallingborough (DM/1056/20/FUL)~~	~~H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)~~	~~**Habitat loss/damage**~~ • ~~Physical change to habitats resulting from the deposition of airborne pollutants~~	~~Potential for cumulative effects from emissions. The air quality assessment for DM/1056/20/FUL concluded that the effects were insignificant at all receptors and given the scale of the project there are no anticipated cumulative effects and it is concluded that there is no potential for AEOI on qualifying interest features.~~
~~53.&~~ 54.	Able Marine Energy Park (AMEP) Regulated Tidal Exchange & Managed Realignment scheme at Cherry Cobb Sands	H1110: Sandbanks which are slightly covered by sea water all the time	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat	The proposed Managed Realignment Scheme is located on the opposite bank of the Humber Estuary. The managed realignment site works has the potential to result in highly localised (i.e., very limited in spatial extent) effects on physical processes elements (such as local flows and elevated suspended sediment levels and sediment deposition) as a result of the breaching. The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the hydrodynamic or sedimentary effects as a result of the IERRT project.

		H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	**Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	Effects on water quality are also predicted to be highly localised quality (such as due to elevated suspended sediment levels and changes to dissolved oxygen and chemical water quality). The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the water quality effects as a result of the IERRT project. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
55.	Humber Low Carbon Pipelines	H1110: Sandbanks which are slightly covered by sea water all the time	**Habitat loss/damage**	**Habitat loss/damage** Based on information provided in the EIA scoping report for the Humber Low Carbon Project, trenchless methods (e.g., bored tunnel) could be used to minimise potential effects on SAC habitats where the pipelines cross the Humber Estuary. However, construction method has not been confirmed at the landfall (trenchless,
~~55.~~	~~Humber Low Carbon Pipelines~~	H~~1110~~1130: ~~Sandbanks which are slightly covered by sea water all the time~~Estuaries ~~H1130: Estuaries~~ H1140: Mudflats and sandflats not covered by seawater at low tide	~~**Habitat loss/damage**~~ • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	~~**Habitat loss/damage**~~ ~~Based on information provided in the EIA scoping report for the Humber Low Carbon Project, trenchless methods (e.g., bored tunnel) could be used to minimise potential effects on SAC habitats where the pipelines cross the Humber Estuary. However, construction method has not been confirmed at the landfall (trenchless,~~ e.g., Horizontal Directional Drilling (HDD), or via cofferdam) and, therefore, features of the SAC could not be scoped out. **Contamination** In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. In relation to the release of sediment -bound contaminants, it is assumed that the Humber Low Carbon Project projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects. If trenchless methods are not feasible and excavation (dredging) of the seabed is required then the project would require sediment samples to be tested in line with OSPAR requirements which minimises the potential for mobilisation of contaminants. Given the current uncertainties with respect to the construction methods and programme for the Humber Low Carbon Pipeline, a detailed assessment of effects on SAC features is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on SAC features. Therefore, assuming appropriate mitigation measures are followed for the IERRT project in-combination effects are not considered to compromise any of the conservation objectives, and a conclusion of no AEOI can be reached, subject to further information becoming available.
			~~bound in sediments, and accidental oil, fuel or chemical releases~~	~~cumulative effects. If trenchless methods are not feasible and excavation (dredging) of the seabed is required then the project would require sediment samples to be tested in line with OSPAR requirements which minimises the potential for mobilisation of contaminants.~~ ~~Given the current uncertainties with respect to the construction methods and programme for the Humber Low Carbon Pipeline, a detailed assessment of effects on SAC features is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on SAC features. Therefore, assuming appropriate mitigation measures are followed for the IERRT project in-combination effects are not considered to compromise any of the conservation objectives, and a conclusion of no AEOI can be reached, subject to further information becoming available.~~
		S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	**Disturbance** • Disturbance through underwater noise and vibration	Given the current uncertainties with respect to the construction methods and programme for the Humber Low Carbon Pipeline, a detailed assessment of underwater noise and vibration effects on SAC features is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on SAC features. Therefore, assuming appropriate

		S1364: Grey seal *Halichoerus grypus*		
56.	Viking CCS Pipeline	No effects on SAC features	N/A	N/A
57.	Immingham Green Energy Terminal	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** Intertidal habitat loss: Immingham Green Energy Terminal will result in the direct loss of 0.00158 ha (due to the marine piling) and a potential indirect loss of 0.03 ha (due to potential erosion as a result of the presence of the jetty causing changes in currents). The IERRT project, including changes made to application (accepted by the ExA on 6 December 2023) will result in direct loss of 0.012 ha (due to marine piling and capital dredging) and potential indirect loss of 0.02 ha (due to potential erosion of the foreshore). The anticipated total loss of intertidal as a result of IERRT and Immingham Green Energy Terminal is anticipated to be 0.044 ha (based on combined direct losses and modelling both schemes together to calculate potential for indirect intertidal losses). The combined intertidal habitat loss represents approximately 0.000120 % of the Humber Estuary SAC and approximately 0.000469 % of the 'mudflats and sandflats not covered by seawater at low tide' feature of the Humber Estuary SAC. The predicted potential indirect intertidal losses for both projects (and direct loss due to capital dredging for IERRT), consist of very narrow strips on the lower shore around the sublittoral fringe. These losses are considered to be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g. due to seasonal patterns in accretion and erosion or following storm events). These de minimis changes in mudflat extent are of a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary. Subtidal habitat loss: Marine piling will result in a direct loss of 0.032 ha and 0.051 ha of seabed habitat for IERRT and Immingham Green Energy Terminal respectively. This combined habitat loss of 0.083 ha represents approximately 0.000226 % of the Humber Estuary SAC. The combined loss in subtidal habitat as a result of the piles is considered negligible in the context of the extent of the overall amount of similar marine habitats found locally in the Humber Estuary. All the species recorded were considered commonly occurring and not protected. Furthermore, faunal assemblage recorded during project specific benthic surveys for both projects are also considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary. Localised losses of this magnitude are also not considered to adversely affect the overall functioning of subtidal habitats within this section of the Humber Estuary.
~~57.~~	~~Immingham Green Energy Terminal~~	~~H1110: Sandbanks which are slightly covered by sea water all the time~~	~~**Habitat loss/damage**~~ • ~~Physical loss or damage of habitat through alterations in physical processes~~ • ~~Physical damage through disturbance and/or smothering of habitat~~ • ~~Physical loss of (or change to) habitat and associated species~~ ~~**Contamination**~~ • ~~Non-toxic contamination through elevated SSC~~ • ~~Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases~~	~~**Habitat loss/damage**~~ ~~The piles required for the jetty of the Immingham Green Energy Terminal project are likely to result in a small loss of subtidal habitat and a *de minimis* (i.e., negligible and ecologically inconsequential) loss in the intertidal. In addition, sedimentation due to the localised resuspension of sediment as a result of seabed disturbance during piling and the small capital dredge as well as changes to hydrodynamic and sedimentary processes due to the presence of the piles/dredging are anticipated to be negligible and highly localised (i.e., very limited in spatial extent). Furthermore, the benthic community is expected to recover relatively rapidly from any localised physical disturbance with subtidal species known to occur in the area typically considered fast growing and/or have rapid reproductive rates. The cumulative effects of change on marine habitats and species are considered negligible for both projects~~ Change to marine habitats: Capital dredging for the Immingham Green Energy Terminal will remove 4,000m³ of material over a maximum area of approximately 10,000m² (with the capital dredge for IERRT removing approximately 190,000m³ of material over a maximum area of approximately 70,000m²). For both projects following dredging, it is considered likely that the dredge pocket would provide similar substrate for infaunal colonisation to that under pre-dredge conditions which would then be expected to be recolonised by a similar assemblage to baseline conditions. In addition, sedimentation as a result of capital dredging for both projects is predicted to be highly localised and similar to background variability. Species recorded in both dredge footprint areas are considered tolerant to the predicted millimetric changes in deposition and therefore smothering effects as considered unlikely. In addition, the species recorded in the benthic invertebrate surveys are fast growing and/or have rapid reproductive rates which allow populations to fully re- establish in typically less than one to two years and for some species within a few months. For IGET, maintenance dredging is expected to be very limited (if required at all). As a result, any dredging that is required will only be undertaken very periodically (frequency will be dictated by operational requirements but is anticipated there could be several years or more between maintenance dredge campaigns). For the IERRT project, regular maintenance dredging (i.e. occurring every 3-4 months) is anticipated to be restricted to a relatively small proportion of the total maintenance dredge area (i.e. focused around the finger pier piles and adjacent areas of the berth pockets and pontoons). The remainder of the area will only be required to be dredged much more periodically (frequency in these areas will be dictated by

		~~H1130: Estuaries~~ ~~H1140: Mudflats and sandflats not covered by seawater at low tide~~		operational requirements but is anticipated to be approximately every 1-2 years or more). In both areas, a generally impoverished benthic community was recorded in the dredge footprint which is likely to reflect the existing high levels of physical disturbance in the area due to strong near bed tidal currents and sediment transport with infaunal populations anticipated to fully re-establish in between several months and 1-2 years. On this basis, given the expected frequency of dredging, a comparable macrofaunal community to pre dredge conditions would be expected to occur over much of both the maintenance dredging footprints. **Contamination** In relation to water and sediment quality, there is the potential for cumulative effects from the resuspension of sediment as a result of seabed disturbance during piling and ~~the small~~ capital ~~dredge~~dredging for both projects will cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	~~There are potential for cumulative effects on local air quality, due to the proximity of the Consent Order application site from the proposed IERRT project, shared receptors and pollutants. There is no AEOI of the proposed IERRT project alone, although the effect of the Consent Order application cannot be confirmed until further information on that application is published.~~ Natural England's Supplementary Advice on Conservation Objectives for the Humber Estuary SAC states that the conservation objective for the 'Atlantic salt meadows *Glauco-Puccinellietalia maritimae*' and '*Salicornia* and other annuals colonising mud and sand' habitat features relevant to the assessment of air quality effects is to "*Maintain concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature on the Air Pollution Information System*". Immingham Green Energy Terminal will result in a mean deposition rate of 16 kg N/ ha/ yr on the nearest saltmarsh habitat. Indeed, air quality modelling forecasts a slight improvement in nitrogen deposition between the base year and 2036 even when allowing for Immingham Green Energy Terminal and IERRT. Therefore, predicted in-combination effects of both projects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with the Immingham Green Energy Terminal works have the potential to result in cumulative effects on lamprey and grey seal features of the Humber Estuary SAC. Dredging for both projects is only expected to cause behavioural reactions in a relatively localised area in the vicinity of the dredger for both fish and marine mammals. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Given the current uncertainties with respect to the construction methods and programme and operational noise impacts for the Immingham Green Energy Terminal, a detailed assessment is not considered possible.~~ ~~It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation
				measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. The same mitigation measures are proposed for both IERRT and Immingham Green Energy Terminal Projects to help minimise potential adverse effects (i.e., soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
58	South Humber Bank Energy	H1330. Atlantic salt meadows	**Habitat loss/damage**	Some potential for significant cumulative effects on local air quality during operation, due to the proximity of

	Centre	(*Glauco-Puccinellietalia maritimae*)	• Physical change to habitats resulting from the deposition of airborne pollutants	the South Humber Bank Energy Centre application site from the proposed IERRT project, shared receptors and pollutants. The cumulative effects on air quality during construction from the IERRT or the South Humber Bank Energy Centre are considered negligible. Predicted concentrations of air pollutants at ground level due to emissions from the stacks during operation of the Humber Bank Energy Centre have been calculated and used to determine the appropriate height of stacks. The proposed South Humber Bank Energy Centre development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for Humber Bank Energy Centre. The predicted in-combination effects are therefore not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
59.	VPI Immingham B OCGT	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Some potential for cumulative effects on local air quality during operation, due to the proximity of the VPI Immingham B OCGT development application site from the proposed IERRT project, shared receptors and pollutants. The cumulative adverse effects on air quality during construction from the IERRT or the VPI Immingham B OCGT development are considered negligible. Predicted concentrations of air pollutants at ground level due to emissions from the stacks during operation of the VPI Immingham B OCGT development have been calculated and used to determine the appropriate height of stacks. The proposed VPI Immingham B OCGT development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for VPI Immingham B OCGT development. The predicted in-combination effects are therefore not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
60.	North Killingholme Power Project	H1110: Sandbanks which are slightly covered by sea water all the time H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The marine elements of the proposed North Killingholme Power Project are located approximately 8 km up-estuary of the IERRT location. In between the two schemes is the infrastructure associated with the Immingham Eastern and Western jetties, the Immingham Outer Harbour and the Humber international Terminal. The assessment for IERRT indicates that the extent of change to hydrodynamics and waves does not extend up-estuary to the North Killingholme Power Project location. There are no anticipated cumulative effects. The North Killingholme Power Project involves the construction of an intake and piling within the existing footprint of the Killingholme Ports jetty. The DCO requires the scheme to be approved by the MMO prior to construction. Given that consent has been granted it is considered that impacts from the North Killingholme Power Project have been adequately mitigated. On this basis cumulative effects are anticipated to be negligible In relation to water and sediment quality, the potential impacts resulting from the North Killingholme Power Project (such as increased suspended sediment levels) will be highly localised (i.e., very limited in spatial extent), temporary and are considered negligible. **Contamination** Given the extent of seabed disturbance which involves construction of an intake and piling any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen). There are no anticipated cumulative effects. ~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
		~~H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)~~	~~**Habitat loss/damage**~~	~~The assessment for the North Killingholme Power Project found no risk of exceedances for the majority of pollutants but considered the potential for an increase in nitrogen deposition which show a maximum impact around 1 km north-east of the stack. The model showed maximum impacts on NOx are >1% of the critical~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		H1330. Atlantic salt meadows	**Habitat loss/damage**	The assessment for the North Killingholme Power Project found no risk of exceedances for the majority of

		(*Glauco-Puccinellietalia maritimae*)	• Physical change to habitats resulting from the deposition of airborne pollutants	pollutants but considered the potential for an increase in nitrogen deposition which show a maximum impact around 1 km north-east of the stack. The model showed maximum impacts on NOx are >1% of the critical level in all scenarios, and the total concentration exceeds critical level, however project-specific monitoring has shown that the Defra and APIS datasets overestimated NOx in the vicinity of the facility and that total concentrations are therefore likely to be below the critical level. The proposed North Killingholme Power Project will operate in accordance with BAT and will be regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for North Killingholme Power Project. The predicted in-combination effects are therefore not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with construction of the intake and piling for the North Killingholme Power Project have the potential to result in cumulative effects sea and river lamprey and grey seal features in the Humber Estuary. Piling noise has the potential to cause injury if these features are within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Both projects~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. Both IERRT and North Killingholme Power Projects will require similar mitigation to help minimise potential adverse effects (such as soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). Assuming appropriate mitigation measures are followed during construction the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
61.	Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme	H1110: Sandbanks which are slightly covered by sea water all the time	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** ~~The revetment works will be restricted to the upper foreshore with the effects of the marine works for the IERRT project largely restricted to subtidal habitats. Any indirect effects resulting from the IERRT project on intertidal habitats in the vicinity of Humber Stallingborough Phase 3 Project (located approximately 2 km away) will be negligible.~~The coastal defence project will result in a permanent loss of 0.25 ha of intertidal habitat in 11 discrete narrow strips averaging 227 m², of which the largest is no more than 10 m wide and 30 m long. These discrete areas of mudflat loss along the revetment are distanced roughly 100 m apart. The HRA undertaken for the project concluded that "within the Pyewipe area, there is approximately 300 ha of this Annex 1 habitat, being over 700 m at its widest extent to the south. Therefore, the loss of 0.25 ha equates to a loss of 0.08 % of the total mudflats within Pyewipe. The loss of these small and discrete parcels of mudflat along the base of the existing revetment is not considered to adversely affect the function of the mudflats as a self-sustaining habitat within the Pyewipe area. This impact is considered to be ecologically inconsequential to the Humber Estuary SAC and so not adversely affecting the integrity of the site. As the impact is considered to be ecologically inconsequential, it is not considered to frustrate the conservation objective of restore the total extent. No adverse effect on the site integrity of the Humber Estuary SAC is anticipated as a result of loss of habitat constituting the qualifying feature of mudflats and sandflats not covered by seawater at high tide associated with construction of rock armour revetment". Losses of intertidal as a result of IERRT will be de minimis in extent (0.032 ha) and were assessed as insignificant. On this basis, potential cumulative effects are considered to be minor. **Contamination** In relation to water and sediment quality, the potential impacts resulting from the Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme (such as increased suspended sediment levels) will be highly localised (i.e., very limited in spatial extent), temporary and are considered negligible. ~~**Contamination**~~ In relation to the release of sediment -bound contaminants, prior to excavation of the toe of the revetment sediment samples will be tested in line with OSPAR requirements to minimise the potential for mobilisation of contaminants. In addition, excavation is restricted to within a few metres of the revetment and therefore this is unlikely to result in a cumulative effect.

		H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide		~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
				Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	There are potential for cumulative effects on local air quality, due to the proximity of the Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme from the proposed IERRT project, shared receptors and pollutants. There is no AEOI of the proposed IERRT project alone, and whilst the effects of the Humber Stallingborough Phase 3 Project cannot be confirmed until further information on that application is published, given the scale of the works it is very unlikely that any in-combination effects will be generated.
		S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	**Disturbance** • Disturbance through underwater noise and vibration	The works for the Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme will be carried out from land and in the dry as far as possible. Sources of underwater noise and vibration would be limited to excavation at the toe of the revetment. Given the extent and nature of the impacts there are no predicted cumulative effects and it is concluded that there is no potential for AEOI on qualifying interest features, subject to further information becoming available.
62.	Immingham Onshore Wind	No effects on SAC features.	NA	NA
~~All projects~~		~~H1110: Sandbanks which are slightly covered by sea water all the time~~ ~~H1130: Estuaries~~ ~~H1140: Mudflats and sandflats not covered by seawater at low tide~~	~~**Habitat loss/damage**~~ ~~•Physical loss or damage of habitat through alterations in physical processes~~ ~~•Physical damage through disturbance and/or smothering of habitat~~ ~~•Physical loss of (or change to) habitat and associated species~~	~~**Habitat loss/damage**~~ ~~With respect to intertidal habitat loss, noting that compensatory habitat will be provided for the Able Marine Energy Park ("AMEP") project, all other projects have intertidal habitats losses that are considered de minimis (i.e., negligible) in extent and ecologically inconsequential. Subtidal losses are also considered de minimis (i.e., negligible) in extent and ecologically inconsequential for all projects.~~ ~~Potential changes to marine habitats during construction or operation as a result of seabed disturbance (such as due to dredging or marine piling) are considered to be localised (i.e., limited in spatial extent), temporary~~
All projects		H1110: Sandbanks which are slightly covered by sea water all the time	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through	**Habitat loss/damage** With respect to intertidal habitat loss, noting that compensatory habitat will be provided for the Able Marine Energy Park ("AMEP") project, all other projects have intertidal habitats losses that are considered de minimis (i.e., negligible) in extent and ecologically inconsequential. Subtidal losses are also considered de minimis (i.e., negligible) in extent and ecologically inconsequential for all projects. Potential changes to marine habitats during construction or operation as a result of seabed disturbance (such as due to dredging or marine piling) are considered to be localised (i.e., limited in spatial extent), temporary and low magnitude for the IERRT project and all other projects with direct no spatial overlap of dredge or construction footprints occurring. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.

	H1130: Estuaries H1140: Mudflats and sandflats not covered by seawater at low tide	release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Contamination** Water quality effects are anticipated to be localised and temporary for all projects with effects on marine habitats or species considered negligible even when considered cumulatively. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	**Habitat loss/damage** Physical change to habitats resulting from the deposition of airborne pollutants	There is the potential for in-combination effects to occur where there are shared receptors and pollutants between the proposed IERRT project and other nearby schemes. The air quality assessment concludes that the proposed IERRT project does not have a significant effect on air quality and would not result in an AEOI. The scale, location and nature of emission sources associated with the other schemes suggests that they will not affect air quality at shared receptors and not result in an AEOI in-combination with the IERRT project.
	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis* S1364: Grey seal *Halichoerus grypus*	**Disturbance** Disturbance through underwater noise and vibration	Underwater noise impacts (on lamprey species and grey seal) as a result of the IERRT project along with several other projects have the potential to result in adverse significant effects in migratory fish and marine mammals species. However, there is considered to be no potential for AEOI on qualifying interest features as a result of the IERRT project with the proposed mitigation measures in place. All projects will be subject to similar mitigation measures to avoid the potential for any adverse cumulative underwater noise effects on these features. It is therefore considered a reasonable and robust conclusion that the predicted residual in-combination effects will not compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.

Table 38. The potential for an AEOI on qualifying species of the Humber Estuary SPA due to in-combination effects.

ID	Plan/Project	Features	Summary of potential effects	Potential for AEOI
1.	Maintenance dredge disposal at Grimsby, Immingham and Sunk Dredged Channel (MLA/2014/00431)	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Disturbance** • Airborne noise and visual disturbance	There is the potential for cumulative effects on birds features if the dredging activities associated with MLA/2014/00431 occur at the same time as construction and maintenance dredging as part of IERRT. The noise and visual stimuli associated with MLA/2014/00431 is likely to be similar to the dredging operations for IERRT and will be limited due the periodic frequency over the course of a year. Any disturbance responses would be expected to be infrequent, short duration and localised (i.e., limited in spatial extent). It is also considered likely that the availability of dredging plant (servicing the ports and approaches across the wider Humber, including Goole, Hull and Grimsby) will mean the potential for dredging to be taking place at adjacent locations and at the same time is limited. Assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
2.	Humber International Terminal (HIT) berth 2: adaptation for car carriers	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with HIT berth 2 works to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore during construction. Data presented as part of the marine licence application for the HIT berth 2 works suggest that waterbirds such as Shelduck, Dunlin, Curlew, Redshank and Black-tailed Godwit are only recorded in very low numbers (typically <10-20 individuals). Piling for the HIT berth 2 works will be short term (2 weeks) with only intermittent piling activity undertaken each day (several hours per day) during this period. Mild disturbance responses and short-term and localised (i.e., limited in spatial extent) displacement of the very low numbers of this species present in the vicinity of the proposed development during the works is possible. However, rather than being displaced from the local area completely, birds would be expected to redistribute to nearby foreshore in the Immingham area and continue to feed and roost in these alternative locations following dispersal. Following completion of the construction phase, birds would be expected to return to use the same areas as used prior to

		A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		construction with any effects considered temporary. In order to reduce potential waterbird disturbance effects associated with the IERRT project a range of mitigation measures are proposed. It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for any adverse cumulative effects on features of designated sites. Assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
3.	Outstrays to Skeffling Managed Realignment Scheme (OtSMRS)	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. There are no cumulative effects anticipated as the OtSMRS ZoI falls outside of the IERRT ZoI for noise and visual disturbance. The distance between each of the projects means that different local populations will be potentially affected. Birds which are part of different local populations may form part of the same feature, however given the scale of the potential disturbance and assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
21.	Development of a sustainable transport fuels facility Two discharge of conditions applications in 2022. Land at Hobson Way, Stallingborough (DM/0664/19/FUL)	No effects on SPA features.	N/A	N/A
35.	Construction of an Energy Recovery Facility with an electricity export capacity of up to 49.5MW and associated infrastructure including a stack to 90m high (DM/0026/18/FUL)	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Disturbance** • Airborne noise and visual disturbance	There is the potential for some cumulative noise effects if there are simultaneous construction works. However, given the generally localised (i.e., limited in spatial extent) nature of noise effects associated with the construction of each scheme, and provided IERRT and DM/0026/18/FUL complies with any assigned noise and vibration limits and follows the general guidance contained within BS 5228-1 with respect to noise mitigation, there are no anticipated in-combination effects, and it is concluded that there is no potential for AEOI on qualifying interest features. There also potential for cumulative operational noise effects, however provided each scheme complies with any operational noise limits or planning conditions/requirements there are no anticipated in-combination effects, and it is concluded that there is no potential for AEOI on qualifying interest features. Cumulative operational road traffic noise effects have already been included in the road traffic noise assessment reported in Chapter 14 Airborne Noise and Vibration (Application Document Reference number 8.2.14). The traffic data used to inform the noise assessment for the proposed IERRT project is inherently cumulative with regards to DM/0026/18/FUL.
44.	New access road from existing public highway on Queens Road, Immingham (DM/0294/21/FUL)	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa*	**Disturbance** • Airborne noise and visual disturbance	There is the potential for some cumulative noise effects if there are simultaneous construction works. However, given the generally localised (i.e., limited in spatial extent) nature of noise effects associated with the construction of each scheme, and provided IERRT and DM/0294/21/FUL complies with any assigned noise and vibration limits and follows the general guidance contained within BS 5228-1 with respect to noise mitigation, then the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.

		totanus (Non-breeding) Waterbird assemblage		
51.	Erection of 2x 24m Biomass Flues. Netherlands Way, Stallingborough	No effects on SPA features.	N/A	N/A
53.	Able Marine Energy Park (AMEP) DCO as consented and Material Change 1 and 2	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Habitat loss/damage** • Physical loss of (or change to) habitat and associated species **Disturbance** • Airborne noise and visual disturbance	**Habitat loss/damage** The AMEP project will result in a direct loss of intertidal habitat (mudflat and saltmarsh) as a result of the reclamation of the proposed quay (33 ha). Compensation for this loss will be provided at the Cherry Cobb Sands compensation site. Direct loss of intertidal as a result of the proposed IERRT development will be *de minimis* (i.e., negligible and ecologically inconsequential) in extent with birds expected to feed below or very close to the approach jetty and other infrastructure on the foreshore. Any avoidance of marine infrastructure is expected to be limited (and highly localised (i.e., very limited in spatial extent)) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. Therefore, with the provision of the compensatory habitat required for AMEP project, there is no additional cumulative effect from the IERRT project that could compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. **Disturbance** There is the potential for the AMEP project along with the IERRT project to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore during construction and operation. Mitigation measures for AMEP include a cold weather construction restriction. In addition, indirect functional loss of intertidal habitat (mudflat and saltmarsh) through disturbance will also be provided at the Cherry Cobb Sands compensation site. Assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects relating to disturbance are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
54.	Able Marine Energy Park (AMEP) Regulated Tidal Exchange & Managed Realignment scheme at Cherry Cobb Sands	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. There are no cumulative effects anticipated as the Cherry Cobb Sands compensation site ZoI falls outside of the IERRT ZoI for noise and visual disturbance. The distance between each of the projects means that different local populations will be potentially affected. Birds which are part of different local populations may form part of the same feature, however given the scale of the potential disturbance and assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		
55.	Humber Low Carbon Pipelines	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. Coastal waterbirds using functionally linked land within the footprint of the pipeline corridor could be potentially impacted due to disturbance during construction which could lead to cumulative effects with the IERRT project. The distance between each of the projects means that different local populations will be potentially affected. However, birds which are part of different local populations may form part of the same feature. Given the current uncertainties with respect to the construction methods and programme for the Humber Low Carbon Pipeline, a detailed assessment of effects on birds which are features of the SPA is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on marine habitats and species. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
56.	Viking CCS Pipeline	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. Coastal waterbirds using functionally linked land within the footprint of the pipeline corridor could be potentially impacted due to disturbance during construction which could lead to cumulative effects with the IERRT project. ~~The distance between each of the projects means that different local populations may be potentially affected. However, birds which are part of different local populations may form part of the same feature.~~ Given the ~~current uncertainties with respect to the construction methods and programme for the V Net Zero Pipeline, a detailed assessment of effects on birds which are features of the SPA is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential~~

		A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		~~for any adverse cumulative~~lack of spatial overlap between the Viking CCS pipeline and IERRT, and the mitigation included for both projects, no in-combination effects ~~on marine habitats and species~~are predicted. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
57.	Immingham Green Energy Terminal	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Habitat loss/damage** • Physical loss of (or change to) habitat and associated species **Disturbance** • Airborne noise and visual disturbance	**Habitat loss/damage** Intertidal habitat loss: Immingham Green Energy Terminal will result in the direct loss of 0.00158 ha (due to the marine piling) and a potential indirect loss of 0.03 ha (due to potential erosion as a result of the presence of the jetty causing changes in currents). The IERRT project, including changes made to application (accepted by the ExA on 6 December 2023) will result in direct loss of 0.012 ha (due to marine piling and capital dredging) and potential indirect loss of 0.02 ha (due to potential erosion of the foreshore). The anticipated total loss of intertidal as a result of IERRT and Immingham Green Energy Terminal is anticipated to be 0.044 ha (based on combined direct losses and modelling both schemes together to calculate potential for indirect intertidal losses). The combined loss of habitat represents approximately 0.000117 % of the Humber Estuary SPA. When considering this is the context of intertidal, the area of loss represents approximately 0.000495 % of intertidal foreshore habitats and approximately 0.000690 % of mudflat within the SPA. The predicted potential indirect intertidal losses for both projects (and direct loss due to capital dredging for IERRT), consist of very narrow strips on the lower shore around the sublittoral fringe. These losses are considered to be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g. due to seasonal patterns in accretion and erosion or following storm events). Waterbird species could potentially be feeding in the predicted areas of habitat loss (albeit minimal habitat loss as explained above) during low water periods, these very small areas remain largely inundated with water and are only uncovered for a very short duration. The direct losses of habitat due to marine piling for both projects will also be highly localised. The spatial extent of these losses represents a barely measurable and inconsequential reduction in available habitat for these mobile species even at a local scale along the eastern frontage of the port. On this basis, any change to prey resources for birds feeding in the local area will be negligible. Individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) will not be affected. These *de minimis* changes in mudflat extent are of a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary.
~~57.~~	~~Immingham Green Energy Terminal~~	~~A048; Common Shelduck (Non-breeding) *Tadorna tadorna*~~	~~**Disturbance**~~ ~~•Airborne noise and visual disturbance~~	Change to marine habitats (including waterbird foraging and roosting habitat as result of the presence of marine infrastructure): The approach jetties for both projects will be an open piled structure with large gaps between each of the piles and between the jetty deck and the foreshore seabed (i.e. the mudflat surface). This will minimise the enclosed feel and allow birds feeding near the structure to maintain sightlines. It should be noted that observations from the ornithology surveys in the area suggest that birds regularly feed in very close proximity to both the Eastern Jetty and the Immingham Oil Terminal approach jetty – which are both similar open piled structures - with species such as Redshank, Dunlin, Turnstone regularly recorded underneath jetties and Curlew, Shelduck and Black-tailed Godwit approaching them closely (<10-20m). On this basis, birds would be expected to show similar highly localised responses to structures associated with both projects with responses ranging from no avoidance for some species to potentially some local avoidance (i.e. directly underneath or in close proximity) for other species. As a consequence, any avoidance of marine infrastructure is expected to be limited (and highly localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. **Disturbance** There is the potential for the IERRT project along with the Immingham Green Energy Terminal to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore if disturbing activities associated with each of the construction programmes are being undertaken concurrently. ~~Given the current uncertainties with respect to the construction methods and programme and operational noise impacts for the Immingham Green Energy Terminal, a detailed assessment is not considered possible.~~ ~~It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites.~~ This could reduce the amount of foreshore available with limited disturbance in the local area. Broadly similar mitigation measures are

		~~A143: Red Knot (Non-breeding) *Calidris canutus*~~ ~~A149: Dunlin *Calidris alpina alpina* (Non-breeding)~~ ~~A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding)~~ ~~A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica*~~ ~~A162: Common Redshank *Tringa totanus* (Non-breeding)~~ ~~Waterbird assemblage~~		proposed for both projects in order to minimise potential disturbance. This includes a winter marine construction restriction from 1 October to 31 March (for works within 200m of exposed mudflat) which will limit potential disturbance over the colder winter months when birds are considered particularly vulnerable to the effects of disturbance. This measure along with the use of acoustic barriers/screens (predicted to reduce noise levels to <70 dB Lmax at distances greater than approximately 200 m from the marine piling) and soft start procedures will also help minimise the potential spatial extent of disturbance. Therefore, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects with alternative locations in the Immingham area are available to birds to feed and roost which will not be in the zone of influence of potential disturbance. Furthermore, following completion of the construction phase, birds would be expected to return to broadly use the same areas as used prior to construction with any effects considered temporary. Coastal waterbirds are regularly recorded feeding nearby or below port structures such as jetties or pontoons and appear to be relatively tolerant to normal day-to-day port operational activities. Therefore, while there is the potential for some mild and infrequent disturbance occurring during operation near to the approach jetties for both projects, it is expected that birds will become habituated relatively quickly which will limit any longer- term disturbance responses. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
58.	South Humber Bank Energy Centre	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with the South Humber Bank Energy Centre to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds which are present on the field to the south of the site, but this will be mitigated for by changing the type of piling technique or applying seasonal timing restrictions to drop hammer piling. On this basis, given the proposed mitigation for both projects, it is concluded that the potential for any adverse cumulative effects on coastal waterbirds would be avoided. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
59.	VPI Immingham B OCGT	No effects on SPA features.	N/A	N/A
60.	North Killingholme Power Project	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with North Killingholme Power Project to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds. However, given the mitigation proposed for both projects which includes soft start procedures and timing restrictions to avoid sensitive periods, it is considered that the impacts are likely to result in mild disturbance responses and short term displacement. The works are located 8 km from IERRT and therefore would affect different local populations. It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for any adverse ~~cumulative effects on marine ecology receptors. Therefore, assuming appropriate mitigation measures are followed during construction of the IERRT project, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
		A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		cumulative effects on marine ecology receptors. Therefore, assuming appropriate mitigation measures are followed during construction of the IERRT project, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
61.	Humber Stallingborough Phase 3 Project	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with the Stallingborough Phase 3 Project to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore if disturbing activities associated with each of the construction programmes are being undertaken concurrently. This could reduce the amount of foreshore available with limited disturbance stimuli in the local area. However, the Stallingborough Phase 3 Project will not be undertaken during the winter period (between October and March) which will help minimise potential disturbance effects associated with this project. In order to reduce potential waterbird disturbance effects associated with the IERRT project a range of mitigation measures are proposed. It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
62	Immingham Onshore Wind	A048; Common Shelduck (Non-breeding) *Tadorna tadorna*	**Disturbance** • Airborne noise and visual	There is the potential for the onshore turbine project to cause displacement effects to SPA coastal waterbird features as well as a collision risk. However, based on the latest scheme design, the turbine locations are too

		A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		potential collision rates will be very low for all SPA waterbird species and will not cause population level effects. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the residual predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
All projects		A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non-breeding) A157: Bar-tailed Godwit (Non-breeding) *Limosa lapponica* A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage	**Habitat loss/damage** • Physical loss of (or change to) habitat and associated species **Disturbance** • Airborne noise and visual disturbance	**Habitat loss/damage** With respect to intertidal habitat loss for coastal waterbirds, on the basis that compensatory habitat will be provided for the Able Marine Energy Park (AMEP project), all other projects have intertidal habitats losses that are considered *de minimis* (i.e., negligible) in extent and ecologically inconsequential. On this basis, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. **Disturbance** Potential noise and visual disturbance impacts during construction as a result of the IERRT project along with several other projects have the potential to result in potential disturbance to coastal waterbirds. However, with the proposed mitigation required for each project there is considered to be no potential for AEOI on qualifying interest features. It is therefore considered a reasonable and robust conclusion that the predicted residual in-combination effects will not compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.

Table 39. The potential for an AEOI on qualifying habitats and species of the Humber Ramsar due to in-combination effects.

ID	Plan/Project	Features	Summary of potential effects	Potential for AEOI
1.	Maintenance dredge disposal at Grimsby, Immingham and Sunk Dredged Channel (MLA/2014/00431)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical loss or damage of habitat through alterations in physical processes • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The habitats in the area are already subject to considerable seabed disturbance as a result of the existing maintenance dredging regime. The variations proposed to this existing maintenance dredge licence will not change the volumes of material to be dredged from the Port of Immingham area. The marine habitats and species occurring in the area are also considered to be commonly occurring and of low conservation value. Changes during dredging as a result of the IERRT project are considered to be localised (i.e., limited in spatial extent) and low magnitude and in-combination with this maintenance dredging project will result in only a small increase in the potential maintenance dredge commitment for the Immingham area and disposal site. There is the potential for cumulative effects on local air quality. Activities associated with MLA/2014/00431 may have emissions to air that could coincide with proposed IERRT emissions and effect shared receptors. Due to the location of MLA/2014/00431 emission sources, shared receptors are limited to air quality sensitive habitats within the Humber Estuary Ramsar, namely the closet areas of saltmarsh. The proposed IERRT project does not impact on the nearest saltmarsh habitats to the extent that the effect is significant. Any emissions associated with MLA/2014/00431 will be limited due to the number of emission sources and intermittent operation of those sources over the course of a year. **Contamination** In relation to the release of sediment -bound contaminants, the Marine Licence requires sediment samples to be tested in line with OSPAR requirements prior to disposal which minimises the potential for mobilisation of contaminants. In addition, this project is concerned with the disposal of recently accreted sediment which is less likely to comprise a source of historic contamination and therefore this is unlikely to result in a cumulative effect. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934	**Disturbance** • Airborne noise and visual disturbance	There is the potential for cumulative effects on birds features if the dredging activities associated with MLA/2014/00431 occur at the same time as construction and maintenance dredging as part of IERRT.

		waterfowl (5-year peak mean 1998/99-2002/3)		The noise and visual stimuli associated with MLA/2014/00431 is likely to be similar to the dredging operations for IERRT and will be limited due the periodic frequency over the course of a year. Any disturbance responses would be expected to be infrequent, short duration and localised (i.e., limited in spatial extent). It is also considered likely that the availability of dredging plant (servicing the ports and approaches across the wider Humber, including Goole, Hull and Grimsby) will mean the potential for dredging to be taking place at adjacent locations and at the same time is limited. Assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	**Disturbance** • Disturbance through underwater noise and vibration	There is the potential for cumulative effects on lamprey and grey seal features if the dredging activities associated with MLA/2014/00431 occur at the same time as construction and maintenance dredging as part of IERRT. The noise associated with MLA/2014/00431 is likely to be similar to the dredging operations for IERRT and will be limited due the intermittent operation over the course of a year. It is also considered likely that the availability of dredging plant (servicing the ports and approaches across the wider Humber, including Goole, Hull and Grimsby) will mean the potential for dredging to be taking place at adjacent locations and at the same time is limited. However, dredging for both projects is only expected to cause behavioural reactions (at most) in a relatively localised area in the vicinity of the dredger. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both		
		river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		
2.	Humber International Terminal (HIT) berth 2: adaptation for car carriers	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The piles required for the HIT berth 2 works will result in a *de minimis* (i.e., negligible and ecologically inconsequential) loss of subtidal habitat. In addition, sedimentation due to the localised resuspension of sediment as a result of seabed disturbance during piling and changes to hydrodynamic and sedimentary processes due to the presence of the piles including potential scouring directly around piles effects are anticipated to be negligible and highly localised (i.e., very limited in spatial extent). Furthermore, the benthic community is expected to recover relatively rapidly from any localised physical disturbance with subtidal species known to occur in the area typically considered fast growing and/or have rapid reproductive rates. The cumulative effects of physical loss of habitat are considered negligible. **Contamination** In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance during piling. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with HIT berth 2 works to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore during construction. Data presented as part of the marine licence application for the HIT berth 2 works suggest that waterbirds such as Shelduck, Dunlin, Curlew, Redshank and Black-tailed Godwit are only recorded in very low numbers (typically <10-20 individuals). Piling for the HIT berth 2 works will be short term (2 weeks) with only intermittent piling activity undertaken each day (several hours per day) during this period. Mild disturbance responses and short-term and localised (i.e., limited in spatial extent) displacement of the very low numbers of this species present in the vicinity of the proposed development during the works is possible. However, rather than being displaced from the local area completely, birds would be expected to redistribute to nearby foreshore in the Immingham area and continue to feed and roost in these alternative locations following dispersal. Following completion of the construction phase, birds would be expected to return to use the same areas as used prior to

		Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		construction with any effects considered temporary. In order to reduce potential waterbird disturbance effects associated with the IERRT project a range of mitigation measures are proposed. It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for any adverse cumulative effects on features of designated sites. Assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis*	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with HIT berth 2 works have the potential to result in cumulative effects on lamprey and grey seal features of the Humber Estuary Ramsar. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Both projects~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. Both IERRT and HIT Projects will require similar mitigation to help minimise potential adverse effects (such as soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). ~~It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
		and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
3.	Outstrays to Skeffling Managed Realignment Scheme (OtSMRS)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The proposed OtSMRS is located approximately 10 km from the IERRT project. The managed realignment site works has the potential to result in highly localised (i.e., very limited in spatial extent) effects on physical processes elements (such as local flows and elevated suspended sediment levels and sediment deposition) as a result of the breaching. The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the hydrodynamic or sedimentary effects as a result of the IERRT project. **Contamination** Effects on water quality are also predicted to be highly localised (i.e., very limited in spatial extent) quality (such as due to elevated suspended sediment levels and changes to dissolved oxygen and chemical water quality). The highly localised and (likely) small extent of effects will not significantly overlap with the ZoI of the water quality effects as a result of the IERRT project. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance:	**Disturbance** • Airborne noise and visual	Both projects have the potential to cause potential disturbance to waterbirds. There are no cumulative effects anticipated as the OtSMRS ZoI falls outside of the IERRT ZoI for noise and visual disturbance. The distance

		Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	disturbance	between each of the projects means that different local populations will be potentially affected. Birds which are part of different local populations may form part of the same feature, however given the scale of the potential disturbance and assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
21.	Development of a sustainable transport fuels facility Two discharge of conditions applications in 2022. Land at Hobson Way, Stallingborough (DM/0664/19/FUL)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Potential for cumulative effects in relation to operational effects from emissions. In terms of impacts from DM/0664/19/FUL on the Humber Estuary, with respect to annual mean NOx, annual mean ammonia and annual mean sulphur dioxide; total concentrations will be below the relevant critical levels. With respect to 24-hour mean NOx, nutrient nitrogen deposition and acid deposition, baseline concentrations currently exceed the critical level or load and as the predicted process contributions exceed 1%/10% of the relevant critical levels and critical loads, significant impacts cannot be discounted The proposed DM/0664/19/FUL development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for DM/0664/19/FUL. The predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
35.	Construction of an Energy Recovery Facility with an electricity export capacity of up to 49.5MW and associated infrastructure including a stack to 90m high (DM/0026/18/FUL)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, ~~saltmarshes, and coastal brackish/saline lagoons.~~	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Potential for cumulative effects in relation to operational effects from emissions. In terms of impacts from DM/0026/18/FUL on the Humber Estuary, with respect to annual mean NOx, annual mean ammonia and annual mean sulphur dioxide total concentrations will be below the relevant critical levels. There is a small magnitude increase in oxides of nitrogen levels and nitrogen deposition on saltmarsh habitats and this is assessed as not significant. The proposed DM/0026/18/FUL development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. The predicted in-~~combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
		saltmarshes, and coastal brackish/saline lagoons.		combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for some cumulative noise effects if there are simultaneous construction works. However, given the generally localised nature of noise effects associated with the construction of each scheme, and provided IERRT and DM/0026/18/FUL complies with any assigned noise and vibration limits and follows the general guidance contained within BS 5228-1 with respect to noise mitigation, there are no anticipated in-combination effects, and it is concluded that there is no potential for AEOI on qualifying interest features. There also potential for cumulative operational noise effects, however provided each scheme complies with any operational noise limits or planning conditions/requirements there are no anticipated in-combination effects, and it is concluded that there is no potential for AEOI on qualifying interest features. Cumulative operational road traffic noise effects have already been included in the road traffic noise assessment reported in Chapter 14 Airborne Noise and Vibration (Application Document Reference number 8.2.14). The traffic data used to inform the noise assessment for the proposed IERRT project is inherently cumulative with regards to DM/0026/18/FUL.
44.	New access road from existing public highway on Queens Road, Immingham (DM/0294/21/FUL)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	The potential impacts on air quality relate to construction dust and it is reasonable to assume that the planning application process has identified a proportionate level of mitigation relating to this effect. There are no predicted impacts in relation to nitrogen deposition and therefore no in-combination effects and no AEOI.

		coastal brackish/saline lagoons.		
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for some cumulative noise effects if there are simultaneous construction works. However, given the generally localised nature of noise effects associated with the construction of each scheme, and provided IERRT and DM/0294/21/FUL complies with any assigned noise and vibration limits and follows the general guidance contained within BS 5228-1 with respect to noise mitigation, then the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
51.	Erection of 2x 24m Biomass Flues. Netherlands Way, Stallingborough (DM/1056/20/FUL)	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Potential for cumulative effects from emissions. The air quality assessment for DM/1056/20/FUL concluded that the effects were insignificant at all receptors and given the scale of the project there are no anticipated cumulative effects and it is concluded that there is no potential for AEOI on qualifying interest features.
53.	Able Marine Energy Park (AMEP) DCO as consented and Material Change 1 and 2	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component ~~habitats: dune systems and humid dune slacks, estuarine waters,~~	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes ~~• Physical damage through disturbance and/or smothering of habitat~~	**Habitat loss/damage** Both the AMEP and IERRT project have the potential to result in changes to marine habitats as a result of capital dredging due to physical disturbance during sediment removal, sediment deposition and indirectly as a result of changes to hydrodynamic and sedimentary processes. These potential effects were assessed as not significant both projects. The subtidal habitats around the Port of Immingham are typically impoverished and of low ecological value reflecting the existing high levels of physical disturbance in the area due to strong ~~near bed tidal currents and sediment transport. Deposition of sediment as a result of dredging for both projects were predicted to be localised and similar to background variability away from the dredge pockets~~
		habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	• Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	near bed tidal currents and sediment transport. Deposition of sediment as a result of dredging for both projects were predicted to be localised and similar to background variability away from the dredge pockets with species occurring in the local area considered tolerant to some sediment deposition. The cumulative effects of change on marine habitats and species from the highly localised (i.e., very limited in spatial extent) and small scale predicted effects due to hydrodynamic and sedimentary processes are considered negligible for both projects. The AMEP project will result in a direct loss of intertidal habitat (mudflat and saltmarsh) as a result of the reclamation of the proposed quay (33 ha). Compensation for this loss will be provided at the Cherry Cobb Sands compensation site. Direct loss of intertidal as a result of the proposed IERRT development will be *de minimis* (i.e., negligible and ecologically inconsequential) and therefore, with the provision of the compensatory habitat required for AMEP project, there is no additional cumulative effect from the IERRT project that could compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. With respect to airborne pollutants, the traffic data used to inform the air quality assessment for the proposed IERRT project is inherently cumulative with regards to the Consent Order for the AMEP. There are no predicted in-combination effects and it is concluded that there is no potential for AEOI on qualifying interest features. **Contamination** In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible.

				In relation to the release of sediment -bound contaminants, the level of contamination in the proposed dredge areas for both projects was considered to be low with material expected be rapidly dispersed by strong tidal currents in the area. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Habitat loss/damage** • Physical loss of (or change to) habitat and associated species **Disturbance** • Airborne noise and visual disturbance	**Habitat loss/damage** The AMEP project will result in a direct loss of intertidal habitat (mudflat and saltmarsh) as a result of the reclamation of the proposed quay (33 ha). Compensation for this loss will be provided at the Cherry Cobb Sands compensation site. Direct loss of intertidal as a result of the proposed IERRT development will be *de minimis* (i.e., negligible and ecologically inconsequential) in extent with birds expected to feed below or very close to the approach jetty and other infrastructure on the foreshore. Any avoidance of marine infrastructure is expected to be limited (and highly localised (i.e., very limited in spatial extent)) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. Therefore, with the provision of the compensatory habitat required for AMEP project, there is no additional cumulative effect from the IERRT project that could compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. **Disturbance** There is the potential for the AMEP project along with the IERRT project to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore during construction and operation. Mitigation measures for AMEP include a cold weather construction restriction. In addition, indirect functional loss of intertidal habitat (mudflat and saltmarsh) through disturbance will also be provided at the Cherry Cobb Sands compensation site. Assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects relating to disturbance are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: ~~The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna~~	**Disturbance** ~~•Disturbance through underwater noise and vibration~~	Underwater noise generated during piling required as part of the IERRT project along with the AMEP works have the potential to result in cumulative effects on lamprey and grey seal features of the Humber Estuary Ramsar. Dredging for both projects is only expected to cause behavioural reactions in a relatively localised ~~area in the vicinity of the dredger for both fish and marine mammals. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. Both projects will require similar~~
		The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	• Disturbance through underwater noise and vibration	area in the vicinity of the dredger for both fish and marine mammals. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. Both IERRT and AMEP Projects will require similar mitigation to help minimise potential adverse effects (such as soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
54.	Able Marine Energy Park (AMEP) Regulated Tidal Exchange & Managed Realignment scheme at Cherry Cobb Sands	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat	**Habitat loss/damage** The proposed Managed Realignment Scheme is located on the opposite bank of the Humber Estuary. The managed realignment site works has the potential to result in highly localised (i.e., very limited in spatial extent) effects on physical processes elements (such as local flows and elevated suspended sediment levels and sediment deposition) as a result of the breaching. The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the hydrodynamic or sedimentary effects as a result of the IERRT project.

		sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Contamination** Effects on water quality are also predicted to be highly localised (i.e., very limited in spatial extent) (such as due to elevated suspended sediment levels and changes to dissolved oxygen and chemical water quality). The highly localised (i.e., very limited in spatial extent) and (likely) small extent of effects will not significantly overlap with the ZoI of the water quality effects as a result of the IERRT project. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. There are no cumulative effects anticipated as the Cherry Cobb Sands compensation site ZoI falls outside of the IERRT ZoI for noise and vibration. The distance between each of the projects means that different local populations will be potentially affected. Birds which are part of different local populations may form part of the same feature, however given the scale of the potential disturbance and assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		
55.	Humber Low Carbon Pipelines	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, ~~intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.~~	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat ~~• Physical loss of (or change to) habitat and associated species~~ ~~**Contamination**~~ ~~• Non-toxic contamination through elevated SSC~~	**Habitat loss/damage** Based on information provided in the EIA scoping report for the Humber Low Carbon Project, trenchless methods (e.g., bored tunnel) could be used to minimise potential effects on Ramsar habitats where the pipelines cross the Humber Estuary. However, construction method has not been confirmed at the landfall (trenchless, e.g., Horizontal Directional Drilling (HDD), or via cofferdam) and, therefore, features of the Ramsar could not be scoped out. ~~**Contamination**~~ ~~In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible.~~
		intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	• Physical loss of (or change to) habitat and associated species **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Contamination** In relation to water and sediment quality, there is the potential for cumulative effects with respect to increased SSC and changes to dissolved oxygen and chemical water quality as a result of seabed disturbance. Any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. In relation to the release of sediment -bound contaminants, it is assumed that the Humber Low Carbon Project projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects. If trenchless methods are not feasible and excavation (dredging) of the seabed is required then the project would require sediment samples to be tested in line with OSPAR requirements which minimises the potential for mobilisation of contaminants. Given the current uncertainties with respect to the construction methods and programme for the Humber Low Carbon Pipeline, a detailed assessment of effects on Ramsar features is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on Ramsar features. Therefore, assuming appropriate mitigation measures are followed for the IERRT project in-combination effects are not considered to compromise any of the conservation objectives, and a conclusion of no AEOI can be reached, subject to further information becoming available.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. Coastal waterbirds using functionally linked land within the footprint of the pipeline corridor could be potentially impacted due to disturbance during construction which could lead to cumulative effects with the IERRT project. The distance between each of the projects means that different local populations will be potentially affected. Given the current uncertainties with respect to the construction methods and programme for the Humber Low

		Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		Carbon Pipeline, a detailed assessment of effects on birds which are features of the SPA is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on marine habitats and species. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	**Disturbance** • Disturbance through underwater noise and vibration	Given the current uncertainties with respect to the construction methods and programme for the Humber Low Carbon Pipeline, a detailed assessment of underwater noise and vibration effects on Ramsar features is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on Ramsar features. Therefore, assuming appropriate mitigation measures are followed for the IERRT project in-combination effects are not considered to compromise any of the conservation objectives, and a conclusion of no AEOI can be reached, subject to further information becoming available.
		Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		
56.	Viking CCS Pipeline	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) ~~Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage)~~	**Disturbance** • Airborne noise and visual disturbance	Both projects have the potential to cause potential disturbance to waterbirds. Coastal waterbirds using functionally linked land within the footprint of the pipeline corridor could be potentially impacted due to disturbance during construction which could lead to cumulative effects with the IERRT project. ~~The distance between each of the projects means that different local populations may be potentially affected. However, birds which are part of different local populations may form part of the same feature.~~ Given the ~~current uncertainties with respect to the construction methods and programme for the V Net Zero Pipeline, a detailed assessment of effects on birds which are features of the Ramsar is not considered possible. However, it is assumed that both projects will be subject to controls by statutory bodies to avoid the potential for any adverse cumulative effects on marine habitats and species. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects~~lack of spatial overlap between the Viking CCS pipeline and IERRT, and the mitigation included for both projects, no in-combination effects are predicted.
		Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)		Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
57.	Immingham Green Energy Terminal	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species	**Habitat loss/damage** ~~The piles required for the jetty of the Immingham Green Energy Terminal project are likely to result in a small loss of subtidal habitat and a *de minimis* (i.e., negligible and ecologically inconsequential) loss in the intertidal. In addition, sedimentation due to the localised resuspension of sediment as a result of seabed disturbance during piling and the small capital dredge as well as changes to hydrodynamic and sedimentary processes due to the presence of the piles/dredging are anticipated to be negligible and highly localised (i.e., very limited in spatial extent). Furthermore, the benthic community is expected to recover relatively rapidly from any localised physical disturbance with subtidal species known to occur in the area typically considered fast growing and/or have rapid reproductive rates. The cumulative effects of change on marine habitats and species are considered low magnitude and *de minimis* (i.e., negligible and ecologically inconsequential) in~~

			• Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	~~scale for both projects.~~ ~~**Contamination**~~ ~~In relation to water and sediment quality, there is the potential for cumulative effects from the resuspension of sediment as a result of seabed disturbance during piling and the small capital dredge will cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible.~~ ~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~ ~~There are potential for cumulative effects on local air quality, due to the proximity of the Consent Order application site from the proposed IERRT project, shared receptors and pollutants. There is no AEOI of the proposed IERRT project alone, although the effect of the Consent Order application cannot be confirmed until further information on that application is published.~~Intertidal habitat loss: Immingham Green Energy Terminal will result in the direct loss of 0.00158 ha (due to the marine piling) and a potential indirect loss of 0.03 ha (due to potential erosion as a result of the presence of the jetty causing changes in currents). The IERRT project, including changes made to application (accepted by the ExA on 6 December 2023) will result in direct loss of 0.012 ha (due to marine piling and capital dredging) and potential indirect loss of 0.02 ha (due to potential erosion of the foreshore). The anticipated total loss of intertidal as a result of IERRT and Immingham Green Energy Terminal is anticipated to be 0.044 ha (based on combined direct losses and modelling both schemes together to calculate potential for indirect intertidal losses). The combined loss of habitat represents approximately 0.000117 % of the Humber Estuary SPA. When considering this is the context of intertidal, the area of loss represents approximately 0.000495 % of intertidal foreshore habitats and approximately 0.000690 % of mudflat within the SPA. The predicted potential indirect intertidal losses for both projects (and direct loss due to capital dredging for IERRT), consist of very narrow strips on the lower shore around the sublittoral fringe. These losses are considered to be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g. due to seasonal patterns in accretion and erosion or following storm events). These de minimis changes in mudflat extent are of a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary. Subtidal habitat loss: Marine piling will result in a direct loss of 0.032 ha and 0.051 ha of seabed habitat for IERRT and Immingham Green Energy Terminal respectively. This combined habitat loss of 0.083 ha represents approximately 0.000218 % of the Humber Estuary Ramsar. The combined loss in subtidal habitat as a result of the piles is considered negligible in the context of the extent of the overall amount of similar marine habitats found locally in the Humber Estuary. All the species recorded were considered commonly occurring and not protected. Furthermore, faunal assemblage recorded during project specific benthic surveys for both projects are also considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary. Localised losses of this magnitude are also not considered to adversely affect the overall functioning of subtidal habitats within this section of the Humber Estuary. Change to marine habitats: Capital dredging for the Immingham Green Energy Terminal will remove 4,000m^3 of material over a maximum area of approximately 10,000m^2 (with the capital dredge for IERRT removing approximately 190,000m^3 of material over a maximum area of approximately 70,000m^2). For both projects following dredging, it is considered likely that the dredge pocket would provide similar substrate for infaunal colonisation to that under pre-dredge conditions which would then be expected to be recolonised by a similar assemblage to baseline conditions. In addition, sedimentation as a result of capital dredging for both projects is predicted to be highly localised and similar to background variability. Species recorded in both dredge footprint areas are considered tolerant to the predicted millimetric changes in deposition and therefore smothering effects as considered unlikely. In addition, the species recorded in the benthic invertebrate surveys are fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than one to two years and for some species within a few months. For IGET, maintenance dredging is expected to be very limited (if required at all). As a result, any dredging that is required will only be undertaken very periodically (frequency will be dictated by operational requirements but is anticipated there could be several years or more between maintenance dredge campaigns). For the IERRT project, regular maintenance dredging (i.e. occurring every 3-4 months) is anticipated to be restricted to a relatively small proportion of the total maintenance dredge area (i.e. focused around the finger pier piles and adjacent areas of the berth pockets and pontoons). The remainder of the area will only be required to be dredged much more periodically (frequency in these areas will be dictated by

				operational requirements but is anticipated to be approximately every 1-2 years or more). In both areas, a generally impoverished benthic community was recorded in the dredge footprint which is likely to reflect the
				existing high levels of physical disturbance in the area due to strong near bed tidal currents and sediment transport with infaunal populations anticipated to fully re-establish in between several months and 1-2 years. On this basis, given the expected frequency of dredging, a comparable macrofaunal community to pre dredge conditions would be expected to occur over much of both the maintenance dredging footprints. **Contamination** In relation to water and sediment quality, there is the potential for cumulative effects from the resuspension of sediment as a result of seabed disturbance during piling and capital dredging for both projects will cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) and the effects are considered negligible. Natural England's Supplementary Advice on Conservation Objectives for the Humber Estuary SAC states that the conservation objective for the 'Atlantic salt meadows *Glauco-Puccinellietalia maritimae'* and 'Salicornia and other annuals colonising mud and sand' habitat features relevant to the assessment of air quality effects is to "Maintain concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature on the Air Pollution Information System". Immingham Green Energy Terminal will result in a mean deposition rate of 16 kg N/ ha/ yr on the nearest saltmarsh habitat. Indeed, air quality modelling forecasts a slight improvement in nitrogen deposition between the base year and 2036 even when allowing for Immingham Green Energy Terminal and IERRT. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Habitat loss/damage** • Physical loss of (or change to) habitat and associated species **Disturbance** • Airborne noise and visual disturbance	**Habitat loss/damage** Intertidal habitat loss: Immingham Green Energy Terminal will result in the direct loss of 0.00158 ha (due to the marine piling) and a potential indirect loss of 0.03 ha (due to potential erosion as a result of the presence of the jetty causing changes in currents). The IERRT project, including changes made to application (accepted by the ExA on 6 December 2023) will result in direct loss of 0.012 ha (due to marine piling and capital dredging) and potential indirect loss of 0.02 ha (due to potential erosion of the foreshore). The anticipated total loss of intertidal as a result of IERRT and Immingham Green Energy Terminal is anticipated to be 0.044 ha (based on combined direct losses and modelling both schemes together to calculate potential for indirect intertidal losses). The combined loss of habitat represents approximately 0.000117 % of the Humber Estuary Ramsar. When considering this is the context of intertidal, the area of loss represents approximately 0.000495 % of intertidal foreshore habitats and approximately 0.000690 % of mudflat within the Ramsar. The predicted potential indirect intertidal losses for both projects (and direct loss due to capital dredging for IERRT), consist of very narrow strips on the lower shore around the sublittoral fringe. These losses are considered to be of a similar scale to that which can occur due to natural background changes in mudflat extent in the local region (e.g. due to seasonal patterns in accretion and erosion or following storm events). Waterbird species could potentially be feeding in the predicted areas of habitat loss (albeit minimal habitat loss as explained above) during low water periods, these very small areas remain largely inundated with water and are only uncovered for a very short duration. The direct losses of habitat due to marine piling for both projects will also be highly localised. The spatial extent of these losses represents a barely measurable and inconsequential reduction in available habitat for these mobile species even at a local scale along the eastern frontage of the port. On this basis, any change to prey resources for birds feeding in the local area will be negligible. Individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) will not be affected. These *de minimis* changes in mudflat extent are of a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary. Change to marine habitats (including waterbird foraging and roosting habitat as result of the presence of marine infrastructure): The approach jetties for both projects will be an open piled structure with large gaps between each of the piles and between the jetty deck and the foreshore seabed (i.e. the mudflat surface). This will minimise the enclosed feel and allow birds feeding near the structure to maintain sightlines. It should be noted that observations from the ornithology surveys in the area suggest that birds regularly feed in very close proximity to both the Eastern Jetty and the Immingham Oil Terminal approach jetty – which are both similar open piled structures - with species such as Redshank, Dunlin, Turnstone regularly recorded underneath jetties and Curlew, Shelduck and Black-tailed Godwit approaching them closely (<10-20m). On this basis, birds would be expected to show similar highly localised responses to structures associated with
		~~Criterion 5 – Bird Assemblages of~~	~~**Disturbance**~~	~~Both projects have the potential to cause potential disturbance to waterbirds if there are simultaneous~~

		~~International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)~~ ~~Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)~~	~~•Airborne noise and visual disturbance~~	~~construction works due to the proximity of the IERRT project and the Immingham Green Energy Terminal. Given the current uncertainties with respect to the construction methods and programme and operational noise impacts for the Immingham Green Energy Terminal, a detailed assessment is not considered possible.~~ ~~It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites.~~ both projects with responses ranging from no avoidance for some species to potentially some local avoidance (i.e. directly underneath or in close proximity) for other species. As a consequence, any avoidance of marine infrastructure is expected to be limited (and highly localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. **Disturbance** There is the potential for the IERRT project along with the Immingham Green Energy Terminal to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore if disturbing activities associated with each of the construction programmes are being undertaken concurrently. This could reduce the amount of foreshore available with limited disturbance in the local area. Broadly similar mitigation measures are proposed for both projects in order to minimise potential disturbance. This includes a winter marine construction restriction from 1 October to 31 March (for works within 200m of exposed mudflat) which will limit potential disturbance over the colder winter months when birds are considered particularly vulnerable to the effects of disturbance. This measure along with the use of acoustic barriers/screens (predicted to reduce noise levels to <70 dB Lmax at distances greater than approximately 200 m from the marine piling) and soft start procedures will also help minimise the potential spatial extent of disturbance. Therefore, with the application of the proposed mitigation measures, disturbance responses are expected to be limited, both in terms of frequency and the spatial extent of effects with alternative locations in the Immingham area are available to birds to feed and roost which will not be in the zone of influence of potential disturbance. Furthermore, following completion of the construction phase, birds would be expected to return to broadly use the same areas as used prior to construction with any effects considered temporary. Coastal waterbirds are regularly recorded feeding nearby or below port structures such as jetties or pontoons and appear to be relatively tolerant to normal day-to-day port operational activities. Therefore, while there is the potential for some mild and infrequent disturbance occurring during operation near to the approach jetties for both projects, it is expected that birds will become habituated relatively quickly which will limit any longer-term disturbance responses. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with the Immingham Green Energy Terminal works have the potential to result in cumulative effects on lamprey and grey seal features of the Humber Estuary Ramsar. Dredging for both projects is only expected to cause behavioural reactions in a relatively localised area in the vicinity of the dredger for both fish and marine mammals. Piling noise has the potential to cause injury effects in fish and marine mammals within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Given the current uncertainties with respect to the construction methods and programme and operational noise impacts~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. The same mitigation measures are proposed for ~~the~~both IERRT and Immingham Green Energy Terminal~~, a detailed assessment is not considered possible.~~ ~~It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites~~ Projects to help minimise potential adverse effects (i.e. soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		~~river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.~~		

				for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with the South Humber Bank Energy Centre to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds which are present on the field to the south of the site, but this will be mitigated for by changing the type of piling technique or applying seasonal timing restrictions to drop hammer piling. On this basis, given the proposed mitigation for both projects, it is concluded that the potential for any adverse cumulative effects on coastal waterbirds would be avoided. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
59.	VPI Immingham B OCGT	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical change to habitats resulting from the deposition of airborne pollutants	Some potential for significant cumulative effects on local air quality during operation, due to the proximity of the VPI Immingham B OCGT development application site from the proposed IERRT project, shared receptors and pollutants. There are no significant cumulative adverse effects on air quality during construction from the IERRT or the VPI Immingham B OCGT development. Predicted concentrations of air pollutants at ground level due to emissions from the stacks during operation of the VPI Immingham B OCGT development have been calculated and used to determine the appropriate height of stacks. The proposed VPI Immingham B OCGT development will operate in accordance with BAT and regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for VPI Immingham B OCGT development. The predicted in-combination effects are therefore not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
60.	North Killingholme Power Project	Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** The marine elements of the proposed North Killingholme Power Project are located approximately 8 km up-estuary of the IERRT location. In between the two schemes is the infrastructure associated with the Immingham Eastern and Western jetties, the Immingham Outer Harbour and the Humber international Terminal. The assessment for IERRT indicates that the extent of change to hydrodynamics and waves does not extend up-estuary to the North Killingholme Power Project location. There are no anticipated cumulative effects. The North Killingholme Power Project involves the construction of an intake and piling within the existing footprint of the Killingholme Ports jetty. The DCO requires the scheme to be approved by the MMO prior to construction. Given that consent has been granted it is considered that impacts from the North Killingholme Power Project have been adequately mitigated. On this basis cumulative effects are anticipated to be negligible In relation to water and sediment quality, the potential impacts resulting from the North Killingholme Power Project (such as increased suspended sediment levels) will be highly localised (i.e., very limited in spatial extent), temporary and are considered negligible. **Contamination** Given the extent of seabed disturbance which involves construction of an intake and piling any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen). There are no anticipated cumulative effects. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
			~~•Non-toxic contamination through elevated SSC~~ ~~•Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases~~	~~In relation to water and sediment quality, the potential impacts resulting from the North Killingholme Power Project (such as increased suspended sediment levels) will be highly localised (i.e., very limited in spatial extent), temporary and are considered negligible.~~ ~~**Contamination**~~ ~~Given the extent of seabed disturbance which involves construction of an intake and piling any changes would cause highly localised (i.e., very limited in spatial extent) and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen). There are no~~

				~~anticipated cumulative effects.~~ ~~Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~ **Changes in marine habitats (air quality)** The assessment for the North Killingholme Power Project found no risk of exceedances for the majority of pollutants but considered the potential for an increase in nitrogen deposition which show a maximum impact around 1 km north-east of the stack. The model showed maximum impacts on NOx are >1% of the critical level in all scenarios, and the total concentration exceeds critical level, however project-specific monitoring has shown that the Defra and APIS datasets overestimated NOx in the vicinity of the facility and that total concentrations are therefore likely to be below the critical level. The proposed North Killingholme Power Project will operate in accordance with BAT and will be regulated by the Environment Agency which will include measures to minimise the impacts of emissions. It is reasonable to assume that the planning application process has identified a proportionate level of mitigation to do likewise for North Killingholme Power Project. The predicted in-combination effects are therefore not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with North Killingholme Power Project to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds. However, given the mitigation proposed for both projects which includes soft start procedures and timing restrictions to avoid sensitive periods, it is considered that the impacts are likely to result in mild disturbance responses and short term displacement. The works are located 8 km from IERRT and therefore would affect different local populations. It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for any adverse cumulative effects on marine ecology receptors. Therefore, assuming appropriate mitigation measures are followed during construction of the IERRT project, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	**Disturbance** • Disturbance through underwater noise and vibration	Underwater noise generated during piling required as part of the IERRT project along with construction of the intake and piling for the North Killingholme Power Project have the potential to result in cumulative effects sea and river lamprey and grey seal features in the Humber Estuary. Piling noise has the potential to cause injury if these features are within close proximity to the piling activity and strong behavioural responses over a wider area of the Humber estuary for both projects. ~~Both projects~~Any barrier to movements caused by the noise during piling for IERRT would be temporary with significant periods during a 24-hour period when no piling will be undertaken (the actual proportion of piling is estimated to be at worst around 14% based on 180 minutes of impact piling per day and 20 minutes of vibro piling per day). This of itself will allow the unconstrained movements of marine mammals through the Humber Estuary. Piling noise will take place for a very small amount of time each day over a period of approximately 24 or 37 weeks (depending on whether a sequenced construction is employed or not). Piling will also not take place continuously as there will be periods of downtime, pile positioning and set up. The proposed mitigation measures for underwater noise will further limit the risk of exposure and reduces the residual impact of the IERRT Project on marine mammal features to a minor adverse effect. Both IERRT and North Killingholme Power Projects will require similar mitigation to help minimise potential adverse effects (such as soft start procedures, timing restrictions to avoid sensitive periods for migratory fish and the use of marine mammal observers). Assuming appropriate mitigation measures are followed during construction the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
61.	Humber Stallingborough Phase 3 Sea Defence Improvement Scheme	~~*marinus* between coastal waters and their spawning areas.~~Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of	**Habitat loss/damage** The coastal defence project will result in a permanent loss of 0.25 ha of intertidal habitat in 11 discrete narrow strips averaging 227 m², of which the largest is no more than 10 m wide and 30 m long. These discrete areas of mudflat loss along the revetment are distanced roughly 100 m apart. The HRA undertaken for the project concluded that "within the Pyewipe area, there is approximately 300 ha of this Annex 1 habitat, being over 700 m at its widest extent to the south. Therefore, the loss of 0.25 ha equates to a loss of 0.08 % of the total mudflats within Pyewipe. The loss of these small and discrete parcels of mudflat along the base of

		systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	habitat • Physical loss of (or change to) habitat and associated species	the existing revetment is not considered to adversely affect the function of the mudflats as a self-sustaining habitat within the Pyewipe area. This impact is considered to be ecologically inconsequential to the Humber Estuary SAC and so not adversely affecting the integrity of the site. As the impact is considered to be ecologically inconsequential, it is not considered to frustrate the conservation objective of restore the total
~~61.~~	~~Humber Stallingborough Phase 3 Project~~	~~Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.~~	~~**Habitat loss/damage**~~ • ~~Physical loss or damage of habitat through alterations in physical processes~~ • ~~Physical damage through disturbance and/or smothering of habitat~~ • ~~Physical loss of (or change to) habitat and associated species~~ • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	~~**Habitat loss/damage**~~ ~~The revetments works will be restricted to the upper foreshore with the effects of the marine works for the IERRT project largely restricted to subtidal habitats. Any indirect effects resulting from the IERRT project on intertidal habitats in the vicinity of Humber Stallingborough Phase 3 Project (located approximately 2 km away) will be negligible~~extent. No adverse effect on the site integrity of the Humber Estuary SAC is anticipated as a result of loss of habitat constituting the qualifying feature of mudflats and sandflats not covered by seawater at high tide associated with construction of rock armour revetment". Losses of intertidal as a result of IERRT will be de minimis in extent (0.032 ha) and were assessed as insignificant. On this basis, potential cumulative effects are considered to be minor. **Contamination** Any potential impacts on water quality resulting from the Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme (such as increased suspended sediment levels) will be highly localised (i.e., very limited in spatial extent), temporary and ~~of a magnitude not expected to cause any adverse reactions in marine species. Potential water quality impacts of the IERRT project were assessed as insignificant~~are considered negligible. In relation to the release of sediment - bound contaminants, prior to excavation of the toe of the revetment sediment samples will be tested in line with OSPAR requirements to minimise the potential for mobilisation of contaminants. In addition, excavation is restricted to within a few metres of the revetment and therefore this is unlikely to result in a cumulative effect. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the IERRT project along with the Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme to cause cumulative effects in term of visual and noise disturbance to coastal waterbirds along the foreshore if disturbing activities associated with each of the construction programmes are being undertaken concurrently. This could reduce the amount of foreshore available with limited disturbance stimuli in the local area. However, the Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme will not be undertaken during the winter period (between October and March) which will help minimise potential disturbance effects associated with this project. In order to reduce potential waterbird disturbance effects associated with the IERRT project a range of mitigation measures are proposed. It is assumed that both projects will be subject to controls by the statutory bodies to avoid the potential for cumulative and in-combination effects on features of designated sites. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*	**Disturbance** • Disturbance through underwater noise and vibration	The works for the Humber Stallingborough Phase 3 ~~Project~~Sea Defence Improvement Scheme will be carried out from land and in the dry as far as possible. Sources of underwater noise and vibration would be limited to excavation at the toe of the revetment. Given the extent and nature of the impacts there are no predicted cumulative effects and it is concluded that there is no potential for AEOI on qualifying interest features, subject to further information becoming available.

		between coastal waters and their spawning areas.		
62	Immingham Onshore Wind	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)	**Disturbance** • Airborne noise and visual disturbance	There is the potential for the onshore turbine project to cause displacement effects to Ramsar coastal waterbird features as well as a collision risk. However, based on the latest scheme design, the turbine locations are too distant from the foreshore and from any associated functionally linked land to cause displacement effects in waterbird species (based on a detailed review of the zone of influence of potential turbine displacement effects). In addition, collision risk modelling based on established methods and industry guidance predicts potential collision rates will be very low for all Ramsar waterbird species and will not cause population level effects. Therefore, assuming the proposed mitigation measures for the IERRT project are implemented, the residual predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Collision Risk**	
All projects		Criterion 1 – natural wetland habitats that are of international importance: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	**Habitat loss/damage** • Physical loss or damage of habitat through alterations in physical processes • Physical damage through disturbance and/or smothering of habitat • Physical loss of (or change to) habitat and associated species • Physical change to habitats resulting from the deposition of airborne pollutants **Contamination** • Non-toxic contamination through elevated SSC • Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases	**Habitat loss/damage** With respect to intertidal habitat loss, on the basis that compensatory habitat will be provided for the Able Marine Energy Park (AMEP) project, all other projects have intertidal habitats losses that are considered *de minimis* (i.e., negligible) in extent and ecologically inconsequential. Subtidal losses are also considered *de minimis* (i.e., negligible) in extent and ecologically inconsequential for all projects. Potential changes to marine habitats during construction or operation as a result of seabed disturbance (such as due to dredging or marine piling) are considered to be relatively localised (i.e., limited in spatial extent), temporary and low magnitude for the IERRT project and all other projects with no direct spatial overlap of dredge or construction footprints occurring. With respect to airborne pollutants and air quality, considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. **Contamination** Water quality effects are anticipated to be localised (i.e., limited in spatial extent) and temporary for all projects with effects on marine habitats or species considered negligible even when considered cumulatively. Considering all pathways, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3) Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)	**Habitat loss/damage** • Physical loss of (or change to) habitat and associated species **Disturbance** • Airborne noise and visual disturbance	**Habitat loss/damage** With respect to intertidal habitat loss for coastal waterbirds, on the basis that compensatory habitat will be provided for the AMEP project, all other projects have intertidal habitats losses that are considered *de minimis* (i.e., negligible) in extent and ecologically inconsequential. On this basis, the predicted in-combination effects are not considered to compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features. **Disturbance** Potential noise and visual disturbance during construction as a result of the IERRT project along with several other projects have the potential to result in potential disturbance to coastal waterbirds. However, with the proposed mitigation required for each project there is considered to be no potential for AEOI on qualifying interest features. It is therefore considered a reasonable and robust conclusion that the predicted residual in-combination effects will not compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
		Criterion 3 – supports populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of	**Disturbance** Disturbance through underwater noise and vibration	Underwater noise (on lamprey species and grey seal) as a result of the IERRT project along with several other projects have the potential to result in adverse significant effects in migratory fish and marine mammals species. However, there is considered to be no potential for AEOI on qualifying interest features as a result of the IERRT project with the proposed mitigation measures. All projects will be subject to similar mitigation measures to avoid the potential for adverse underwater noise effects on these features.

	grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the ~~furthest south regular breeding site on the east coast.~~		~~It is therefore considered a reasonable and robust conclusion that predicted residual in-combination effects will not compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.~~
	furthest south regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		It is therefore considered a reasonable and robust conclusion that predicted residual in-combination effects will not compromise any of the conservation objectives, and it is concluded that there is no potential for AEOI on qualifying interest features.
	~~*marinus* between coastal waters and their spawning areas.~~		

5 Conclusions

5.1.1 This report provides information for the Secretary of State, as the relevant Competent Authority, to undertake the first two stages of a Habitats Regulations Assessment as required under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended).

5.1.2 The Stage one (Screening) assessment has considered how the proposed construction of a new Ro-Ro facility within the Port of Immingham might affect five European sites in the vicinity of the project. This screening stage concluded that Likely Significant Effects could not be discounted with respect to four European sites, all with coincident boundaries:

- Humber Estuary SAC;
- Humber Estuary SPA;
- Humber Estuary Ramsar site; and
- The Wash and North Norfolk Coast SAC.

5.1.3 The impact pathways screened into stage 2 (AA) covered the following pathways:

- Physical loss of habitat and associated species;
- Physical damage through disturbance and/or smothering of habitat;
- Physical loss or damage of habitat through alterations in physical processes;
- Direct changes to qualifying habitats beneath marine infrastructure due to shading;
- Physical change to habitats resulting from the deposition of airborne pollutants;
- Non-toxic contamination through elevated SSC;
- Toxic contamination through release of toxic contaminants bound in sediments, and accidental oil, fuel or chemical releases;
- Airborne noise and visual disturbance;
- Disturbance through underwater noise and vibration; and
- Biological disturbance due to potential introduction and spread of non- native species.

5.1.4 At Stage two AA, further information has been collated to examine the potential for changes in the baseline conditions as a result of the project with reference to the conservation objectives for each site. Where relevant, mitigation measures have been proposed to reduce the potential for adverse effects.

5.1.5 The assessment has concluded that for the majority of pathways there is no potential for an adverse effect on site integrity or any potential for the predicted effects to compromise any of the conservation objectives. However, for two pathways there was uncertainty in this conclusion either due to limitations in the evidence base or related to uncertainties in timing of construction (e.g., in relation to sensitive migration periods). This was relevant to the following pathways:

- The potential effects of airborne noise and visual disturbance during construction and operation on qualifying species; and
- The potential effects of underwater noise and vibration during piling on qualifying species.

5.1.6 Mitigation has been identified in relation to the effects of airborne noise and visual disturbance during construction which includes restrictions on working over winter in certain locations, acoustic barriers and visual screens, soft-start piling and cold weather restrictions. In operation as a precaution screening will be installed so that movements of workers or vehicles will not be as visible from the foreshore.

5.1.7 Based on the distribution of birds, the likely level of disturbance and the Applicant's commitment to mitigation, it is considered that there will be no adverse effects on the integrity of either the Humber Estuary SPA or Ramsar from the effects of airborne noise and visual disturbance.

5.1.8 Mitigation has been identified in relation to the effects of underwater noise and vibration during piling which includes soft-start piling, vibro-piling where possible, seasonal piling restrictions, night-time piling restrictions and use of Marine Mammal Observers.

5.1.9 Based on the assessment of effects on qualifying species (river and sea lamprey and grey seal), the likely level of disturbance and the Applicant's commitment to mitigation, it is considered that there will be no adverse effects on the integrity of the Humber Estuary SAC or Ramsar from the effects of underwater noise and vibration during piling. There is also considered to be no adverse effects on the integrity of The Wash and North Norfolk Coast SAC (as a result of underwater noise and vibration during piling on the common seal qualifying feature), based on the commitment to mitigation.

5.1.10 A summary of the mitigation measures that the Applicant has committed to is provided in Table 40. Further detail is provided in Section 4 of this report.

5.1.11 A review of other plans and projects that could contribute to effects has established that significant adverse in-combination effects on site integrity with other plans and projects are not likely to occur.

5.1.12 In conclusion, based on scientific information and professional judgement, it is considered that the construction and consequent operation will create no adverse effects on the integrity of any European designated sites.

Table 40. Summary of ~~porposed~~proposed mitigation measures

Site	Features	Impact pathway	Proposed mitigation	Mitigation effectiveness	Confidence in mitigation effectiveness
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica* (Non- breeding)	Airborne noise and visual disturbance during construction	Winter marine construction restriction from 1 October to 31 March within 200 m of exposed mudflat (until acoustic barrier/visual screen on approach jetty from 1 October to 31 March) ~~Noise suppression system for percussive piling~~ ~~Acoustic barrier/screening on marine construction barges~~ for activity associated with the approach jetty, linkspan, innermost pontoon and the inner finger pier within 200 m of exposed mudflat. Further details on this mitigation measure are provided in paragraph 4.10.38. ~~Apply soft start procedures during percussive piling~~ ~~Cold weather construction restriction~~	The measure is considered effective at minimising disturbance and when applied as part of the overall construction disturbance mitigation package is considered effective at reducing disturbance to a level which will not cause an AEOI. The effectiveness of this measure is described in more detail in Appendix E and specifically with respect to minimising the potential for AEOI on qualifying features in Table 30.	High: Spatial and temporal effectiveness of the restriction is well understood based on existing evidence.

			This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.		
	A157: Bar-tailed Godwit *Limosa lapponica* (Non-breeding) A162: Common Redshank *Tringa totanus* (Non-breeding) Waterbird assemblage		Noise suppression system during all percussive piling activities for the outer finger pier. Further details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	The measure is considered effective at helping to reduce potential noise related disturbance associated with piling and when applied as part of the overall construction disturbance mitigation package is considered effective at minimising disturbance to a level which will not cause an AEOI. The effectiveness of this measure is described in more detail in Appendix E and specifically with respect to minimising the potential for AEOI on qualifying features in Table 30.	High: The effectiveness of the measure is based on applying well established noise criteria and detailed airborne noise modelling.
			Acoustic barrier/screening on marine construction barges closest to the foreshore and construction activity should only be undertaken from the side of the barge facing away from the foreshore during the over wintering period. Further details on this mitigation measure are provided in paragraph 4.10.38.	The measure is considered effective at helping to minimise potential noise and visual related disturbance associated marine construction barges and when applied as part of the overall construction disturbance mitigation package is considered effective at reducing	High: Effectiveness is well understood based on existing evidence.

			This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	disturbance to a level which will not cause an AEOI. The effectiveness of this measure is described in more detail in Appendix E and specifically with respect to minimising the potential for AEOI on qualifying features in Table 30.	
			Apply soft start procedures during all percussive piling. Further details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	The measure is considered effective at helping to reduce potential noise related disturbance associated with piling and when applied as part of the overall construction disturbance mitigation package is considered effective at minimising disturbance to a level which will not cause an AEOI. The effectiveness of this measure is described in more detail in Appendix E and specifically with respect to minimising the potential for AEOI on qualifying features in Table 30.	Medium: The measure is considered likely to be effective based on existing information.
			Cold weather construction restriction implemented following seven consecutive days of freezing (zero or sub- zero temperature) weather conditions. Further	This measure will ensure that no foreshore or marine construction activity is undertaken during freezing periods when waterbirds are considered particularly	High: Effectiveness is well understood based on existing

			details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 8 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	vulnerable to disturbance with potential disturbance effects completely avoided during the restriction. When applied as part of the overall construction disturbance mitigation package, this measure is considered effective at minimising disturbance to a level which will not cause an AEOI.		evidence.
~~Humber Estuary Ramsar site~~	~~Criterion 5 – Bird Assemblages of International Importance:~~ ~~Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)~~					
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)					

	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)				
Humber Estuary SPA	A048; Common Shelduck (Non-breeding) *Tadorna tadorna* A143: Red Knot (Non-breeding) *Calidris canutus* A149: Dunlin *Calidris alpina alpina* (Non-breeding) A156: Black-tailed Godwit *Limosa limosa islandica*	Airborne noise and visual disturbance during operation	Screening installed either side of the linkspan and approach jetty (phased ~~removed~~removal after 2 years). The screening forms part of the authorised development specifically Work No. 1 as set out in Schedule 1 of the draft DCO.	This measure which has been applied on a precautionary basis and is considered likely to be most effective initially during operation when birds are less likely to be as habituated to the new sources of noise and visual disturbance stimuli. The proposed mitigation is considered effective at minimising disturbance to a level which will not cause an AEOI.	High: Effectiveness is well understood based on existing evidence.

	(Non- breeding)				
	A157: Bar-tailed Godwit *Limosa lapponica* (Non-breeding)				
	A162: Common Redshank *Tringa totanus* (Non-breeding)				
	Waterbird assemblage				
Humber Estuary Ramsar site	Criterion 5 – Bird Assemblages of International Importance:				
~~Humber Estuary Ramsar site~~	Wintering waterfowl - 153,934 waterfowl (5-year peak mean 1998/99-2002/3)				
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black- tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot,				

	Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering)				
Humber Estuary SAC	S1095: Sea lamprey *Petromyzon marinus* S1099: River lamprey *Lampetra fluviatilis*	Underwater noise and vibration during piling on qualifying species	Apply soft start procedures during percussive piling ~~Use vibro~~ based on JNCC piling ~~where possible~~ ~~Seasonal percussive piling restrictions~~ ~~Night-time percussive piling restriction~~ ~~Marine Mammal Observer will follow JNCC protocol to minimise the risk of injury to marine mammals during percussive piling~~protocol. Further details on this mitigation measure are provided in paragraph 4.10.38.	The measure will help reduce potential underwater effects to lamprey and seals and marine mammals through providing an opportunity to move away from the area before the onset of full impact strikes as	Medium to high: Effectiveness is generally well understood based on existing evidence.
	S1364: Grey seal *Halichoerus grypus*		This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	described in paragraph 4.11.40. When applied as part of the overall construction disturbance mitigation package this measure is considered effective at minimising disturbance to a level which will not cause an AEOI.	

			Use vibro piling where possible. Further details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	The measure will help to reduce potential displacement and a reduced acoustic barrier compared to percussive piling as described in paragraph 4.11.40. When applied as part of the overall construction disturbance mitigation package this measure is considered effective at minimising disturbance to a level which will not cause an AEOI.	Medium to high: Effectiveness is generally well understood based on existing evidence.
			Seasonal percussive piling including no percussive piling is to take place within the waterbody between 1 April and 31 May and restrictions on the duration of percussive piling within the waterbody from 1 June to 30 June and 1 August to 31 October. Further details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	The seasonal restriction will help limit potential disturbance effects to sea lamprey during sensitive migratory periods as described in paragraph 4.11.40. When applied as part of the overall construction disturbance mitigation package this measure is considered effective at minimising disturbance to a level which will not cause an AEOI.	Medium to high: The effectiveness of the measure is based on an understanding of sensitive periods for lamprey species and the approach taken for other consented developments on the Humber Estuary.
Humber	Criterion 3 – supports		Night-time percussive piling restriction within the	The restriction will help limit potential disturbance effects	High: The effectiveness

Estuary Ramsar site	populations of plants and/or animal species of international importance: The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south ~~regular breeding site on the east coast.~~		waterbody between 1 March to 31 March, 1 June to 30 June and 1 August to 31 October inclusive after sunset and before sunrise on any day. Further details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	to river lamprey during sensitive migratory periods as described in paragraph 4.11.40. When applied as part of the overall construction disturbance mitigation package this measure is considered effective at minimising disturbance to a level which will not cause an AEOI.	of the measure is based on an understanding of sensitive periods for lamprey.
	regular breeding site on the east coast. Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: The Humber Estuary acts as an important		Marine Mammal Observer will follow JNCC protocol to minimise the risk of injury to marine mammals during percussive piling. Further details on this mitigation measure are provided in paragraph 4.10.38. This is secured in condition 12 of Part 2 of the Deemed Marine Licence (DML) at Schedule 3 of the draft DCO.	Following JNCC measures will help limit potential injury effects to seals as described in paragraph 4.11.40. When applied as part of the overall construction disturbance mitigation package this measure is considered effective at minimising disturbance to a level which will not cause an AEOI.	High: The mitigation is based on well-established protocols which are widely applied to both inshore and offshore developments involving piling.

	migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.				
The Wash and North Norfolk Coast SAC	1365: Harbour seal *Phoca vitulina*				

6 References

Aage, C., Bell, A.K., Bergdahl, L., Blume, A., Bolt, E., Eusterbarkey, H., Tetsuya, H., Kofoed-Hansen, H., Maly, D., Single, M. and Rytkönen, J. (2003). Guidelines for managing wake wash from high-speed vessels. PIANC.

Aarts, G., Brasseur, S. & Kirkwood, R. (2017) Response of grey seals to pile-driving. Wageningen, Wageningen Marine Research (University & Research centre), Wageningen Marine Research report C006/18. 54 pp.

Able UK Limited. (2021). Able Marine Energy Park (Material Change 2 – Tr030006). Updated Environmental Statement: Chapter 10: Aquatic Ecology.

Associated British Ports (ABP) Research (1999) Good Practice Guidelines for Ports and Harbours Operating Within or Near UK European Marine Sites. English Nature, UK Marine SACs Project. ABP Research & Consultancy Ltd, pp 120.

ABP Research. (2000). The Marine Environment Impact Identification and Evaluation TS/ME7. ABP Southampton: Dibden Terminal, Associated British Ports, Southampton, ABP Research & Consultancy Ltd, Research Report No. R.782

ABP Research. (2001). ABP Grimsby & Immingham, Immingham Outer Harbour Environmental Statement. ABP Research & Consultancy Ltd, Report No. R.903.

ABPmer. (2002). ABP Teignmouth Quay Development Environmental Statement. ABP Marine Environmental Research Ltd, Report No. R.984a.

ABPmer. (2009). Humber Estuary: Environmental Management and Monitoring Plan: Data 2009. R. 1587.

ABPmer. (2013). Bury Marsh Bird Monitoring 2012-2014: Interim Report. ABP Marine Environmental Research Ltd, Report No. R.2123.

ABPmer (2014). Bird Disturbance Monitoring of the 'RWE Pontoon' at the Port of Mostyn. First Yearly Summary: October 2013 to March 2014. Gwynt y Môr Offshore Wind Farm Ltd

ABPmer, (2015). Bird Disturbance Monitoring of the 'RWE Pontoon' at the Port of Mostyn: Review of Two Year Monitoring Programme (2013 to 2015). ABP Marine Environmental Research Ltd, Report No. R.2320.

ABPmer (2021). Bathside Bay Bird Monitoring, First Annual Report – September 2020 to June 2021, ABPmer Report No. R.3714. A report produced by ABPmer for Galloper Wind Farm Limited, October 2021.

Air Pollution Information System (APIS) (2022). Site Relevant Critical Loads and Source Attribution. Available at: [redacted] (accessed 24 November 2022).

Alabaster, J.S. (1993). River Usk Barrage Order 1993. Proof of Evidence on Pollution and Fisheries.

Ashley, M. (2016). [*Nephtys hombergii*] and [*Streblospio shrubsolii*] in littoral mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted]

Ashley, M. and Budd, G.C. (2020). [*Hediste diversicolor*] and [*Corophium volutator*] in littoral mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Review, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: https:[redacted].marlin.ac.uk/habitat/detail/1200.

Barsiene, J. (1994). Chromosome set changes in molluscs from highly polluted habitats, in: A.R. Beaumont. Ed. Genetics and Evolution of Aquatic Organisms, Chapman & Hall, London. pp.434–447.

Belanger, L. and Bedard, J. (1990). Energetic cost of man-induced disturbance to staging snow geese. Journal of Wildlife Management, 54, pp.36-41.

Blockley, D.J. and Chapman, M.G. (2006). Recruitment determines differences between assemblages on shaded or unshaded seawalls. Marine Ecology Progress Series, 327, pp.27-36.

Blockley, D.J. (2007). Effect of wharves on intertidal assemblages on seawalls in Sydney Harbour, Australia. Marine environmental research, 63(4), pp.409-427.

Bolam, S.G., Rees, H.L., Somersfield, P., Smith, R., Clarke, K.R., Warwick, R.M., Atkins, M., and Bradbury, A. P., Colenutt, A. J., Cross, J., Eastick, C., and Hume, D. (2003). Evaluation of Coastal Process Impacts Arising from Nearshore Aggregate Dredging for Beach Recharge–Shingles Banks, Christchurch Bay. In International Conference on Coastal Management 2003: Proceedings of the International Conference on Coastal Management, Organised by the Institution of Civil Engineers and Held in Brighton, UK, on 15-17 October 2003. p.98.

Bolam, S.G., Schratzberger, M. and Whomersley, P. (2004). Macrofaunal recolonization in intertidal mudflats: the effect of organic content and particle size. Journal of Experimental Marine Biology and Ecology, 306.

Bolam, S.G., Schratzberger, M. and Whomersley, P. (2006a). Macro- and meiofaunal recolonization of dredged material used for habitat enhancement: Temporal patterns in community development. Marine Pollution Bulletin, 52, pp.1746-1755.

Bolam, S.G., Rees, H.L., Somersfield, P., Smith, R., Clarke, K.R., Warwick, R.M., Atkins, M. and Garnacho, E. (2006b). Ecological consequences of dredged material disposal in the marine environment: A holistic assessment of activities around the England and Wales coastline. Marine Pollution Bulletin, 52, pp.415-426.

Bolam, S.G., McIlwaine, P.S.O. and Garcia, C. (2016). Application of biological traits to further our understanding of the impacts of dredged material disposal on benthic assemblages. Marine Pollution Bulletin, 105(1), pp.180-192.

Borja, Á., Belzunce, M.J., Garmendia, J.M., Rodríguez, J.G., Solaun, O. and Zorita, I. (2012). Impact of Pollutants on Coastal and Benthic Marine Communities. Ecological Impacts of Toxic Chemicals, 165.

Bowgen, K.M. (2016). Predicting the effect of environmental change on wading birds: insights from individual-based models.

Boyd, S.E., Cooper, K.M., Limpenny, D.S., Kilbride, R., Rees, H.L., Dearnaley, M.P., Stevenson, J., Meadows W.J. and Morris, C.D. (2004). Assessment of the re-habilitation of the seabed following marine aggregate dredging. Sci. Ser. Tech. Rep., Cefas Lowestoft, 121, p.154.

Bradbury, A.P., Colenutt, A.J., Cross, J., Eastick, C. and Hume, D. (2003). Evaluation of coastal process impacts arising from nearshore aggregate dredging for beach recharge - Shingles Bank, Christchurch Bay. p.15.

Britwell, I. K. (2000). Effects of Sediment on Fish and Their Habitat, DFO Pacific Region, Habitat Status Report 2000/01 E, Canada.

Budd, G.C. (2004). Burrowing amphipods and Eurydice pulchra in well-drained clean sand shores. Marine life information network: Biology and sensitivity key information subprogramme, Plymouth, Marine Biological Association of the United Kingdom. [Online] Available at: [redacted] (accessed January 3, 2005).

Burger, J. and Gochfeld, M. (1998). Effects of ecotourists on bird behaviour at Loxahatchee National Wildlife Refuge, Florida. Environmental Conservation, 25, 13-21.

Burton, N. H. (2000). Winter site-fidelity and survival of Redshank *Tringa totanus* at Cardiff, south Wales. Bird Study, 47(1), 102-112.

Burton, N.H., Rehfisch, M.M., and Clark, N.A. (2002a). Impacts of disturbance from construction work on the densities and feeding behavior of waterbirds using the intertidal mudflats of Cardiff Bay, UK. Environmental Management, 30(6), pp.0865-0871.

Burton, N. H., Armitage, M. J., Musgrove, A. J., & Rehfisch, M. M. (2002b). Impacts of man-made landscape features on numbers of estuarine waterbirds at low tide. Environmental Management, 30(6), 0857-0864.

Burton, N.H.K., Rehfisch, M.M., Clark, N.A. and Dodd, S.G. (2006). Impacts of sudden winter habitat loss on the body condition and survival of redshank *Tringa totanus*. Journal of Applied Ecology, 43, pp.464–473.

Byers, J.E. and Grabowski, J.H. (2014). Soft-sediment communities. Marine Community Ecology. Sinauer, pp.227-249.

Calladine J.R., Park, K.J, Thompson, K. and Wernham, C.V. (2006). Review of Urban Gulls and their Management in Scotland. A report to the Scottish Executive.

Carlton, J.T. (1992). Marine Species Introductions by Ships' Ballast Water: An

Overview. In: Proceedings of the Conference and Workshop on Introductions and Transfers of Marine Species: Achieving a Balance Between Economic Development and Resource Protection, Hilton Head Island, South Carolina October 30 – November 2, 1991, ed. By M.R. De Voe. pp.23-25. South Carolina Sea Grant Consortium.

Carlton, J.T., and Geller, J.B. (1993). Ecological Roulette: The Global Transport of Nonindigenous Marine Organisms. Science, 261, pp.78-82.

Carter, M.I., Boehme, L., Duck, C.D., Grecian, J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C., Moss, S., Thompson, D. and Thompson, P. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS, OESEA-16-76, OESEA-17-78.

Catalano, B., Moltedo, G., Martuccio, G., Gastaldi, L., Virno-Lamberti, C., Lauria, A. and Ausili, A. (2012). Can *Hediste diversicolor* (Nereidae, Polychaete) be considered a good candidate in evaluating PAH contamination? A multimarker approach. Chemosphere, 86(9), pp.875-882.

CEDA. (2011). Underwater sound in relation to dredging. CEDA Position Paper - 7 November 2011.

Cefas. (2012). ME1101. Development of Approaches, Tools and Guidelines for the Assessment of the Environmental Impact of Navigational Dredging in Estuaries and Coastal Waters: Literature Review of Dredging Activities: Impacts, Monitoring and Mitigation.

Cefas (2016). Suspended Sediment Climatologies around the UK. Report for the UK Department for Business, Energy & Industrial Strategy offshore energy Strategic Environmental Assessment programme.

Cefas. (2020). The Sizewell C Project: Volume 2 Main Development Site Chapter 22 Marine Ecology and Fisheries Appendix 22L – Underwater noise effects assessment for Sizewell C: Edition 2. Revision 1.0. May 2020.

Cetacean Strandings Investigation Programme (CSIP). (2020). Annual Report for the period 1st January – 31st December 2018 (Contract number ME6008).

Coleman, R.A., Salmon, N.A and Hawkins, S.J. (2003). Sub-dispersive human disturbance of foraging oystercatchers *Haematopus ostralegus*. Ardea, 91, pp.263-268.

Collop, C., Stillman, R.A., Garbutt, A., Yates, M.G., Rispin, E., and Yates, T. (2016). Variability in the area, energy and time costs of wintering waders responding to disturbance. Ibis, 158(4), pp.711-725.

Cook, E.J., Macleod, A. Payne, R.D., and Brown, S (2014) (edited by Natural England and Natural Resources Wales in 2015). Marine Biosecurity Planning - Guidance for producing site and operation-based plans for preventing the introduction and spread of non-native species in England and Wales. Available online at: www.nonnativespecies.org/downloadDocument.cfm?id=1401 [accessed 30/11/2021]

Cox, R., Wadsworth, R.A. and Thomson, A.G. (2003). Long-term changes in salt marsh extent affected by channel deepening in a modified estuary. Continental Shelf Research, 23(17-19), pp.1833-1846.

Cundy, A.B., Hopkinson, L., Lafite, R., Spencer, K., Taylor, J.A., Ouddane, B., Heppell, C.M., Carey, P.J., Charman, R., Shell, D., Ullyott, S. (2005). Heavy metal distribution and accumulation in two Spartina sp.-dominated macrotidal salt marshes from the Seine estuary (France) and the Medway estuary (UK). Applied Geochemistry 20, 1195–1208.

Curtin, S., Richards, S., Westcott, S. (2009). Tourism and grey seals in South Devon: management strategies, voluntary controls and tourists' perception of disturbance. Current Issues in Tourism, 12(1), 59-81.

Cutts, N.D (2021), Nseleni Independent Floating Power Plant (NIFPP) EIA. Provision of Professional Opinion on Waterbird Disturbance Potential: Audible and Visual Stimuli Impacts and Mitigation Measures. Cutts & Hemingway Estuarine Ecology and Management Ltd. (CHEEM), UK. Report to SE Solutions (Pty) Ltd, South Africa; Report No. CHEEM019-F2-2021.

Dauvin, J.C. (2008). Effects of heavy metal contamination on the macrobenthic fauna in estuaries: The case of the Seine estuary. Marine Pollution Bulletin, 57, pp.160-169.

Davidson, N. C., and Rothwell, P. I. (1993). Human disturbance to waterfowl on estuaries: conservation and coastal management implications of current knowledge. Wader study group bulletin, 68, 97-105.

De-Bastos, E.S.R. (2016a). [*Kurtiella bidentata*] and [*Abra*] spp. in infralittoral sandy mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted]

De-Bastos, E.S.R. (2016b). [*Nephtys hombergii*] and [*Tubificoides*] spp. in variable salinity infralittoral soft mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted]

De-Bastos, E.S.R. & Hill, J., 2016. *Polydora ciliata* and *Corophium volutator* in variable salinity infralittoral firm mud or clay. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 17- 05-2022]. Available from: [redacted]

De-Bastos, E. and Hiscock, K. (2016). [*Aphelochaeta marioni*] and [*Tubificoides*] spp. in variable salinity infralittoral mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted]

Defew, E.C., Perkins, R.G. and Paterson, D.M. (2004). The influence of light and temperature interactions on a natural estuarine microphytobenthic assemblage. Biofilms, 1(1), pp.21-30.

Deloffre, J., Lafite, R., Lesueur, P., Lesourd, S., Verney, R. and Guézennec, L. (2005). Sedimentary processes on an intertidal mudflat in the upper macrotidal Seine estuary, France. Estuarine, Coastal and Shelf Science, 64(4), pp.710-720.

Durell, S.E.A. le V. dit, Stillman, R.A., Triplet, P., Aulert, C., Bio, D.O. dit, Bouchet, A., Duhamel, S., Mayot, S. and Goss-Custard, J.D. (2005). Modelling the efficacy of proposed mitigation areas for shorebirds: a case study on the Seine estuary, France. Biological Conservation, 123, pp.67–77.

Dwyer, R.G. (2010). Ecological and anthropogenic constraints on waterbirds of the Forth Estuary: population and behavioural responses to disturbance. Thesis submitted as candidature for the degree of Doctor of Philosophy Centre for Ecology and Conservation.

Dyer, K.R. (1994). Estuarine sediment transport and deposition. Sediment transport and depositional processes, pp.193-218.

Elliott, M., Nedwell, S., Jones, N.V., Read, S.J., Cutts, N.D. and Hemmingway, K.L. (1998). Intertidal sand and mudflats & subtidal mobile sandbank Volume II. An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. Scottish Association of Marine Science UK Marine SACs Project 151pp.

Environment Agency. (2013). Review of fish population data in the Humber Estuary. A report by the University of Hull for the Environment Agency.

Environment Agency. (2016). Air emissions risk assessment for your environmental permit – Updated 2021. [Online]. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit (accessed 24 November 2022).

Erirf, A. and Soomere, T. (2004). Influence of fast ship waves on the optical properties of sea water in Tallinn Bay, Baltic Sea. In Proceedings of the Estonian Academy of Sciences, Biology and Ecology (Vol. 53, No. 3, pp. 161-178). Estonian Academy Publishers.

ERM. (1996). South Humber Power Station, Pyewipe, Bird Monitoring Study, April 1996.

Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E. and Austin, G.E. (2021). Waterbirds in the UK 2019/20: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.

Gill, J.A., Norris, K. and Sutherland, W.J. (2001a). Why behavioural responses may not reflect the population consequences of human disturbance. Biological

Conservation, 97, pp.265-268.

Gill, J.A., Norris, K. and Sutherland, W.J. (2001b). The effects of disturbance on habitat use by black-tailed godwits Limosa limosa. Journal of Applied Ecology 38: 846-856.

Glover, H.K., Guay, P.J., and Weston, M.A. (2015). Up the creek with a paddle; avian flight distances from canoes versus walkers. Wetlands Ecology and Management, pp.1-4.

GoBe Consultants Ltd (2011); Port of Mostyn – Wind Farm Service Vessel Pontoon Facility - Environmental Statement. Prepared for RWE Npower Renewables Ltd.

Goss-Custard, J.D., Triplet, P., Sueur, F., and West, A.D. (2006). Critical thresholds of disturbance by people and raptors in foraging wading birds. Biological Conservation, 127(1), pp.88-97.

Goss-Custard, J. D., Hoppe, C. H., Hood, M. J., and Stillman, R. A. (2020). Disturbance does not have a significant impact on waders in an estuary close to conurbations: importance of overlap between birds and people in time and space. Ibis, 162(3), pp.845-862.

Grabowski, R.C., Droppo, I.G. and Wharton, G. (2011). Erodibility of cohesive sediment: The importance of sediment properties. Earth-Science Reviews, 105(3-4), pp.101-120.

Granadeiro, J. P., Dias, M. P., Martins, R. C., & Palmeirim, J. M. (2006). Variation in numbers and behaviour of waders during the tidal cycle: implications for the use of estuarine sediment flats. Acta oecologica, 29(3), 293-300.

Grant, W.D. and Madsen, O.S. (1979). Combined wave and current interaction with a rough bottom. Journal of Geophysical Research: Oceans, 84(C4), pp.1797-1808.

Goodship, N. & Furness, R.W. (2019). Seaweed hand-harvesting: literature review of disturbance distances and vulnerabilities of marine and coastal birds. Scottish Natural Heritage Research Report No. 1096

Goodship, N.M. and Furness, R.W. (2022). Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. NatureScot Research Report 128

Guay, P.J., McLeod, E.M., Taysom, A.J., and Weston, M.A. (2014). Are vehicles 'mobile bird hides'?: A test of the hypothesis that 'cars cause less disturbance'. The Victorian Naturalist 131, pp.150-155.

Gunnarsson, T. G., Gill, J. A., Petersen, A., Appleton, G. F. and Sutherland, W. J. (2005). A double buffer effect in a migratory shorebird population. Journal of Animal Ecology, 74(5), pp.965–971.

Hannam, M.L., Bamber, S.D., Galloway, T.S., Moody, A.J. and Jones, M.B. (2010). Effects of the model PAH phenanthrene on immune function and oxidative stress in the haemolymph of the temperate scallop *Pecten maximus*. Chemosphere, 78(7), pp.779-784.

Harris, R.E., Miller, G.W. and Richardson, W.J. (2001). Seal responses to airgun sounds during summer seismic surveys in the Alaskan Beaufort Sea. Marine Mammal Science, 17, pp.795–812.

Hawkins, A.D., Roberts, L. and Cheesman, S. (2014). Responses of free-living coastal pelagic fish to impulsive sounds. The Journal of the Acoustical Society of America, 135.

Hawkins, A.D., Pembroke, A., and Popper, A. (2015). Information gaps in understanding the effects of noise on fishes and invertebrates. Reviews in Fish Biology and Fisheries, 25, pp. 39–64.

Hawkins A. D., and Popper, A. N. (2017). A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. ICES Journal of Marine Science, Volume 74, Issue 3, 1 March 2017, Pages 635–651. [Online] Available at: [redacted]

Henry, E., & Hammill, M. O. (2001). Impact of small boats on the haulout activity of harbour seals (Phoca vitulina) in Metis Bay, Saint Lawrence Estuary, Quebec, Canada. Aquatic Mammals, 27(2), 140-148.

Hesselman, D.M., Blake, N.J. and Peters, E.C. (1988). Gonadal neoplasms in hard shell clams *Mercenaria* spp., from the Indian River, Florida: occurrence, prevalence, and histopathology. Journal of Invertebrate Pathology, 52(3), pp.436-446.

HM Government (2019). Guidance on the use of Habitats Regulations Assessment. [Online]. Available at: https://www.gov.uk/guidance/appropriate-assessment (accessed 2 January 2023).

Hockin, D., Ounsted, M., Gorman, M., Keller, V., and Barker, M.A. (1992). Examination of the effects of disturbance of birds with reference to its importance in ecological assessments. Journal of Environmental Management. 36, pp.253-286.

Holman *et al*. (2020). A guide to the assessment of air quality impacts on designated nature conservation sites. Version 1.1. [Online]. Available at: [redacted]

Hoover-Miller, A., Bishop, A., Prewitt, J., Conlon, S., Jezierski, C., & Armato, P. (2013). Efficacy of voluntary mitigation in reducing harbor seal disturbance. The Journal of Wildlife Management.

Ikuta, L. A., & Blumstein, D. T. (2003). Do fences protect birds from human disturbance?. Biological Conservation, 112(3), 447-452.

Institute of Estuarine and Coastal Studies (IECS). (1997). Saltend Development Cumulative Impact Study: Ornithological Impacts. Report to Consultants in Environmental Sciences Ltd. Report No. ZO80-97-F. IECS, University of Hull, 28p.

Institute of Estuarine and Coastal Studies (IECS). (2001). Impacts of sediment disturbance and deposition on intertidal biota. Final Report to English Nature September 2001.

Institute of Estuarine and Coastal Studies (IECS). (2009a). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Institute of Estuarine and Coastal Studies Report to Humber INCA.

Institute of Estuarine and Coastal Studies (IECS). (2009b). Ornithological Monitoring, Saltend: Summary Trend Report #33 January 2007 to March 2007 Late Winter. Report to ABP Port of Hull. IECS, University of Hull.

Institute of Estuarine and Coastal Studies (IECS). (2010). South Humber Channel Marine Studies: Intertidal and Subtidal Benthic & Fish Surveys 2010: Report to Yorkshire Forward.

Institute of Estuarine and Coastal Studies (IECS) (2013). Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning and Construction Projects.

International Union for Conservation of Nature (IUCN). (2011). Invasive Species. [Online] Available at: [redacted]

Jackson, M. V. (2017). Literature Review: Importance of artificial roosts for migratory shorebirds. Report to Charles Darwin University. Charles Darwin University: Darwin.

Jackson, M.V., Woodworth, B.K., Bush, R., Clemens, R.S., Fuller, R.A., Garnett, S.T., Lilleyman, A., Maron, M., Purnell, C., Rogers, D.I. and Amano, T. (2021). Widespread use of artificial habitats by shorebirds in Australia. Emu-Austral Ornithology, pp.1-10.

Johnson, L.L., Anulacion, B.F. and Arkoosh, M.R. (2014). Effects of legacy persistent organic pollutants (POPs) in fish – current and future challenges. In K. B. Tierney, A. P. Farrell and C. J. Brauner (Eds.), Organic chemical toxicology of fishes, fish physiology vol. 33 (pp. 53–140). London, UK: Academic Press.

Johnson, G.E.L., Caneco, B., Latto, P., Warner, I., Kaiser, M.J., and Donovan, C. (2017). Towards an understanding of the physical effects of natural disturbance and demersal fishing on UK mobile sediment MPAs. Defra contract ME6001.

Joint Nature Conservation Committee (JNCC). (2004). Common Standards Monitoring Guidance for Lowland Wetland, Version.

Joint Nature Conservation Committee (JNCC). (2007). Information Sheet on Ramsar Wetlands - Humber Estuary. Available at: [redacted] (accessed 2 January 2023).

Joint Nature Conservation Committee (JNCC) (2010). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise.

Joint Nature Conservation Committee (JNCC). (2021). [redacted].

Joint Nature Conservation Committee (JNCC), (2022a). [redacted]. Accessed 4 March 2022

Joint Nature Conservation Committee (JNCC), (2022b). [redacted].

Jones, D., and Marten, K. (2016). Dredging sound levels, numerical modelling and EIA. Terra et Aqua, 144, pp. 21-29.

Kingston, PF (2001). Benthic Organisms Review. In Encyclopedia of Ocean Sciences, 2nd Edition. Compiled by Steele, JS and edited by Steele, JS; Thorpe, SA & Turekian, KK

Kjelland, M.E., Woodley, C.M., Swannack, T.M. and Smith, D.L. (2015). A review of the potential effects of suspended sediment on fishes: potential dredging-related physiological, behavioural, and transgenerational implications. Environment Systems and Decisions, 35(3), pp.334-350.

Koschinski, S., Culik, B.M., Henriksen, O.D., Tregenza, N., Ellis, G., Jansen, C. and Käthe, G. (2003). Behavioural reactions of free-ranging porpoises and seals to the noise of a simulated 2 MW windpower generator. Marine Ecology Progress Series, 265, pp.263–273.

Kudale, M. D. (2010). Impact of port development on the coastline and the need for protection. Indian Journal of Geo-Marine Sciences, 39(4), pp.597-604.

Lambeck, R.H.D. (1991). Changes in abundance, distribution and mortality of wintering oystercatchers after habitat loss in the Delta Area, SW Netherlands. Acta XX Congressus Internationalis, 4, pp.2208–2218.

Lausen K.L., J. Kahlert & J. Frikke (2005). Factors affecting escape distances of staging waterbirds. Nordic Board for Wildlife Research.

Larsen, S.J., Kilminster, K.L., Mantovanelli, A., Goss, Z.J., Evans, G.C., Bryant, L.D. and McGinnis, D.F. (2019). Artificially oxygenating the Swan River estuary increases dissolved oxygen concentrations in the water and at the sediment interface.
Ecological Engineering, 128, pp.112-121.

Levin, L.A., Ekau, W., Gooday, A.J., Jorissen, F., Middelburg, J.J., Naqvi, S.W.A. and Zhang, J. (2009). Effects of natural and human-induced hypoxia on coastal benthos. Biogeosciences, 6(10), pp.2063-2098.

Liley, D. & Tyldesley, D. (2013). Solent Disturbance and Mitigation Project: Phase III. Towards an Avoidance and Mitigation Strategy. Unpublished report. Footprint

Ecology/David Tyldesley & Associate people hidden from view to the bird.

Liley, D., Stillman, R. and Fearnley, H. (2010). The Solent Disturbance and Mitigation Project Phase II: Results of Bird Disturbance Fieldwork 2009/10. Footprint Ecology/Solent Forum.

Linssen., H., Van De Pol, M., Allen, A.M., Jans, M., Ens, B.J., Krijsveld, K.L., Frauendorf, M and Van der Kolk, H.J. (2019). Disturbance increases high tide travel distance of roosting shorebird but only marginally effects daily expenditure. Avian Research, 10(1), pp.1-11.

Long, E.R., MacDonald, D.D, Smith, S.L. and Calder, F.D. (1995). Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management, 191, pp.81-97.

MacDonald, D.D. and Ingersoll, C.G. (2010). Tools for assessing contaminated sediments in freshwater, estuarine, and marine ecosystems. Sedimentology of Aqueous Systems, pp.171-199.

Mander, L., Marie-Orleach, L., and Elliott, M. (2013). The value of wader foraging behaviour study to assess the success of restored intertidal areas. Estuarine, Coastal and Shelf Science, 131, pp.1-5.

Mander, L., Nicholson, I., Green, R., Dodd, S., Forster, R. & Burton, N. (2022) Individual, sexual and temporal variation in the winter home range sizes of GPS-tagged Eurasian Curlews *Numenius arquata*, Bird Study, [redacted]

Marine Ecological Surveys Ltd. (2008). Marine Macrofauna Genus Trait Handbook.

Martín, B., Delgado, S., Cruz, A., Tirado, S., and Ferrer, M. (2014). Effects of human presence on the long-term trends of migrant and resident shorebirds: evidence of local population declines. Animal Conservation, 18, pp.73–81.

Mathews, E. A., Jemison, L. A., Pendleton, G. W., Blejwas, K. M., Hood, K. E., & Raum-Suryan, K. L. (2016). Haul-out patterns and effects of vessel disturbance on harbor seals (Phoca vitulina) on glacial ice in Tracy Arm, Alaska. Fishery Bulletin, 114(2).

McKenna, M.F., Ros, D., Wiggins, S.M. and Hildebrand, J.A. (2012). Underwater radiated noise from modern commercial ships. Journal of the Acoustical Society America, 131(1), pp.92-103.

Méndez, V., Gill, J.A., Alves, J.A., Burton, N.H., and Davies, R.G. (2018). Consequences of population change for local abundance and site occupancy of wintering waterbirds. Diversity and Distributions, 24(1), pp.24-35.

McLeod, E. M., Guay, P. J., Taysom, A. J., Robinson, R. W., & Weston, M. A. (2013). Buses, cars, bicycles and walkers: the influence of the type of human transport on the flight responses of waterbirds. PLoS One, 8(12), e82008.

Milsom, T. P., Ennis, D. C., Haskell, D. J., Langton, S. D., & McKay, H. V. (1998). Design of grassland feeding areas for waders during winter: the relative importance of sward, landscape factors and human disturbance. Biological Conservation, 84(2), 119-129.

Mitsch, W.J. and Gosselink, J.G. (2000) The value of wetlands: importance of scale and landscape setting. *Ecological economics*, 35(1), pp.25-33.

MMO (2015). Modelled Mapping of Continuous Underwater Noise Generated by Activities. A report produced for the Marine Management Organisation, pp 50. MMO Project No: 1097. ISBN: 978-1-909452-87-9.

MMO (2018). Record of Appropriate Assessment Regulation 63 of the Conservation of Habitats and Species Regulations 2017, Statutory Instrument 2017/1012. MLA/2016/00463.

Mohanty, P.K., Patra, S.K., Bramha, S., Seth, B., Pradhan, U., Behera, B., Mishra, P. and Panda, U.S. (2012). Impact of groins on beach morphology: a case study near Gopalpur Port, east coast of India. Journal of Coastal Research, 28(1), pp.132-142.

Moulton, V.D., Richardson, W.J., Williams, M.T. and Blackwell, S.B. (2003). Ringed seal densities and noise near an icebound artificial island with construction and drilling. Acoustics Research Letters Online, 4, p.112.

Mullner, A., Linsenmair, K.E. and Wikelski, M. (2004). Exposure to ecotourism reduces survival and effects stress response in hoatzin chicks (*Opisthocomus hoazin*). Biological Conservation, 118, pp.549-558.

Nacci, D. and Jackim, E. (1989). Using the DNA alkaline unwinding assay to detect DNA damage in laboratory and environmentally exposed cells and tissues. Marine Environmental Research, 28(1-4), pp.333-337.

Natural England and JNCC (2016). Departmental Brief: Greater Wash potential Special Protection Area. [Online] Available at: [redacted] (accessed December 2022).

Natural England (2017). Natural England Evidence Information Note EIN033: motorised and non-motorised land vehicles.

Natural England. (2021a). Natural England Conservation Advice for Marine Protected Areas: Humber Estuary SAC. [Online] Available at: [redacted]

[redacted] (accessed July 2021).

Natural England. (2021b). Natural England Conservation Advice for Marine Protected Areas: Humber Estuary SPA. [Online] Available at: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCod e=UK9006111&SiteName=humber&countyCode=&responsiblePerson=&SeaArea=& IFCAArea=&HasCA=1&NumMarineSeasonality=15&SiteNameDisplay=Humber%20 Estuary%20SPA (accessed July 2021).

Natural England. (2022). Multi-Agency Geographic Information for the Countryside (MAGIC) Interactive Map. [Online] Available at: https://magic.defra.gov.uk/ (accessed December 2022).

Naylor, L. A., MacArthur, M., Hampshire, S., Bostock, K., Coombes, M. A., Hansom, J. D., ... & Folland, T. (2017). Rock armour for birds and their prey: ecological enhancement of coastal engineering. In Proceedings of the Institution of Civil Engineers-Maritime Engineering (Vol. 170, No. 2, pp. 67-82). Thomas Telford Ltd.

Navedo, J.G., and Herrera, A.G. (2012). Effects of recreational disturbance on tidal wetlands: supporting the importance of undisturbed roosting sites for waterbird conservation. Journal of Coastal Conservation, 16(3), pp.373-381.

Nedelec, S.L., Campbell, J., Radford, A.N., Simpson, S.D. and Merchant, N.D. (2016). Particle motion: the missing link in underwater acoustic ecology. Methods in Ecology and Evolution, 7, pp.836-842.

Newell, R.C., Seiderer, J.L. and Hitchcock, D.R. (1998). The Impact of Dredging Works in Coastal Waters: A Review of Sensitivity to Disturbance and Subsequent Recovery of Biological Resources on the Seabed. Oceanography and Marine Biology: An Annual Review, 36, pp.127-78.

NMFS. (2021). Section 7 Consultation Guidance: Pile Driving Noise Calculator (Excel spreadsheet download). Available at: https://www.fisheries.noaa.gov/southeast/consultations/section-7-consultation - guidance (accessed November 2021).

NOAA. (2018). 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-59, p.167.

NOAA. (2021). User Manual and User Spreadsheet Tool - 2018 Acoustic Technical Guidance. Available at: https://www.fisheries.noaa.gov/action/user-manual-optional-spreadsheet-tool-2018-acoustic-technical-guidance (accessed November 2021).

O'brien, D.J., Whitehouse, R.J.S. and Cramp, A. (2000). The cyclic development of a macrotidal mudflat on varying timescales. Continental Shelf Research, 20(12-13), pp.1593-1619.

Parchure, T.M., McAnally, W.H. and Teeter, A.M. (2001). Wave-induced sediment resuspension near the shorelines of the Upper Mississippi River system (No. ENV Report 20).

Pardal-Souza, A.L., Dias, G.M., Jenkins, S.R., Ciotti, Á.M. and Christofoletti, R.A. (2017). Shading impacts by coastal infrastructure on biological communities from subtropical rocky shores. Journal of Applied Ecology, 54(3), pp.826-835.

Parnell, K.E., Soomere, T., Zaggia, L., Rodin, A., Lorenzetti, G., Rapaglia, J. and Scarpa, G.M. (2015). Ship-induced solitary Riemann waves of depression in Venice Lagoon. Physics Letters A, 379(6), pp.555-559.

Paterson , W D , Russell , D J F , Wu , G-M , McConnell , B , Currie , J I , McCafferty, D J & Thompson , D (2019) , ' Post-disturbance haulout behaviour of harbour seals ' , Aquatic Conservation: Marine and Freshwater Ecosystems , vol. 29, no. S1 , pp. 144-156 . [redacted].

Pearce, F., Peeler, E. and Stebbing, P. (2012). Modelling the Risk of the Introduction and Spread of Non-Indigenous Species in the UK and Ireland. Cefas Report.

Percival, S. (2011). Spatial and temporal patterns in black-tailed godwit use of the Humber Estuary, with reference to historic planning and development at Killingholme Pits. Report by Ecology Consulting

Perry, F. (2016). [*Sabella pavonina*] with sponges and anemones on infralittoral mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted] accessed December 2020).

Peterson, C. H. (1991). Intertidal Zonation of Marine Invertebrates in Sand and Mud. American Scientist, pp.236-249.

Pienkowski, M. W. (1983). Surface activity of some intertidal invertebrates in relation to temperature and the foraging behavior of their shorebird predators. Marine ecology progress series. Oldendorf, 11(2), 141-150.

Pineda, M.C., Strehlow, B., Sternel, M., Duckworth, A., Den Haan, J., Jones, R. and Webster, N.S. (2017). Effects of sediment smothering on the sponge holobiont with implications for dredging management. Scientific Reports, 7(1), pp.1-15.

Planning Inspectorate (PINS) (2022). Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Version 9, republished August 2022.

Popper, A.N., Hawkins, A.D., Fay, R., Mann, D., Bartol, S., Carlson, Th., Coombs, S., Ellison, W.T., Gentry, R., Halvorsen, M.B., Lokkeborg, S., Rogers, P., Southall, B.L., Zeddies, D.G. and Tavolga, W.N. (2014). Sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-Accredited standards committee S3/SC1 and registered with ANSI. Springer, ASA Press. ISBN 2196-1212. (e-book ISBN 978-2-219-06659-2).

Prumm, M., and Iglesias, G. (2016). Impacts of port development on estuarine morphodynamics: Ribadeo (Spain). Ocean & Coastal Management, 130, pp.58-72.

Radford, C.A., Montgomery, J.C., Caiger, P. and Higgs, D.M. (2012). Pressure and particle motion detection thresholds in fish: a re-examination of salient auditory cues in teleosts. Journal of Experimental Biology, 215(19), pp.3429-3435.

Rayment, W.J. (2002). Semi-permanent tube-building amphipods and polychaetes in sublittoral mud or muddy sand. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted].

Rees, B.C., Bruce, J.H. and White, G.T. (2005). Factors affecting the behavioural responses of whooper swans (Cygnus c. Cygnus) to various human activities. Biological Conservation, 121, pp.369-382.

Reuscher, M. G., Montagna, P. A., & Sturdivant, S. K. (2019). Sampling techniques for the marine benthos. In Cochran, J. K., Bokuniewicz, H. J., & Yager, P. L. (2019). Encyclopedia of Ocean Sciences. Academic Press. Pages 752-764,

Rodgers, J.A., and Schwikert, S.T., (2002). Buffer-Zone Distances to Protect Foraging and Loafing Waterbirds from Disturbance by Personal Watercraft and Outboard-Powered Boats. Conservation Biology, 16(1), 216-224.

Ross, K and Liley, D, (2014). Humber Winter Bird Disturbance Study. Unpublished report for the Humber Management Scheme by Footprint Ecology

RSPB. (2010). [redacted]. Accessed November 2021 Ruddock, M. and Whitfield, D.P. (2007). A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Ruiz, G.G. and Carlton, J.T. (2003). Invasive Species – Vectors and Management Strategies. Island Press, Washington, Covelo, London.

Russell, D.J.F. (2016). Movements of grey seal that haul out on the UK coast of the southern North Sea. Report for the Department of Energy and Climate Change (OESEA-14-47).

Santos, C. D., Miranda, A. C., Granadeiro, J. P., Lourenço, P. M., Saraiva, S., & Palmeirim, J. M. (2010). Effects of artificial illumination on the nocturnal foraging of waders. Acta Oecologica, 36(2), 166-172.

Santos, T.M., Cabral, J.A., Lopes, R.J., Pardal, M., Marques, J.C. and Goss-

Custard, J. (2005). Competition for feeding in waders: A case study in an estuary of south temperate Europe (Mondego, Portugal). Hydrobiologia. 544(1), pp.155–166.

Sexton, C. (2017). Influence of the disturbance on shorebird behaviour. BSc thesis, University College Cork, Ireland.

Schaeffer, D.J. and Herricks, E.E. (1993). Biological monitors of pollution. In Handbook of Hazardous Materials (pp. 69-80). Academic Press.

Schoeman, R.P., Patterson-Abrolat, C. and Plön, S., (2020). A global review of vessel collisions with marine animals. Frontiers in Marine Science, 7, p.29

Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V., and Garthe, S. (2011). Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications 21(5), 1851-1860Seawatch Foundation. (2021). Eastern England Sightings 2021. [Online] Available at: [redacted]. (accessed August 2021).

Scottish Government. (2010). Habitats Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Appropriate Assessment Information Review. Potential for Adverse Effects on Anadromous Fish and Freshwater Pearl Mussel Features. March 2011.

Sharples R.J., Mattiopoulos J., and Hammond P.S., (2008). Distribution and movements of harbour seals around the coast of Britain: Outer Hebrides, Shetland, Orkney, the Moray Firth, St Andrews Bay, The Wash and the Thames. Report to Geotek. Sea Mammal Research Unit. DTI.

Sharples, R.J., Moss, S. E., Patterson, T. A., & Hammond, P. S. (2012). Spatial variation in foraging behaviour of a marine top predator (*Phoca vitulina*) determined by a large-scale satellite tagging program. PLoS one, 7(5), e37216.

Smit, C.J. & Visser, G.J. (1993) . Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area. Wader Study Group Bull. 68: 6-19.

Soomere, T. (2006). Nonlinear ship wake waves as a model of rogue waves and a source of danger to the coastal environment: a review. Oceanologia, 48(S).

Soulsby, R.L., Hamm, L., Klopman, G., Myrhaug, D., Simons, R.R., Thomas, G.P. (1993). Wave–current interaction within and outside the bottom boundary layer. Coastal Engineering 21, 41–69.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr, C.R., Kastak, D., Miller, J.H., Nachigall, P.E., Richardson, W,.J., Thomas, J.A and Tyack, P.L. (2007). Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33, pp.411–521.

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019). Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2).

Stillman, R.A., West, A.D., Caldow, R.W., and Durell, S.E.L.V. (2007). Predicting the effect of disturbance on coastal birds. Ibis, 149(1), pp.73-81.

Stillman, R.A., West, A.D., Clarke, R.T. and Liley, D. (2012). Solent Disturbance and Mitigation Project Phase II: Predicting the impact of human disturbance on overwintering birds in the Solent. Report to the Solent Forum.

Special Committee on Seals (SCOS). (2022). Scientific Advice on Matters Related to the Management of Seal Populations: 2021.

Stamplecoskie, K. M., Binder, T. R., Lower, N., Cottenie, K., McLaughlin, R. L., & McDonald, D. G. (2012). Response of migratory sea lampreys to artificial lighting in portable traps. North American Journal of Fisheries Management, 32(3), 563-572.

Strong P and Morris SR. (2010). Grey seal (Halichoerus grypus) disturbance, ecotourism and the Pembrokeshire Marine Code around Ramsey Island. J. Ecotourism 9(2): 117–132.

Takada, Y. (1999). Influence of shade and number of boulder layers on mobile organisms on a warm temperate boulder shore. Marine Ecology Progress Series, 189, pp.171-179.

Thrush, S.F., Hewitt, J.E., Parkes, S., Lohrer, A.M., Pilditch, C., Woodin, S.A., Wethey, D.S., Chiantore, M., Asnaghi, V., De Juan, S. and Kraan, C. (2014). Experimenting with ecosystem interaction networks in search of threshold potentials in real-world marine ecosystems. Ecology, 95(6), pp.1451-1457.

Tillin, H.M., Houghton, A.J., Saunders, J.E. and Hull, S.C. (2011). Direct and Indirect Impacts of Marine Aggregate Dredging. Marine ALSF Science Monograph Series No. 1. MEPF 10/P144. (Edited by R. C. Newell & J. Measures). p.41.

Tillin, H.M. (2016). Oligochaetes in variable or reduced salinity infralittoral muddy sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at: [redacted] (accessed December 2020).

Tillin, H.M. and Rayment, W., (2016). *Hediste diversicolor* and *Limecola balthica* in littoral sandy mud. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 05-04-2022]. Available from: [redacted]

Tillin, H.M., Tyler-Walters, H. and Garrard, S.L. (2019). Infralittoral mobile clean sand with sparse fauna. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. [Online] Available at:

[redacted]

Todd, V.L., Todd, I.B., Gardiner, J.C., Morrin, E.C., MacPherson, N.A., DiMarzio, N. A., and Thomsen, F. (2015). A review of impacts of marine dredging activities on marine mammals. ICES Journal of Marine Science, 72(2), pp.328-340.

Tolhurst, T.J., Chapman, M.G. and Murphy, R.J. (2020). The Effect of Shading and Nutrient Addition on the Microphytobenthos, Macrofauna, and Biogeochemical Properties of Intertidal Flat Sediments. Frontiers in Marine Science, 7, p.419.

Tollit D. J., Black A. D., Thompson P. M., Mackay A., Corpe H. M., Wilson B., Van Parijs S. M., Grellier K., and Parlane, S., (1998). Variations in harbour seal Phoca vitulina diet and dive-depths in relation to foraging habitat. Journal of Zoology, 244(2), pp. 209-222.

Tweedley, J.R., Hallett, C.S., Warwick, R.M., Clarke, K.R. and Potter, I.C. (2015). The hypoxia that developed in a microtidal estuary following an extreme storm produced dramatic changes in the benthos. Marine and Freshwater Research, 67(3), pp.327-341.

Tyler-Walters, H., Tillin, H.M., d'Avack, E.A.S., Perry, F., Stamp, T. (2018). Marine Evidence-based Sensitivity Assessment (MarESA) – A Guide. Marine Life Information Network (MarLIN). Marine Biological Association of the UK, Plymouth, p. 91. [Online] Available at: [redacted] (accessed December 2020).

Tyler-Walters, H. & Garrard, S.L., 2019. *Arenicola marina* in infralittoral fine sand or muddy sand. In Tyler-Walters H. and Hiscock K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 10-12-2021]. Available from: [redacted]

UK Marine Monitoring Assessment Strategy (UKMMAS). (2010). Charting Progress 2 Feeder report: Clean and Safe Seas. (Eds. Law, R. and Maes, T.). Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. p.366.

UK Marine SACs Project. (2001). Environmental impacts of a ship's wash. [Online] Available at: [redacted]

Uncles, R. J., Stephens, J. A., & Law, D. J. (2006). Turbidity maximum in the macrotidal, highly turbid Humber Estuary, UK: Flocs, fluid mud, stationary suspensions and tidal bores. Estuarine, Coastal and Shelf Science, 67(1-2), 30-52.

Van Colen, C., Thrush, S.F., Parkes, S., Harris, R., Woodin, S.A., Wethey, D.S., Pilditch, C.A., Hewitt, J.E., Lohrer, A.M. and Vincx, M. (2015). Bottom–up and top–down mechanisms indirectly mediate interactions between benthic biotic ecosystem components. Journal of Sea Research, 98, pp.42-48.

Van Dijk, W.M., Cox, J.R., Leuven, J.R.F.W., Cleveringa, J., Taal, M., Hiatt, M.R., Sonke, W., Verbeek, K., Speckmann, B. and Kleinhans, M.G. (2019). The vulnerability of tidal flats and multi-channel to dredging and disposal, EarthArxiv.

Verney, R., Deloffre, J., Brun-Cottan, J.C. and Lafite, R. (2007). The effect of wave-induced turbulence on intertidal mudflats: Impact of boat traffic and wind. Continental Shelf Research, 27(5), pp.594-612.

Walters, K., Kosciuch, K. & Jones, J. (2014). Can the effect of tall structures on birds be isolated from other aspects of development? *Wildlife Society Bulletin* [redacted].

Webb, J. F., Popper, A. N. and Fay, R. R. (2008). Fish Bioacoustics. New York, NY: Springer.

Wenger, A.S., Harvey, E., Wilson, S., Rawson, C., Newman, S.J., Clarke, D., Saunders, B.J., Browne, N., Travers, M.J., Mcilwain, J.L. and Erftemeijer, P.L. (2017). A critical analysis of the direct effects of dredging on fish. Fish and Fisheries, 18(5), pp.967-985.

Williams, G.A. (1994). The relationship between shade and molluscan grazing in structuring communities on a moderately-exposed tropical rocky shore. Journal of Experimental Marine Biology and Ecology, 178(1), pp.79-95.

Wilson, S. (2009). Estuarine Bird Monitoring (05 Dec 2008-19 Jan 2009) - TERRC Facility. Prepared for Hartlepool Borough Council.

Wilson, S.C. (2014). The impact of human disturbance at seal haul-outs. A literature review for the Seal Conservation Society.

WODA. (2013). Technical Guidance on: Underwater Sound in Relation to Dredging.

Woodward, I.D., Calbrade, N.A and Holt., C.A. (2014). Humber Estuary Bird Decline Investigation 2014. BTO Research Report No. 668. Report of work carried out by The British Trust for Ornithology under contract to Natural England.

Woodward, I., Thaxter, C.B., Owen, E. & Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening, Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate, ISBN 978-1-912642-12-0.

Wright, M.D., Goodman, P., and Cameron, T.C. (2013). Exploring behavioural responses of shorebirds to impulsive noise. Wildfowl, 60(60), pp.150-167.

Wright, L.J., Mendez, V., and Burton, N.H. (2014). Review of knowledge regarding the effect of major estuarine developments on bird populations with reference to proposals for an airport in the Thames *Estuary*. British Trust for Ornithology.

Xodus. (2012). Grimsby River Terminal Construction Pile Noise Monitoring and Bird Behaviour Observations. Associated British Ports.

Zaggia, L., Lorenzetti, G., Manfé, G., Scarpa, G.M., Molinaroli, E., Parnell, K.E., Rapaglia, J.P., Gionta, M. and Soomere, T. (2017). Fast shoreline erosion induced by ship wakes in a coastal lagoon: Field evidence and remote sensing analysis. PloS one, 12(10), p.e0187210.

Zielinski, D. P., McLaughlin, R., Castro-Santos, T., Paudel, B., Hrodey, P., & Muir, A. (2019). Alternative sea lamprey barrier technologies: history as a control tool. Reviews in Fisheries Science & Aquaculture, 27(4), 438-457.

7 Abbreviations/Acronyms

AA Appropriate Assessment
ABB ABB Power Generation Ltd
ABP Associated British Ports
AEOI Adverse Effect On
Integrity AMEP Able Marine
Energy Park
APIS Air Pollution Information
System BAT Best Available Techniques
BTO British Trust for Ornithology
Cefas Centre for Environment, Fisheries and Aquaculture
Science CEMP Construction Environmental Management Plan
CoCP Code of Construction
Practice COVID Coronavirus
cSAC Candidate Special Areas of Conservation
CSIP Cetacean Strandings Investigation
Programme dB Decibel
dBA A-weighted decibel
DCO Development Consent Order
Defra Department for Environment, Food and Rural
Affairs DNA Deoxyribonucleic Acid
EC European Commission
EEA European Economic Area
EEC European Economic Community
EIA Environmental Impact
Assessment EMP Environmental
Management Plan EMS European Marine
Site
ERM ERM Group
ES Environmental Statement
EU European Union
FID Flight Initiation Distance
GPS Global Positioning System
HDD Horizontal Directional Drilling
HEEs High Energy Events
HGVs Heavy Goods Vehicle
HIT Humber International Terminal

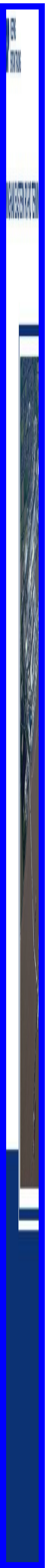
HM Her Majesty's (His Majesty's)
HRA Habitats Regulations
Assessment
IAQM Institute of Air Quality
Management ID Identity
IECS Institute of Estuarine & Coastal Studies
IERRT Immingham Eastern Roll-on Roll-off
Terminal IMO International Maritime Organisation
IOH Immingham Outer Harbour
IOT Immingham Oil Terminal
IROPI Imperative Reasons of Overriding Public
Interest IUCN International Union for Conservation of Nature
JNCC In-combination Climate Change Impacts
LAeq Equivalent Continuous Sound Pressure Level,
LAmax F Maximum 'A'-weighted Sound Pressure Level (Fast Time
Weighed) Lmax. Maximum 'A'-weighted Sound Pressure Level
LSE Likely Significant Effect
MAGIC Multi-Agency Geographic Information for the
Countryside MarESA Marine Evidence based Sensitivity
Assessment
MarLIN Marine Life Information
Network MCAA Marine and Coastal
Access Act MHWS Mean High Water
Springs MLWN Mean Low Water Neaps
MLWS Mean Low Water Springs
MMO Marine Management Organisation
MP Mean Peak
MPA Marine Protected Area
MPS Marine Policy Statement
MS Marine Straggler species
MW Megawatt
NBN National Biodiversity Network
NE Natural England
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric
Administration NPFF National Planning Policy
Framework
NSIP Nationally Significant Infrastructure Projects
O&M Operation and
Maintenance OCGT Open Cycle Gas
Turbine
OSPAR Convention for the Protection of the Marine Environment of the North- East Atlantic
OtSMRS Outstrays to Skeffling Managed Realignment
Scheme PAH Polycyclic Aromatic Hydrocarbons
PCBs Polychlorinated Biphenyl

PEIR Preliminary Environmental Information Report
PIANC The World Association for Waterborne Transport
Infrastructure PINS Planning Inspectorate
pSAC Possible Special Area of
Conservation pSPA Potential Special Protection
Areas PTS Permanent Threshold Shifts
PW Phocid Pinniped
Ramsar Wetlands of international importance, designated under The Convention on Wetlands (Ramsar, Iran, 1971)
REC Regional Environmental Characterisation
Ro-Ro Roll On-Roll Off
RSPB Royal Society for the Protection of
Birds SAC Special Area of Conservation
SEL Sound Exposure Levels
SL Source Level
SPA Special Protection Area
SPL Sound Pressure Levels
SSC Suspended Sediment
Concentrations SSSI Site of Special
Scientific Interest
TBT Tributyltin
TSHD Trailer Suction Hopper Dredger
TTS Temporary Threshold Shift
UK United Kingdom
WCA Wildlife and Countryside
Act WeBS Wetland Bird Survey
WODA World Organization of Dredging
Associations ZoI Zone of Influence

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Appendix A: Baseline Information to Inform the HRA



Habitat Regulations Assessment
Appendix A: Baseline to Inform HRA
Document Reference: 9.6

APFP Regulations 2009 – Regulation 5(2)(g)
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Immingham Eastern Ro-Ro Terminal

Habitat Regulations Assessment
Appendix A: Baseline to Inform HRA

October 2023

Document Information

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Contents

Tables

Figures

1 HRA baseline

1.1 Introduction

1.1.1 This appendix provides baseline ecological information relevant to the Shadow HRA. This information is a summary of baseline data provided in marine ecology assessment (Chapter 9 of Volume 1 of the ES – Application Document Reference number 8.2.9) but focused specifically on features of relevant designated sites.

1.1.1 This report has been structured as follows:

- **Section 2: Designated sites** provides a summary of citation information for the Humber Estuary European Marine Site (EMS), the Wash and North Norfolk Coast Special Area of Conservation (SAC) and Greater Wash Special Protection Area (SPA).
- **Section 3: Marine ecology features** summaries baseline information on benthic habitats and species, lamprey and seal features of relevant designated sites; and
- **Section 4**: **Coastal waterbird features** summaries baseline information on coastal waterbirds features of relevant designated sites.

1.1.2 This appendix is also supported by the following figures and annexes:

- **Figure A.1**: Internationally and nationally designated conservation sites;
- **Figure A.2:** Project specific subtidal benthic sampling stations;
- **Figure A.3**: Annual grey seal pup counts at Donna Nook;
- **Figure A.4:** Aerial counts of grey seals at Donna Nook;
- **Figure A.5:** Monitoring locations of coastal waterbird surveys in the vicinity of the Project;
- **Figure A.6**: The 5-year mean peak number of birds in Sector B during different winter months;
- **Figure A.7**: The broad distribution of coastal waterbirds in Sector B;
- **Annex A.1**: Bird data for Sector B, covering the period October 2021 to September 2022 which covers winter, passage and summer months; and
- **Annex A.2:** Summary bird data for Sectors A and C.

1.2 Designated sites

1.2.1 The proposed development falls within the boundaries of the Humber Estuary SAC, SPA and Ramsar site (collectively forming the Humber EMS; Figure A.1). For the Humber Estuary SAC, the primary reason for designation is the presence of two broad scale habitats, 1130 Estuaries and 1140 Mudflats and sandflats not covered by seawater at low tide (JNCC, 2022a). These broad scale habitats support other more specific habitats which are qualifying features but not a primary reason for designation. These are:

- 1110 Sandbanks which are slightly covered by sea water all the time;
- 1150 Coastal lagoons (identified as a priority feature);

- 1310 *Salicornia* and other annuals colonizing mud and sand;
- 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae);
- 2110 Embryonic shifting dunes;
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes');
- 2130 Fixed coastal dunes with herbaceous vegetation ('grey dunes') (identified as a priority feature); and
- 2160 Dunes with *Hippopha rhamnoides*.

1.2.2 Alongside the habitats for which the SAC is designated, there are also three mobile species listed on Annex II of the EU Habitats Directive (92/43/EEC) (the Natural Habitats and Wild Fauna and Flora Directive) included in the designation (JNCC, 2022a), namely:

- 1095 Sea lamprey *Petromyzon marinus*;
- 1099 River lamprey *Lampetra fluviatilis*; and
- 1364 Grey seal *Halichoerus grypus*.

1.2.3 Qualifying features of the Humber Estuary SPA and Humber Estuary Ramsar site are shown in Table A.1 and Table A.2 respectively.

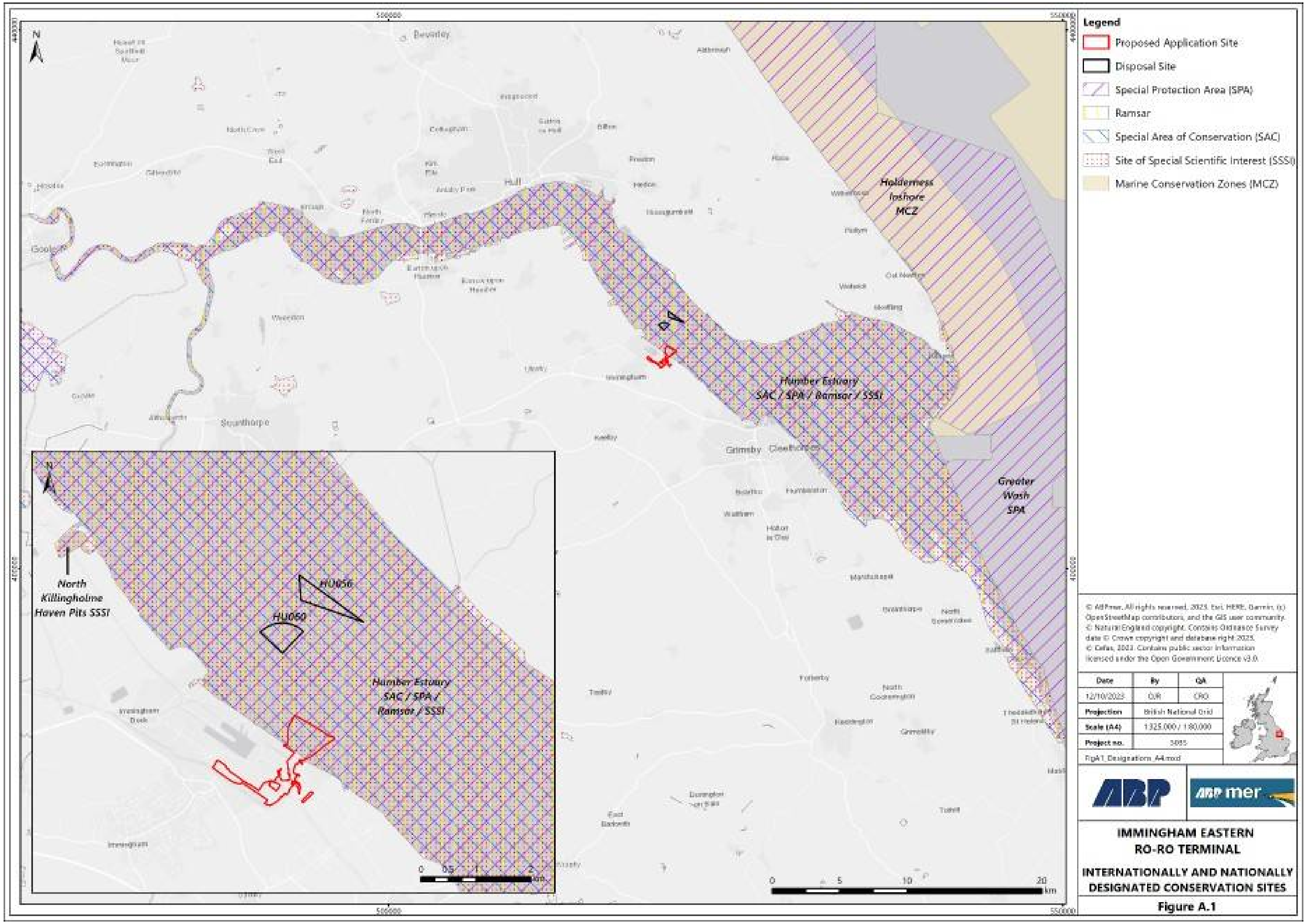

Figure A.1. Internationally and nationally designated conservation sites

Table A.1. Qualifying features of the Humber Estuary SPA

Internationally Important Populations of Regularly Occurring Annex 1 Species	
Breeding Species Population	
Bittern *Botaurus stellaris*	2 calling males (10.5% of the GB population)
Marsh Harrier *Circus aeruginosus*	10 breeding females (6.3% of the GB population)
Avocet *Recurvirostra avosetta*	64 pairs (8.6% of the GB population)
Little Tern *Sternula albifrons*	51 pairs (2.1% of the GB population)
Wintering Species Population	
Bittern	4 (4.0% of the GB population)
Hen harrier *Circus cyaneus*	8 (1.1% of the GB population)
Bar-tailed Godwit *Limosa lapponica*	2,752 (4.4% of the GB population)
Golden Plover *Pluvialis apricaria*	30,709 (12.3% of the GB population)
Avocet *Recurvirostra avosetta*	54 (1.7% of the GB population)
On passage Species population	
Ruff *Calidris pugnax*	128 (1.4% of the GB population)
Internationally Important Populations of Regularly Occurring Migratory Species	
Wintering Species Population	
Teal† *Anas crecca*	2,322 (<1% of the population)
Wigeon† *Mareca penelope*	5,044 (<1% of the population)
Mallard† *Anas platyrhynchos*	2,456 (<1% of the population)
Turnstone† *Arenaria interpres*	629 (<1% of the population)
Common Pochard† *Aythya ferina*	719 (<1% of the population)
Greater Scaup† *Aythya marila*	127 (<1% of the population)
Brent Goose† *Branta bernicla*	2,098 (<1% of the population)
Goldeneye† *Bucephala clangula*	467 (<1% of the population)
Sanderling† *Calidris alba*	486 (<1% of the population)
Dunlin *Calidris alpina*	22,222 (1.7% of the Northern Siberia/Europe/Western Africa population)
Red Knot *Calidris canutus*	28,165 (6.3% of the North-eastern Canada/Greenland/Iceland/North-wester n Europe population)
Ringed Plover† *Charadrius hiaticula*	403 (<1% of the population)
Oystercatcher† *Haematopus ostralegus*	3503 (<1% of the population)
Black-tailed Godwit *Limosa*	1,113 (3.2% of the Icelandic Breeding population)
Curlew† *Numenius arquata*	3,253 (<1% of the population)
Grey Plover† *Pluvialis squatarola*	1,704 (<1% of the population)
Shelduck *Tadorna tadorna*	4,464 (1.5% of the North-western Europe population)
Redshank *Tringa totanus*	4,632 (3.6% of the Eastern Atlantic Wintering population)
Northern Lapwing† *Vanellus vanellus*	22,765 (<1% of population)
Internationally Important Populations of Regularly Occurring Migratory Species	
On passage Species Population	

Sanderling†	818 (<1% of the population)
Dunlin	20,269 (1.5% of the Northern Siberia/Europe/Western Africa population)
Red Knot	18,500 (4.1% of the North-eastern Canada/Greenland/Iceland/North-western Europe population)
Ringed Plover†	1,766 (<1% of the population)
Black-tailed Godwit	915 (2.6% of the Icelandic Breeding population)
Whimbrel† *Numenius phaeopus*	113 (<1% of the population
Grey Plover†	1,590 (<1% of the population)
Greenshank† *Tringa nebularia*	77 (<1% of the population)
Redshank	7,462 (5.7% of the Eastern Atlantic Wintering population)
Internationally Important Assemblage of Waterfowl	
Waterfowl assemblage	153,934 waterfowl
†Species with this symbol do not represent a population that is > 1% of the international threshold but are included in the waterfowl assemblage.	

Source: JNCC (2022b)

Table A.2. Qualifying marine features of the Humber Estuary Ramsar Site

Ramsar Criterion	
Criterion 1 – natural wetland habitats that are of international importance	
The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	
Criterion 3 – supports populations of plants and/or animal species of international importance	
The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	
Criterion 5 – Bird Assemblages of International Importance	
Wintering waterfowl	153,934 waterfowl (5-year peak mean 1998/99-2002/3)
Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance	
Species	Spring/Autumn Population (5-year peak mean 1996-2000)
Golden Plover	17,996 (2.2% of the Iceland & Faroes/East Atlantic population)
Red Knot	18,500 (4.1% of the West & Southern African wintering population)
Dunlin	20,269 (1.5% of the West Siberia/West Europe population)
Black-tailed Godwit	915 (2.6% of the Iceland/West Europe population)
Redshank	7,462 (5.7% of the population)
Species	Wintering Population (5-year peak mean 1996/7-2000/1)
Shelduck	4,464 (1.5% of the North-western Europe Population)
Golden Plover	30,709 (3.8% of the Iceland & Faroes/East Atlantic population)
Red Knot	28,165 (4.1% of the West & Southern African wintering population)

Dunlin	22,222 (1.7% of the West Siberia/West Europe population)
Black-tailed Godwit	1,113 (3.2% of the Iceland/West Europe population)
Bar-tailed Godwit	2,752 (2.3% of the West Paleartic population)
Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path	
The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	

Source: JNCC (2022c)

1.2.4 The Greater Wash SPA is designated for a range of seabird and diving bird species and is located approximately 20 km from the proposed development. Qualifying features of this site is shown in Table A.3

Table A.3. Qualifying marine features of the Greater Wash SPA

Internationally Important Populations of Regularly Occurring Annex 1 Species	
Breeding Species Population	
Little Tern *Sternula albifrons*	798 pairs (42% of GB breeding population)
Common Tern *Sterna hirundo*	510 pairs (5.1% of GB breeding population)
Sandwich Tern *Sterna sandvicensis*	852 pairs (35% of GB breeding population)
Wintering Species Population	
Little Gull *Hydrocoloeus minutus*	1,255 (no current GB population estimate)
Red-throated Diver *Gavia stellata*	1,407 (8.3% of GB non-breeding population)
Internationally Important Populations of Regularly Occurring Migratory Species	
Common Scoter *Melanitta nigra*	3,449 (0.6% of biogeographic population)

Source: JNCC (2022d)

1.2.5 The Wash and North Norfolk Coast SAC supports common seal *Phoca vitulina* as a qualifying feature. This site is located over 75 km from the proposed development but it is acknowledged that there could be potentially connectivity between the Wash and North Norfolk Coast SAC and the Humber Estuary with respect to common seal movements.

1.3 Marine ecology features

Data and information sources

1.3.1 Current baseline conditions have been determined by a desk-based review of available information. A project-specific subtidal benthic survey has also been undertaken to characterise seabed habitats and species within and near to the proposed dredge footprint.

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

Benthic habitats and species

- Able Marine Energy Park Benthic Surveys: The results of intertidal benthic surveys (undertaken in 2015 and 2016) using a 0.01 m² core sample and a subtidal survey in 2016 using a 0.1 m² Day Grab in the North Killingholme area (Able UK Limited, 2021);
- Humber Estuary SAC Intertidal Sediment Survey: Ecological survey work undertaken in 2014 to monitor and assess the intertidal mudflat and sandflat communities of the Humber Estuary (Franco *et al.,* 2015);
- Immingham Outer Harbour (IOH) Benthic Surveys: Intertidal sampling at 14 stations (using a Day Grab (0.06 m²) or Van Veen Grab (0.03 m²)) and subtidal sampling at 17 stations in the Port of Immingham area in 2009 (ABPmer, 2009);
- South Humber Channel Marine Studies: Benthic sampling in the intertidal (using a 0.01 m² core from 36 stations) and subtidal (0.1 m² Hamon grab from 30 stations) between the Humber Sea Terminal and Immingham Port undertaken in 2010 (Institute of Estuarine and Coastal Studies (IECS), 2010);
- HU056 Disposal Site Monitoring: Benthic invertebrate samples collected at five sites within the disposal sites and at six locations nearby (triplicate samples at all locations) in 2017 (ABPmer, 2017); and
- Clay Huts Disposal Site Benthic Monitoring: Benthic invertebrate samples collected from four stations in 2008 from within and near to the Clay Huts disposal sites (ABPmer, 2009).

1.3.3 Site specific surveys that have been undertaken to underpin the assessments include:

- **Intertidal benthic sampling:** Ten intertidal stations were sampled in September 2021 using a 0.01 m² hand-held core. The location of the survey stations are shown in Figure 9.2.
- **Subtidal benthic sampling:** Ten subtidal stations were sampled in September 2021 (using a 0.1 m² Day Grab) within and near to the proposed development footprint. In addition, six stations were sampled at each of the disposal sites (HU060 and HU056) using a 0.1 m² Day Grab (four within each of the disposal sites and two nearby to each of the disposal sites). The location of the survey stations is shown in Figure 9.2.

1.3.4 All the samples collected were analysed for macrofaunal analysis (faunal composition, abundance and biomass), Particle Size Analysis (PSA) and Total Organic Carbon (TOC). Polychaetes, bivalves and other species considered waterbird prey items were also measured and categorised using size classes. The methods and results of these surveys are included in Appendix 9.1 of Chapter 9 of the ES ES – Application Document Reference number 8.2.9 and summarised in this appendix.

Lamprey

Seals

- Review of fish population data in the Humber Estuary: A review of avai

- Donna Nook Seal Counts: The latest pup counts available from the Lincolnshi

- Records of ma
Environmental Re
Network (NBN, 20
- At-sea Distributio
habitat- based pre
seals in the Brit
estimated using c
Mammal Research
- Donna Nook Tele
seals from the Do
grey seals in the r

- Special Committee on Seals (SCOS) Annual Report: Information on the status of seals around t by the SMRU advi

Benthic habitats an

d species

Humber Estuary overview

1.3.5 The Humber Estuary supports a wide variety of marine habitats including intertidal mudflats and sandflats, intertidal seagrass beds, coastal lagoons, saltmarsh, reedbeds, subtidal sandbanks and mixed sediment habitats (Humber Nature Partnership, 2015; Natural England, 2015; Franco *et al*., 2015).

1.3.6 The intertidal area of the Humber Estuary is extensive, covering approximately 10,000 ha, of which more than 90% is mudflat and sandflat (English Nature, 2003). The largest areas of mudflat occur in the outer Humber Estuary at Spurn Bight and Pyewipe, at Foul Holme and Skitter Sand in the mid Humber Estuary and across most of the Estuary width in the inner estuary above the Humber Bridge. This habitat changes from moderately exposed sandy shores at the mouth of the Humber Estuary to sheltered muddy shores within the main body of the Estuary and up into the tidal rivers. The mid and upper Humber Estuary is characterised by fringing reedbeds *Phragmites australis* on the upper shore while saltmarshes are present along the north bank and on the Lincolnshire coast east of Cleethorpes (English Nature, 2003; Natural England, 2021a; Natural England 2021b; Franco *et al*., 2015).

1.3.7 The subtidal area of the Estuary is approximately 16,800 ha in extent (English Nature, 2003). The subtidal environment of the Humber Estuary is highly dynamic and varies according to the composition of the bottom sediments, salinity, sediment load and turbidity and dissolved oxygen. Many of these factors vary with the season or state of the tide. Subtidal sand (including muddy sand) is the predominant subtidal sediment type in the Humber Estuary. The high mobility of sediments and high turbidity means that this habitat is typically relatively impoverished with a limited fauna characterised by very low densities of opportunistic species and species adapted to these conditions (Natural England, 2021a; Natural England 2021b; English Nature, 2003).

1.3.8 Invasive marine species known to occur in the Humber Estuary region include slipper limpet *Crepidula fornicata*, Chinese mitten crab *Eriocheir sinensis*, Pacific oyster *Magallana gigas* and acorn barnacle *Austrominius modestus* (Natural England, 2015; IECS, 2010; Appendix 9.1 of Chapter 9 of the ES Application Document Reference number 8.2.9).

Project specific benthic surveys

1.3.9 In order to characterise the benthic communities present in the vicinity of the proposed development (and associated dredge disposal sites), intertidal and subtidal sampling was undertaken in September 2021. The intertidal samples were collected using a 0.01 m² hand-held core and the subtidal stations using a 0.1 m² Day Grab from the following areas:

- **Immingham Eastern Ro-Ro Terminal intertidal samples**: Ten stations within and near to the proposed development footprint (Figure

A.2);

- **Immingham Eastern Ro-Ro Terminal subtidal samples**: Ten stations within and near to the proposed development footprint (Figure A.2);
- **HU056 disposal site subtidal samples:** Six stations (four within each of the disposal sites and two nearby to each of the disposal sites) (Figure A.2); and
- **HU060 disposal site subtidal samples:** Six stations (four within each of the disposal sites and two nearby to each of the disposal sites (Figure A.2).

1.3.10 At each station, a sample was analysed for macrofaunal analysis (faunal composition, abundance and biomass), PSA and TOC. Polychaetes, bivalves and other species considered to be waterbird prey items were also measured and categorised using size classes.

1.3.11 The results of these project specific benthic surveys are summarised below and in Table A.4 to Table A.6 with the methods and results described in more detail in Appendix 9.1 of Chapter 9 of the ES (Application Document Reference number 8.2.9).

Immingham Eastern Ro-Ro Terminal intertidal samples

1.3.12 The sediment in samples collected in this area consisted predominantly of sandy mud (Table A.4). The TOC in the samples ranged between approximately 1% and 3%. Overall, the number of taxa found in the samples was variable and ranged from four (Station IMM 1 and IMM 3) to 15 (Station IMM 7). The number of individuals was also highly variable and ranged from 1,100 organisms per m² (Station IMM 1) to 40,600 organisms per m² (Station IMM 7). The range in total species biomass in the samples was between 1 gram per m² at Station IMM 3 and 190 grams per m² at Station IMM 7 (which was primarily attributed to the ragworm *Hediste diversicolor* and the peppery furrow shell *Scrobicularia plana*) (Table A.4).

1.3.13 The infaunal samples were predominantly characterised by nematodes, the oligochaetes *Tubificoides benedii* and *Enchytraeida*e spp., the mud shrimp *Corophium volutator*, the mudsnail *Peringia ulvae*, Baltic tellin *Limecola balthica* as well as the polychaetes *Hediste diversicolor* and *Pygospio elegans*. These characterising species dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at most of the sites. All the species recorded from the samples in this area were considered commonly occurring in the region and not protected (Table A.4).

1.3.14 During the surveys, the non-native Pacific oyster *Crassostrea gigas* and barnacles were recorded attached to piles on existing jetties in the area.

1.3.15 The assemblage recorded is considered typical of the community recorded on mudflats in the nearby area (ABPmer, 2009; IECS, 2010; Able UK Limited, 2021). For example, intertidal surveys at North Killingholme (located approximately 3 km from the proposed development) in 2015 and 2016 also recorded a benthic assemblage characterised by species such as *Corophium volutator, Tubificoides benedii, Pygospio elegans, Hediste diversicolor, Limicola balthica* and nematodes with a broadly similar total number of individuals in the samples (up to around 50,000 organisms per m²) (Able UK Limited, 2021).

1.3.16 Many of the species recorded in the samples are considered prey species for coastal waterbirds such as polychaetes, Baltic tellin *Limecola balthica*, mudsnail *Peringia* spp. and mudshrimp *Corophium* spp. (Stillman *et al.,* 2005; Woodward *et al*., 2014). The species and size of the prey taken varies between different coastal waterbirds. Larger waders are typically capable of consuming larger invertebrate prey items than smaller species. For example, Dunlin typically takes polychaetes up to 50 to 60 mm and the bivalve *Limecola balthica* up to 8 mm whereas larger waders such as Curlew, godwits and Oystercatcher will consume polychaetes up to 80 mm and *Limecola balthica* up to 20 mm. In addition, only smaller species of wader typically consume *Peringia* spp. and *Corophium* spp. such as Dunlin, Ringed Plover and Common Redshank (Stillman *et al.,* 2005). In order to better understand prey size in the samples collected, prey species were assigned to different size classes based on a size class classification supplied by the laboratory which has been used by Natural England and the Environment Agency in previous studies. The results are summarised in Table A.5. The benthic prey recorded in the surveys were typically small size classes that are consumed by both smaller and larger wading bird species.

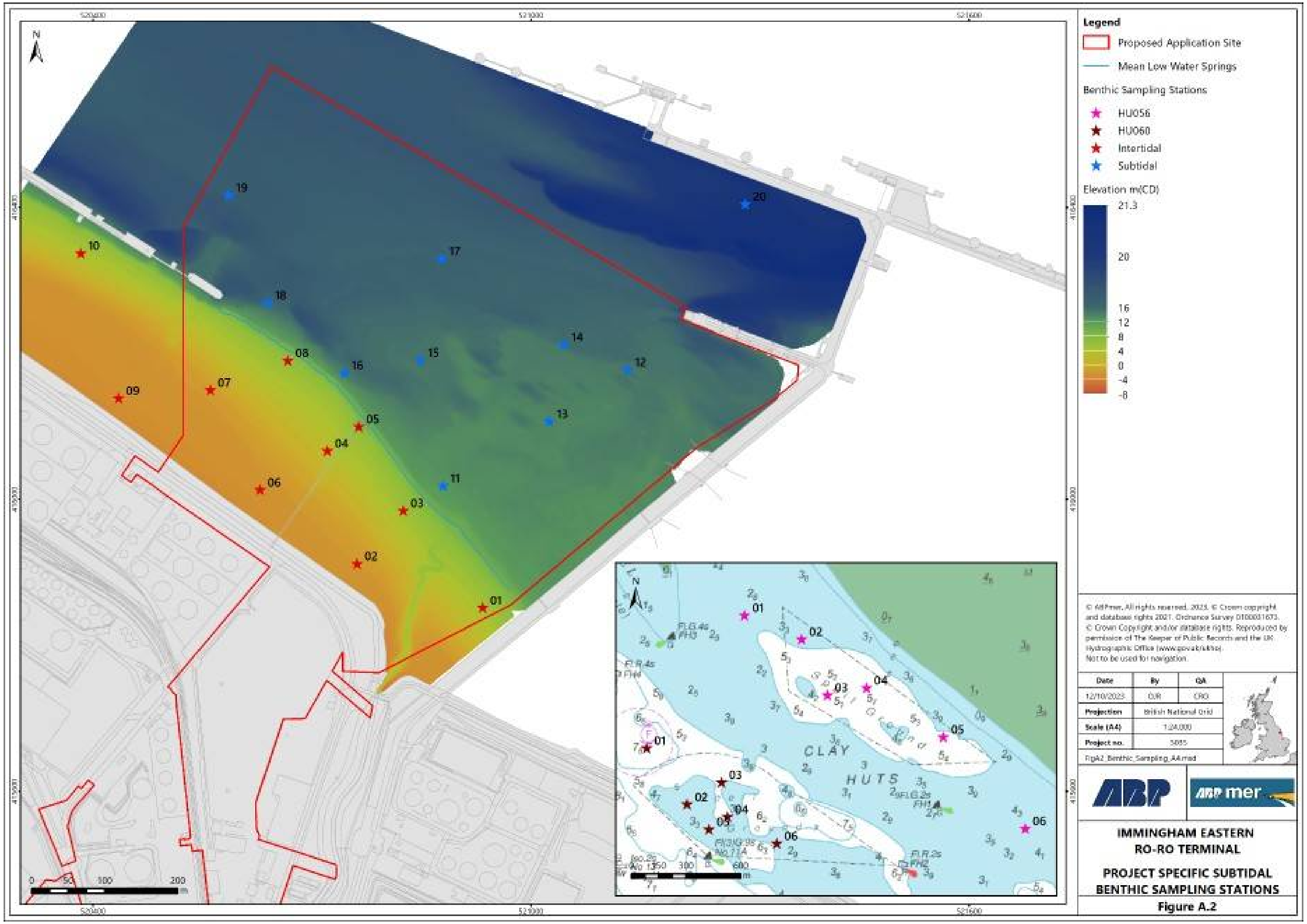

Figure A.2. Project specific subtidal benthic sampling stations

Table A.4. Intertidal benthic survey results

Station	Sediment Type	TOC (%)	No. of Taxa (per m²)	No. of Individuals (per m²)	Total Biomass (g per m²)	Key Characterising Species (Number per m² shown in brackets)
IMM 1	Mud	3.65	4	1,100	6.29	*Nematoda* (400) *Limecola balthica* (300) *Tubificoides benedii* (300) *Nephtys* (100)
IMM 2	Sandy Mud	3.32	14	15,400	105.76	*Peringia ulvae* (4,600) *Nematoda* (2,400) *Enchytraeidae* (2,100) *Hediste diversicolor* (1,500) *Tubificoides benedii* (1,400) *Pygospio elegans* (1,100) *Abra tenuis* (500)
IMM 3	Sandy Mud	2.99	4	1,300	1.13	*Nematoda* (500) *Limecola balthica* (500) *Tubificoides benedii* (200) *Tharyx (100)*
IMM 4	Sandy Mud	2.92	9	20,700	31.14	*Tubificoides benedii* (14,400) *Corophium volutator* (3,600) *Nematoda* (800) *Limecola balthica* (700) *Tellinoidea* (600) *Pygospio elegans* (300)
IMM 5	Sandy Mud	3.05	6	1,600	6.16	*Tubificoides benedii* (900) *Limecola balthica* (300) *Nematoda* (100) *Enchytraeidae* (100) *Corophium volutator* (100) *Tellinoidea* (100)
IMM 6	Sandy Mud	2.90	11	30,300	58.07	*Enchytraeidae* (5,400) *Peringia ulvae* (5,400) *Tubificoides benedii* (5,000) *Nematoda* (4,900)

						Hediste diversicolor (2,700) *Limecola balthica* (2,500) *Abra tenuis* (2,000)
IMM 7	Sandy Mud	3.36	15	40,600	189.77	*Tubificoides benedii* (13,800) *Enchytraeidae* (5,700) *Nematoda* (5,100) *Limecola balthica* (3,500) *Pygospio elegans* (3,400) *Hediste diversicolor* (3,300) *Peringia ulvae* (1,800)
IMM 8	Sandy Mud	3.05	14	4,100	15.87	*Nematoda* (800) *Limecola balthica* (700) *Tubificoides benedii* (600) *Peringia ulvae* (400) *Hediste diversicolor* (300)
IMM 9	Sandy Mud	3.73	14	21,600	47.98	*Hediste diversicolor* (6,800) *Nematoda* (3,200) *Abra tenuis* (2,000) *Enchytraeidae* (1,600) *Peringia ulvae* (1,500) *Tubificoides benedii* (1,400) *Limecola balthica* (1,200)
IMM 10	Sandy Mud	2.71	8	26,800	57.37	*Corophium volutator* (16,400) *Tubificoides benedii* (4,800) *Nematoda* (2,100) *Limecola balthica* (1,800) *Tellinoidea* (1,100) *Eteone longa* (400)

Table A.5. Size classes of key bird prey species

Species group	Species	Size class	Abundance (total for all intertidal samples)	Biomass (total for all intertidal samples)	% (proportion of the total recorded within a particular size class for each species)

Polychaetes	*Eteone longa*	<25 mm	14	0.005	100
		>25 mm	0	0	0
	Hediste diversicolor	<25 mm	113	0.2202	77
		25-50 mm	34	1.2453	23
	Nephtys spp	<25 mm	3	0.0068	100
		>25 mm	0	0	0
	Pygospio elegans	<25 mm	68	0.0142	100
		>25 mm	0	0	0
	Streblospio shrubsolii	<25 mm	12	0.0015	100
		>25 mm	0	0	0
	Tharyx	<25 mm	3	0.0003	100
		>25 mm	0	0	0
	Manayunkia aestuarina	<25 mm	22	0.0003	100
		>25 mm	0	0	0
Crustacean	*Corophium volutator*	<3 mm	142	0.0285	65
		>3 mm	75	0.0597	35
Gastropod	*Peringia ulvae*	<3 mm	136	0.0986	99
		3-5 mm	1	0.005	1
Bivalves	*Limecola balthica*	<9 mm	117	0.8544	98
		9-15 mm	2	0.4533	2
	Abra tenuis	<5 mm	51	0.2517	100
		>5 mm	0	0	0
	Scrobicularia plana	20-25 mm	2	1.6589	100
Size classes used: *Hediste diversicolor* + other polychaetes: <25 mm, 25-50 mm, 50-75 mm, 75-100 mm, >100 mm *Corophium volutator* + other corophiid species: <3 mm, >3 mm *Peringia ulvae*:<3 mm, 3-5 mm, >5 mm *Macoma balthica:*<9 mm, 9-15 mm, 15-20 mm, >20 mm Other bivalve species: < 5 mm, 5-10 mm, 10-15 mm, 15-20 mm					

Immingham Eastern Ro-Ro Terminal subtidal samples

1.3.17 The sediment from samples collected from the area of the proposed development consisted of mud and sandy mud. The TOC in the samples ranged between approximately 3% and 13% (Table A.6). Overall, the number of taxa found in the samples ranged from two (Station IMM 15) to 17 (Station IMM 14), and the number of individuals from 20 organisms per m² (Station IMM 15) to 37,540 organisms per m² (Station IMM 13). However, most stations were relatively impoverished (<10 taxa and <10,000 organisms per m²). The range in total species biomass in the samples was between <1 and 14 grams per m².

1.3.18 The faunal samples were predominantly characterised by nematodes, the mudsnail *Corophium volutator*, polychaetes (such as *Streblospio shrubsolii Polydora cornuta Tharyx* spp. and *Nephtys* spp.), oligochaetes *Tubificoides* spp. and barnacle *Amphibalanus improvises*. All the species recorded from the samples in this area were considered commonly occurring in the region and not protected.

1.3.19 The faunal assemblage recorded is considered characteristic of subtidal habitats in this section of the Humber Estuary. For example, subtidal benthic surveys undertaken in the Immingham area in 2009, 2010 and 2016 predominantly recorded mud or muddy sand habitat which was generally impoverished (with a low number of taxa occurring at the majority of sites). The most commonly recorded infaunal species (generally recorded in low abundances) were the polychaetes *Capitella capitata*, *Streblospio shrubsolii, Pygospio elegans, Polydora cornuta*, oligochaetes *Tubificoides* spp., mud shrimp *Corophium volutator*, and nematodes (ABPmer, 2009; IECS, 2010; Able UK Limited, 2021).

HU056 disposal site subtidal samples

1.3.20 The sediment in samples collected in this area consisted of sand, gravelly sand and sandy gravel with TOC ranging from between approximately 1% and 3% (Table A.6). The stations were considered highly impoverished (with 0 to 2 taxa and 0 to 30 organisms per m² recorded). The samples were characterised by low abundances of a few species (the amphipod *Corophium volutator*, mysid shrimp *Gastrosaccus spinifer*, bryozoan *Electra monostachys* and springtails *Collembola* spp.).

1.3.21 Benthic monitoring in 2017 at disposal site HU056 recorded commonly occurring estuarine species generally in low abundances such as the polychaetes *Polydora cornuta, Pygospio elegans Arenicola marina* and *Capitella* spp., bivalve *Limecola balthica*, mysid shrimps and amphipods (ABPmer, 2017).

1.3.22 The impoverished assemblage recorded is considered typical of scoured subtidal habitats in the Humber Estuary (which are subject to very strong tidal currents). No protected species were recorded.

HU060 disposal site subtidal samples

1.3.23 The sediment in samples collected in this area consisted predominately of sand with TOC between approximately<1 and 3% at all stations (Table A.6).

1.3.24 Most stations were considered impoverished (<7 taxa and <121 organisms per m²). However, 16 taxa were recorded at both Station HU060 4 and HU060 6 with 1,880 and 4,030 organisms per m² respectively at each of these stations. Biomass ranged from 0 to 3.37 grams per m².

1.3.25 The samples were characterised by a wide range of species but typically in low abundances including nematodes, barnacle *Amphibalanus improvises*, polychaetes (such as *Pygospio elegans* and *Arenicola* spp.) and the amphipod *Corophium volutator*. All the species recorded from the samples in this area were considered commonly occurring in the region and not protected.

1.3.26 Benthic surveys undertaken in 2008 within and near to Clay Huts disposal sites also recorded a community characterised by the polychaetes *Arenicola marina* and *Pygospio elegans* as well as nematodes and amphipods (ABPmer, 2009).

Table A.6. Subtidal benthic survey results

Area	Station	Sediment Type	TOC (%)	No. of Taxa (per m²)	No. of Individuals (per m²)	Total Biomass (g per m²)	Key Characterising Species (Number per m² shown in brackets)
Immingham Eastern Ro-Ro Terminal	IMM 11	Mud	3.83	12	11,740	8.32	*Corophium volutator* (8, 910) *Tubificoides benedii* (1,570) *Streblospio shrubsolii* (420) *Nematoda* (250) *Tharyx* (240) *Limecola balthica* (130) *Tubificoides swirencoides* (100)
	IMM 12	Sandy Mud	4.63	16	12,270	1.44	*Nematoda* (9,830) *Streblospio shrubsolii* (1,210) *Amphibalanus improvises* (450) *Polydora cornuta* (440) *Corophium volutator* (110) *Mytilus edulis* (90) *Tharyx* (60)
	IMM 13	Sandy Mud	13.01	4	37,540	14.13	*Corophium volutator* (33,130) *Polydora cornuta* (4,170) *Nematoda* (230) *Tubificoides benedii* (10)
	IMM 14	Sandy Mud	4.03	17	22,480	3.34	*Streblospio shrubsolii* (13,790)
							Nematoda (7,150) *Amphibalanus improvisus* (520) *Polydora cornuta* (340) *Tharyx* (210) *Tubificoides benedii* (210) *Corophium volutator* (70)
	IMM 15	Sandy Mud	13.01	2	20	0.10	*Nephtys hombergii* (10)

							Amphibalanus improvisus (10)
	IMM 16	Sandy Mud	4.03	5	250	1.19	*Tubificoides benedii* (120) *Nephtys* (50) *Nematoda* (40) *Limecola balthica* (40)
	IMM 17	Sandy Mud	3.98	4	80	0.09	*Nephtys* (30) *Nematoda* (20) *Diastylis rathkei* (20) *Corophium volutator* (10)
	IMM 18	Sandy Mud	3.69	5	9,580	6.30	*Corophium volutator* (9,550) *Tubificoides benedii* (10) *Enchytraeidae* (10) *Limecola balthica* (10)
	IMM 19	Mud	4.23	8	300	0.57	*Streblospio shrubsolii* (110) *Nematoda* (50) *Nephtys hombergii* (50) *Tubificoides benedii* (30) *Tharyx* (20) *Limecola balthica* (20) *Diastylis rathkei* (10)
	IMM 20	Sand	4.22	9	5,130	4.91	*Corophium volutator* (4,950) *Streblospio shrubsolii* (70) *Nematoda* (30) *Nephtys* (30) *Limecola balthica* (20) *Diastylis rathkei* (10) *Austrominius modestus* (10) *Tubificoides benedii* (10)
Disposal site HU060	HU060 1	Sand	4.04	6	40	0.004	*Nematoda* (10) *Pygospio elegans* (10) *Arenicola* (10) *Bathyporeia elegans* (10)
	HU060 2	Sand	0.38	0	0	0.00	
	HU060 3	Slightly	0.92	6	60	0.01	*Scoloplos armiger* (20) *Eteone*

		Gravelly Muddy Sand					*longa* (10) *Tharyx* (10) *Corophium volutator* (10) *Tellinoidea* (10)
	HU060 4	Sand	1.69	16	1,880	3.37	*Amphibalanus improvisus* (1,800) *Nototropis guttatus* (20) *Jaera (Jaera) albifrons* (20) *Scoloplos armiger* (10) *Tubificoides benedii* (10) *Corophium volutator* (10) *Limecola balthica* (10)
	HU060 5	Sand	2.51	3	120	0.01	*Protodriloides chaetifer* (90) *Mytilus edulis* (20) *Tubificoides benedii* (10)
	HU060 6	Sand	3.04	16	4,030	0.56	*Nematoda* (2,170) *Pygospio elegans* (900) *Arenicola* (590) *Polydora cornuta* (80) *Ampharete cf. acutifrons* (80) *Austrominius modestus* (50) *Corophium volutator* (50)
Disposal site HU056	HU056 1	Sand	2.01	1	30	0.001	*Corophium volutator* (30)
	HU056 2	Slightly Gravelly Muddy Sand	2.84	2	0	0.001	*Corophium volutator* (P) *Electra monostachys* (P)
	HU056 3	Muddy Gravel	1.05	1	10	0.002	*Corophium volutator* (10)
	HU056 4	Gravelly Mud	1.01	0	0	0.00	
	HU056 5	Gravelly Sand	1.40	0	0	0.00	
	HU056 6	Muddy Gravel	1.03	2	20	0.12	*Gastrosaccus spinifer* (10) *Collembola* (10)

Lamprey species

1.3.27 The river lamprey *Lampetra fluviatilis* and the sea lamprey *Petromyzon marinus* are both anadromous species, spawning in freshwater but completing part of their lifecycle in estuaries or at sea. The sea lamprey adult growth phase is short and lasts around two years. In this time, the species is parasitic, feeding on a variety of marine and anadromous fishes, including shad and salmon as well as herring, cod, haddock and basking sharks. Unlike sea lamprey, the growth phase of river lamprey is primarily restricted to estuaries (Environment Agency, 2013).

1.3.28 River lamprey have been frequently recorded in the Humber Estuary, with the Ouse catchment believed to support one of the most important river lamprey populations in the UK. In the Humber basin, river lamprey mainly enter the rivers from the estuary in autumn and then spawn in April. Sea lamprey spawning is almost entirely restricted to the Ouse catchment, principally the Rivers Ouse, Swale, Ure and Wharfe (Environment Agency, 2013).

1.3.29 The spawning migration of sea lamprey usually takes place in April and May when the adults
start to migrate bac
lamprey takes place
and resting under ro
2013).

Seals

Regional

1.3.30 The most commonly occurring marine mammals recorded in the Humber Estuary region are seals with populations of both grey seal *Halichoerus grypus* and common (harbour) seal *Phoca vitulina* occurring. Further information about the abundance and distribution of these species is provided below followed by a description of cetacean (whale, dolphin and porpoise) species occurring in the region.

1.3.31 The intertidal area at Donna Nook is the main haul out site in the region and is an important breeding ground for grey seals. This colony is located over 25 km from the proposed development at the mouth of the Humber Estuary. In 2019, there were an estimated 67,789 grey seal pups born in Britain (SCOS, 2022) with approximately 3% of the pup production occurring at Donna Nook. Breeding occurs once a year between October and December and the vast majority of seals in this colony breed at Donna Nook, with a few seals breeding on Skidbrooke Ridge, south of Donna Nook. Peak grey seal pup numbers in winter 2021/22 and 2020/21 at Donna Nook consisted of 2,122 and 2,214 seals respectively with numbers having increased substantially in recent years from under 100 pups born annually in the 1980s (Figure A.3).

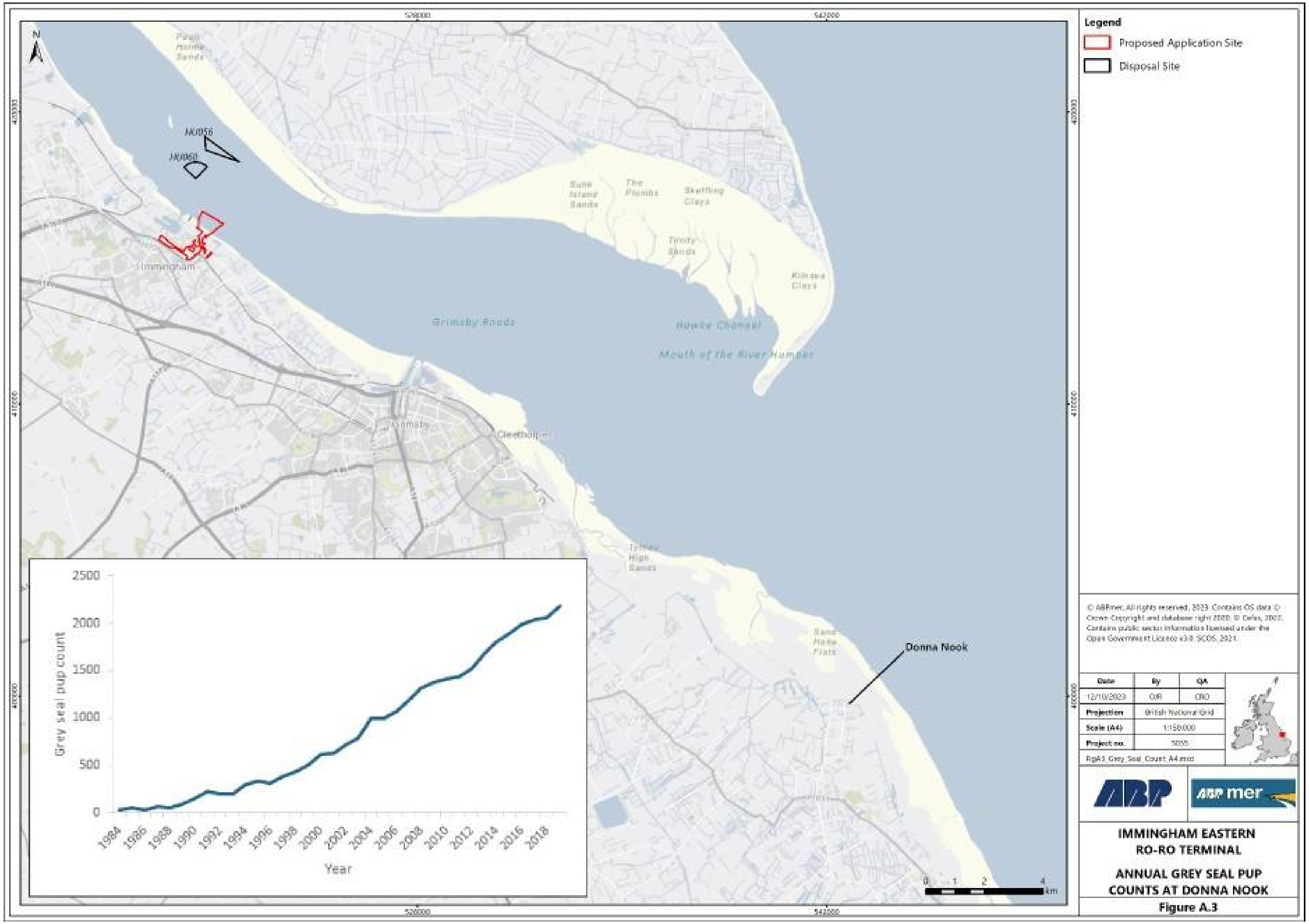

Figure A.3. Annual grey seal pup counts at Donna Nook

1.3.32 The intertidal mudflats also provide an important habitat throughout the year for grey seals to haul out or rest, particularly during the spring when all grey seals (except young born the previous year) are moulting. Aerial seal counts undertaken in August 2021 recorded 3,897 grey seals hauled out at Donna Nook. Totals numbers at this colony have increased from the low hundreds recorded in the late 1990s and early 2000s to counts over 4000-5,000 seals in more recent years (SCOS, 2022) (Figure A.4).

1.3.33 Grey seals can undertake wide ranging seasonal movements over several thousand kilometres (McConnell *et al*. 1999; Carter *et al*., 2020; Russel, 2016). However, while grey seals may range widely between haul out sites, tracking has shown that most foraging probably occurs within 100 km of a haul-out site (SCOS, 2017). Seals tagged at Donna Nook were recorded undertaking wide ranging movements in the outer Humber Estuary and approaches as well as more widely in the North Sea (Russel, 2016). This is reflected in high predicted at-sea densities of grey seals in the approaches to the Humber Estuary (Carter *et al.,* 2020).

1.3.34 The Humber Estuary region also supports a small population of common seal. As for the grey seal, Donna Nook is also the key haul out site for common seals. A total of 122 common seals were recorded as part of annual aerial monitoring in the region in August 2021. Since the 1990s numbers have generally fluctuated between 100 and 400 counts annually in the region (SCOS, 2022). Common seals typically forage within 40 to 50 km of haul out sites (SCOS, 2022).

Immingham area

1.3.35 Marine mammal survey data or sighting records for the Immingham area are limited. However, given that seals (particularly grey seals) are regularly recorded foraging in the Humber Estuary, this species would be expected to occur relatively frequently in this area. For example, approximately 10 to 15 grey seals were observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during the project specific benthic surveys as detailed in Appendix 9.1 of Chapter 9 of the ES ES – Application Document Reference number 8.2.9. This haul out site is located approximately 4 km north east from the proposed development and around 3 - 4 km from the dredge disposal sites (including transit routes). No seal haul out sites are known to occur nearer to the proposed development.

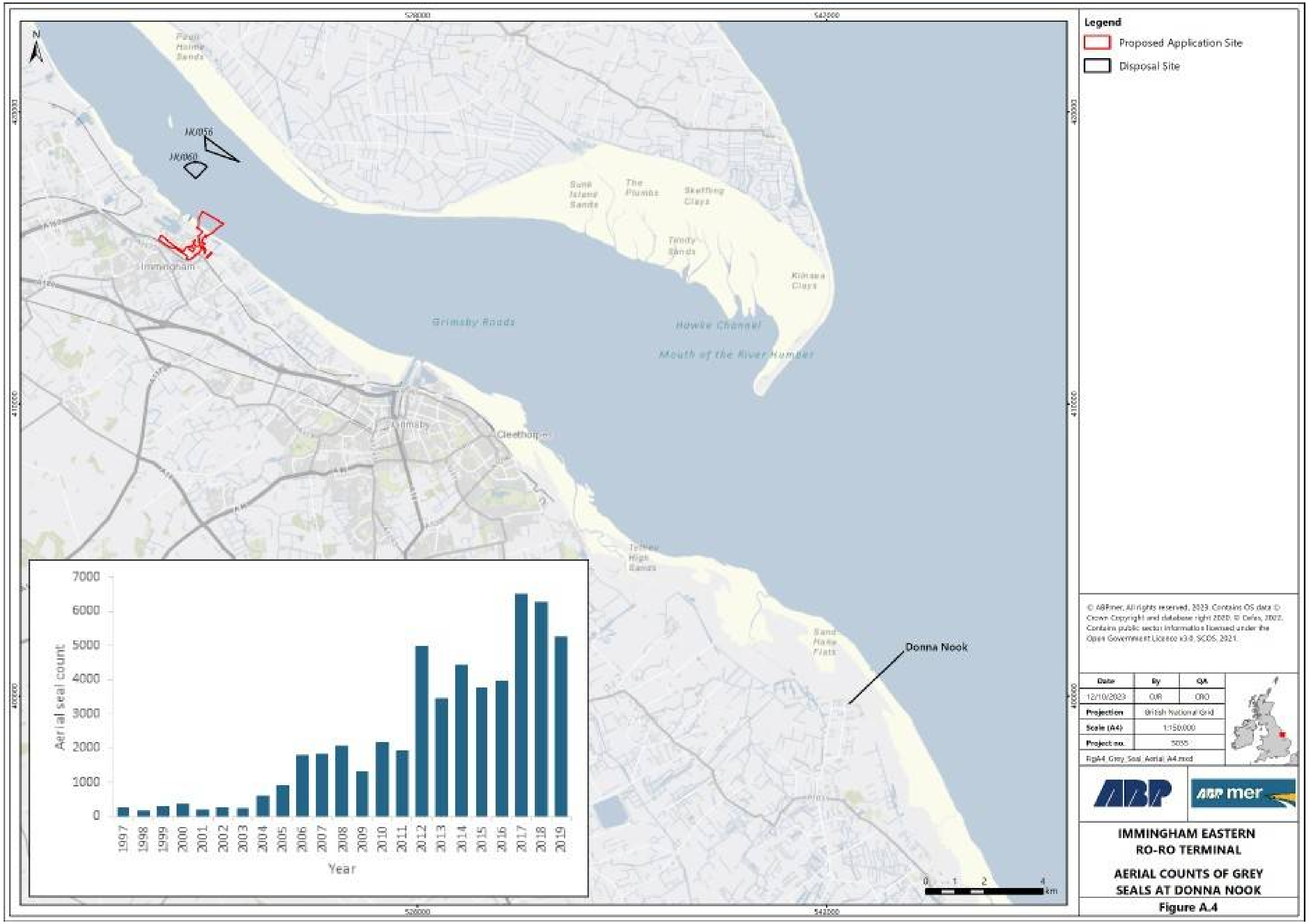

Figure A.4. Aerial counts of grey seals at Donna Nook

1.4 Coastal waterbird features

Data and information sources

1.4.1 Current baseline conditions have been determined by a desk-based review of available information (as well as the field surveys undertaken as set out below):

- IOH Ornithology Surveys: Pre and post consent monitoring of coastal waterbirds as part of the IOH development. These surveys which overlap with the proposed development area (Figure A.5) have been undertaken between October and March twice a month[1]. The surveys started in winter 1997/98 and have been ongoing annually since then. During each survey, either five counts (October and March) or four counts (November to February) are undertaken every two hours after high water. The most recent 5-years of data (2017/18 to 2021/22) has been analysed. In addition, the 2021/22 survey season started in August rather than October. The surveys have been continued on a monthly basis in 2022 rather than stopping in March as per previous years. On this basis, the results from surveys covering passage and summer months (August and September 2021 and April to September 2022) have also been presented;
- Wetland Bird Survey (WeBS) Core Counts Data: Core count data for data for 'Immingham Docks - Sector K' (ID 38905) which overlaps with the proposed development. These surveys are typically undertaken around high water. The most recent 5-years of data available from the British Trust for Ornithology (BTO) (2016/17 to 2020/21) has been analysed. In addition, estuary wide WeBS data for the Humber Estuary for 2015/16 to 2019/20 has also been reviewed to provide contextual information (Frost *et al*., 2021) [2];
- Natural England Designated Sites Portal: Background information on the ecology of SPA qualifying bird species in the Humber Estuary (Natural England, 2021b);
- Population Trends for Species in the Humber Estuary: Information on long-term trends in the population status of waterbirds in the Humber Estuary is available for the period up to 2016/2017 from the latest WeBS 'Alerts Report' (Woodward *et al*., 2019). This is an information source describing waterbird numbers on protected areas and has an 'alert system' where species that have undergone major declines in numbers are identified; and
- BTO Research Report Analysing WeBS data for the Humber Estuary: Population trends of waterbird species in different parts of the Humber Estuary for the period 2000/01 to 2016/17 (Woodward *et al.,* 2018).

- ~~[2] It should be noted that as a result of COVID-19 lockdowns, the BTO were unable to undertake comprehensive counts and therefore produce robust data for 2020/21 at an estuary-wide scale and therefore the period 2015/16 to 2019/20 is the most recent 5 years of data available from the BTO.~~

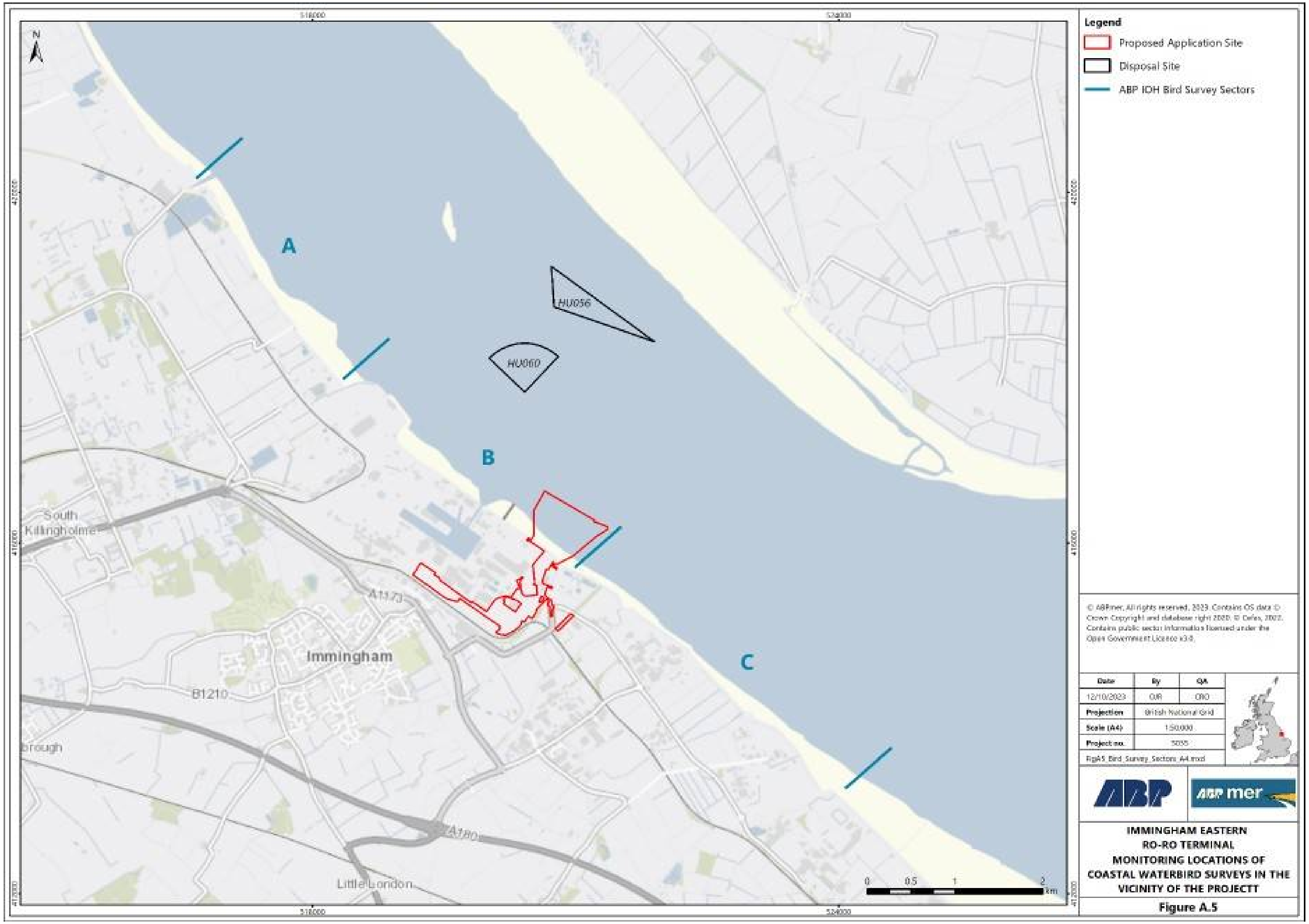

Figure A.5. Monitoring locations of coastal waterbird surveys in the vicinity of the Project

Humber Estuary overview

1.4.2 The Humber Estuary is a site of national and international importance for its waders and wildfowl (ducks and geese) populations, regularly supporting over 130,000 waterbirds during winter and passage periods (Frost *et al.*, 2021; Woodward *et al.,* 2018).

1.4.3 Waterbird numbers are highly variable in the Humber Estuary throughout the year, but it is considered to be an important site year-round due to the presence of different populations of wintering, passage and breeding birds which move into and out of the estuary. In general, numbers of coastal waterbirds are at their lowest during June, when the assemblage is dominated by wildfowl, before numbers start increasing during July due to the return of waders such as Dunlin. Golden Plover start to become more abundant in late summer. The arrival of wintering waterfowl such as Pink-footed Geese and Wigeon as well as wader species such as Knot typically occurs in early autumn. Numbers start to fall in late winter with the departure of species such as Golden Plover and Knot, before increasing slightly in spring as passage flocks start to move through the area and wildfowl depart (Natural England, 2021b).

1.4.4 Table A.7 provides summary ecology information on key waterbird species occurring in the Humber Estuary in intertidal and marine habitats. This includes the 5-year estuary-wide mean peaks for these species for 2015/16 to 2019/20 (the most recent 5-years of data available from the BTO) (Frost *et al.,* 2021)[3].

Table A.7. Summary information for key species of coastal waterbird in the Humber Estuary

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]
Wader	Golden Plover	Roosts but rarely feeds in the intertidal	Mainly insects, especially beetles, as well as other invertebrates and some plant material.	Golden Plover mainly uses the estuary to roost in areas including Alkborough Flats, Whitton Sands, Blacktoft Sands, Read's Island in the Inner Humber Estuary and Salt End, Stone Creek, Paull Holme Stray, Cherry Cobb Sands and Pyewipe in the Middle Humber.	Oct-Dec	31,237
	Knot	Intertidal benthivore	Mainly molluscs, including the bivalve *Limecola balthica*, cockles *Cerastoderma edulis* and mud snail *Peringia ulvae*, the latter especially in early winter. Diet proportions of 75% bivalves, 1% worms and 24% 'other'. Prey is eaten whole and crushed within the	Knot is found in the outer Humber including Cherry Cobb Sands and the Lincolnshire coast south of Grimsby. Easington Lagoons provide an important roost site for Knot during high spring tides.	Jan, Mar, Nov-Dec	22,500

			gizzard.			
Species group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]**
	Lapwing	Roosts but rarely feeds in the intertidal	Wide range of invertebrates including beetles and earthworms.	Lapwing mainly uses the estuary to roost in areas including Alkborough Flats, Whitton Sands, Blacktoft Sands and Read's Island in the Inner Humber Estuary as well as Salt End, Stone Creek, Paull Holme Stray, Cherry Cobb Sands and Pyewipe (all Middle Humber Estuary). The majority of feeding occurring inland, though some feeding on intertidal areas takes place during July to September.	Jan-Feb, Dec	16,453
	Dunlin	Intertidal benthivore	Oligochaetes, polychaete worms (such as *Hediste diversicolor, Nephtys* spp., *Pygospio elegans* and *Scoloplos armiger*), bivalves (such as *Limecola balthica*) and the mud snail *Peringia ulvae*.	Widespread with important areas including Read's Island (Inner Humber Estuary), Cherry Cobb Sands, Pyewipe, Stone Creek and Salt End (all Middle Humber Estuary) and Saltfleet (Outer Humber Estuary).	Aug, Nov-Dec	15,954

			Diet proportions of			
Species group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]**
			70% worms, 14% bivalves and 16% 'other'.			
	Oyster-catcher		Predominantly bivalves especially large cockles *Cerastoderma edule*, mussels *Mytilus edulis* and tellins *Limecola* spp. Diet might also include polychaete worms on mudflats and earthworms from wet fields.	Found predominantly in the Outer Humber Estuary. The most important areas for Oystercatcher are along the Lincolnshire coast.	Feb, Sep-Dec	5,816
	Black-tailed Godwit		Invertebrates, including beetles, polychaete worms (such as *Hediste diversicolor, Nephtys, Pygospio elegans* and *Scoloplos armiger*), molluscs (such as *Limecola balthica)* crustaceans and some plant material.	Key areas include Pyewipe and North Killingholme Haven Pits for this species during winter.	Aug-Oct	4,545
						WeBS Core

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]
	Grey Plover		Polychaete worms (such as *Hediste diversicolor* and *Arenicola marina*), bivalves (such as *Limecola balthica*) and the muds snail *Peringia ulvae.*	Widespread usage across the Middle and Outer parts of the Humber Estuary. Typically, more usage of the north bank compared to the south bank. Particular key areas include Cherry Cob Sands, and Welwick.	Jan, Mar, May, Sep	3,179
	Redshank		Polychaete worms (such as *Hediste diversicolor, Nephtys spp., Pygospio elegans and Scoloplos armiger*), the bivalve *Limecola balthica,* crustaceans (such as brown shrimp *Crangon crangon and* mud shrimp *Corophium* spp.*) and* the mud snail *Peringia ulvae*. Will also consume terrestrial invertebrates, including insects and spiders. Diet proportions of	Widespread with key areas including Cherry Cobb Sands and in the outer Humber Estuary.	Sep-Oct, Dec	2,881

Specie s group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wid e mean peaks (2015/16 to 2019/20) [5]
			46% worms, 7% bivalves and 47% 'other'.			
	Curlew		Primarily bivalves (such as *Cerastoderma edule* and *Limecola balthica)*, the ragworm *Hediste diversicolor* and lugworm *Arenicola marina).* Earthworms on terrestrial habitats, Diet proportions during winter of 46% bivalves, 35% worms and 19% 'other'.	Important areas include Cherry Cobb sands and Patrington to Easington (Outer North), Read's Island (Inner Humber), Pyewipe, Salt End (both Middle Humber) and Theddlethorpe St. Helen (Outer South).	Jan, Jul, Sep	2,787
	Avocet		Benthic crustaceans e.g., *Corophium* spp. and worms such as ragworm *H. diversicolor*. Insects, especially Chironomidae larvae, in freshwater habitats.	Largest wintering flocks are present in the inner Humber around Far Ings/Read's Islands, close to the favoured locations for breeding.	Aug-Oct	2,479
		Feeding			Month	WeBS Core Count 5-year

Specie s group	Species	behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	of peak count [4]	estuary-wid e mean peaks (2015/16 to 2019/20) [5]
	Bar-tailed Godwit		Polychaete worms are the principal food source during winter such as *Hediste diversicolor, Nephtys, Pygospio elegans and Scoloplos armiger*. Diet proportions comprise 94% worms. Other species sometimes consumed include the shrimp *Crangon crangon* and bivalve *Limecola balthica.*	The most important sectors for Bar-tailed Godwit are the three sectors that make up the Outer (North) area, and the adjacent Cherry Cobb Sands (Middle Humber), and Paull Holme Strays (also Middle Humber).	Feb, Sep, Nov	1,561
	Ringed Plover		In winter, mainly marine worms, crustaceans (such as *Corophium* spp.) and molluscs (such as *Peringia ulvae*).	Most commonly recorded in the Outer Estuary.	Aug-Sep	731
	Sanderling		Polychaete worms (such as *Hediste diversicolor*), crustaceans and insects. Diet	Within the Humber Estuary, Sanderling are found exclusively in the outer estuary, particularly on the	May, Jul-Aug, Dec	579
Specie	**Species**	**Feeding behaviour in**	**Diet [2]**	**Distribution in the Humber**	**Month of peak**	**WeBS Core Count 5-year estuary-wid**

s group		the marine environment [1]		Estuary [3]	count [4]	e mean peaks (2015/16 to 2019/20) [5]
			proportions comprise 60% worms, 1% molluscs and 39% ‘other’.	sandflats of the Lincolnshire coast.		
	Turnstone		A wide range of invertebrates and other food sources. This includes polychaete worms and mudshrimp *Corophium* spp. on mudflats. Also feeds on rocky shore species, including mussels, amphipods, molluscs (such as periwinkles) and crabs. Diet proportions comprise 20% bivalves, 5% worms and 75% ‘other’.	Key areas for Turnstone include rocks around New Holland between Barton upon Humber and East Halton (Middle Humber) and between Grimsby and Cleethorpes (Outer South). Also feed on jetties and around the harbours.	Feb, Sep, Nov-Dec	239
	Whimbrel		On passage the species consumes shrimps, molluscs, worm and crabs.	No obvious preferred areas, found throughout the Humber during migration periods.	Jul-Aug	110
Species group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to**

						2019/20) [5]
	Ruff	Intertidal benthivore on mudflats but omnivores more generally	Omnivore feeding on insects, larvae, frogs, small fish and seeds.	The Humber Estuary is considered an important site for passage Ruff. The most important areas of the Humber for the ruff are the intertidal mud and sand flats and adjacent lagoons of Alkborough Flats and Blacktoft Sands with smaller numbers also observed wintering along the River Trent, at North Killingholme and at Tetney). During autumn, Paull Holme Strays, Sunk Island, Read's Island, New Holland and Whitgift Sand on the River Ouse are also important areas.	Aug-Oct	80
Water - fowl	Pink-footed Goose	Herbivorous waterfowl	Herbivorous. Outside the breeding season this species feeds on improved grasslands, cereal stubbles and vegetables (e.g., potatoes, sugar beet, carrots).	Recorded mainly on Read's Island, which it uses as a roosting site, flying inland during the day to feed in fields.	Oct-Nov	14,345
Specie s group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wid e mean peaks (2015/16 to 2019/20) [5]**

	Shelduck	Intertidal benthivore	Invertebrates, with small molluscs predominant in north and west Europe, especially mud snail *Peringia* spp. Other species consumed include the mud shrimp *Corophium volutator*, bivalves and polychaetes.	Shelduck are found throughout the estuary with key areas including Read's Island and Alkborough Flats (Inner Humber) and at Pyewipe, Salt End, Cherry Cobb Sands and Paull Holme Sands (Middle Humber).	Jul-Aug, Oct-Nov	4,515
	Teal	Omnivorous waterfowl	Seeds of saltmarsh and other wetland plants, including glasswort Salicornia spp. and oraches *Atriplex* spp., and invertebrates (especially small oligochaetes) sifted from the benthos.	Key areas include Alkborough Flats, Read's Island and Blacktoft Sands.	Sep-Nov	3,757
	Dark-bellied Brent Goose	Herbivorous waterfowl	Mainly grasses, and on arable land the shoots of winter cereals, and oilseed rape. On estuaries, eelgrass	The North Lincolnshire coast between Tetney and Donna Nook is a key area. Spurn is also important during spring passage.	Jan, Nov-Dec	3,092
Species group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]**

			Zostera spp. and saltmarsh plants.			
	Wigeon		Plants (leaves, stems, stolons, bulbils and rhizomes).	Alkborough Flats and Read's Island as well as Faxfleet to Brough Haven (also Inner Humber) are key areas.	Jan-Feb, Sep, Nov	2,672
	Greylag Goose		Grass, roots, cereal leaves and spilled grain.	Present within the Inner Humber to a greater extent (e.g., Faxfleet). Present in greatest numbers close to freshwater pools.	Aug-Sep, Nov	1,595
	Mallard	Omnivorous waterfowl	Omnivorous, including both plants and animal matter.	Occurs throughout Humber Estuary, with key areas including the River Ouse and Cherry Cobb Sands. The area around the outfall at New Holland is also a favoured area where the birds feed on grain spill from the dock.	Jan-Feb, Sep, Nov-Dec	1,046
	Barnacle Goose	Herbivorous waterfowl	The leaves and stems of grasses, roots and seeds.	Present on fields/arable land around the entire Humber Estuary in low densities.	Jan-Mar, Sep	878
	Common Scoter	Benthivorous diving duck	Molluscs.	Present within the Outer Humber due to their more pelagic lifestyle. Occurs in passage and winter.	Mar, Oct-Dec	682
Species group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]**

	Canada Goose	Herbivorous waterfowl	Roots, grass, leaves and seeds.	Occurs within the Inner Humber in the largest numbers. Present in greatest numbers close to freshwater pools.	Jun, Sep	641
	Goldeneye	Benthivorous diving duck	Mostly aquatic insects, molluscs and crustaceans. Occasional fish. Plant material generally less than 25%.	Goxhill to New Holland and Barrow to Barton (including Barton Pits) are key areas.	Jan, Dec	329
Gull	Black-headed Gull	Omnivorous/ scavenging gull	Worms, insects, small fish, crustacea and carrion.	Widely distributed.	Aug-Sep	11,217
	Common Gull		Worms, insects, fish and carrion.	Widely distributed.	Aug-Oct, Dec	1,599
	Herring Gull		Carrion, offal, seeds, fruits, young birds, eggs, crustaceans, small mammals, insects and fish.	Widely distributed.	Jan, Apr, Sep, Dec	1,015
	Great Black-backed Gull		Shellfish, birds and carrion.	Widely distributed.	Sep-Dec, Feb	292
Terns, and other	Sandwich Tern	Piscivorous plunge diver	Fish such as sandeels, sprats and whiting.	Widely distributed.	Jul-Aug	686
Species group	**Species**	**Feeding behaviour in the marine environment [1]**	**Diet [2]**	**Distribution in the Humber Estuary [3]**	**Month of peak count [4]**	**WeBS Core Count 5-year estuary-wide mean peaks (2015/16 to 2019/20) [5]**
diving	Commo		Fish and crustaceans	Widely distributed.	Aug-Sep	476

birds	n Tern		in some areas.			
	Cormorant	Piscivorous pursuit diver	Feeds on fish such as flatfish, blennies gadoids, sandeel, salmonid and eels.	Widely distributed.	Jan-Feb, Sep, Nov	323
	Red-throated Diver	Piscivorous pursuit diver	Diet consists predominantly of fish (mainly clupeids, mackerels, flatfish, gadoids and sand eels).	Recorded mainly in the outer Humber Estuary and approaches.	Jan-March	39
1. Feeding behaviour based on Mander *et al.* (2021) and Camphuysen *et al*. (1999):						
Intertidal benthivore: Waterbird species feeding on infaunal and/or epibenthic invertebrates in intertidal habitats; Herbivorous waterfowl: Geese, swans and ducks feeding on plant material; Omnivorous waterfowl: Ducks feeding on a range of animal and plant food; Benthivorous diving duck: Diving ducks/seaducks feeding on epibenthic and infaunal invertebrates on the seabed; Omnivorous/scavenging gull: Gulls feeding on a range of animal and plant food including through scavenging; Piscivorous plunge diver: Seabirds foraging for fish through plunge diving; and Piscivorous pursuit diver: Seabirds foraging for fish through pursuit diving. 2. Based on Stillman *et al*. (2005); Woodward *et al*. (2014) and RSPB (2021). 3. Based on Woodward *et al.* (2014) and Natural England Designated Sites Viewer (https://designatedsites.naturalengland.org.uk/) 4. Months when peaks count occurred in the 2015/16 to 2019/20 estuary-wide BTO Core Counts (Frost *et al.,* 2021). 5.Data from Frost *et al.* (2021).						

1.4.5 The most abundant wading bird species recorded in the Humber Estuary are Golden Plover and Knot (5-year mean peak for 2015/16 to 2019/20 of 31,237 and 22,500 birds respectively). Other wading birds occurring in large numbers include Lapwing (5-year mean peak of 16,453 birds) and Dunlin (5- year mean peak of 15,954 birds) as well as Oystercatcher, Black-tailed Godwit, Grey Plover, Curlew, Avocet and Bar-tailed Godwit (Frost *et al.,* 2021). Important areas for feeding and roosting waders include the Pyewipe frontage on the south bank and Paull Holme, Cherry Cobb, Foulholme, Spurn and Sunk Island Sands on the north bank of the Humber Estuary. In the inner section of the Humber Estuary, sites such as Blacktoft Sands, Alkborough and Read's Island Flats are considered important (Natural England, 2021b). The numbers of different waders in the Humber Estuary can show a high degree of interannual variation with some species (such as Black-tailed Godwit, Avocet, Oystercatcher) showing an overall long-term increase in estuary wide numbers with other species such as Dunlin, Redshank and Knot showing an overall decline (Woodward *et al*., 2018; Woodward *et al*., 2019).

1.4.6 Key prey items for waders on the Humber Estuary include annelid worms (such as ragworm *Hediste diversicolor*, lugworm *Arenicola marina*, *Pygospio elegans, Streblospio shrubsolii, Tubificoides* spp., and *Nephtys* spp), the bivalves *Cerastoderma edule* and *Limecola balthica*, the mudsnail *Peringia* spp. and mud shrimp *Corophium* spp. (Stillman *et al*., 2005; Woodward *et al*., 2014).

1.4.7 The most abundant wildfowl bird species recorded in the Humber Estuary are Pink-footed Goose and Shelduck (5-year mean peak of 14,345 and 4,515 birds respectively). The number of Shelduck in the Humber Estuary has remained relatively stable with Pink-footed Goose showing a long-term increase (Woodward *et al*., 2018; Woodward *et al*., 2019). Other commonly occurring wildfowl include Teal, Dark-bellied Brent Geese, Wigeon, Greylag Goose and Mallard (Frost *et al.,* 2021). Pink-footed Goose are recorded in large numbers at Read's Island with Dark-bellied Brent Geese and Wigeon, principally occur in areas along the southern shore from Cleethorpes to Saltfleetby (Natural England, 2021b).

1.4.8 Black-headed Gull (5-year mean peak of 11,217 birds) as well as Herring Gull and Common Gull (occurring in lower numbers) are widespread in the Humber Estuary.

1.4.9 The Humber Estuary also supports several heron species including Grey Heron, Little Egret and Great Bittern. Grey Heron and Little Egret are recorded in a wide variety of intertidal and coastal habitats with Great Bittern recorded within reedbed habitats such as around Blacktoft Sands, Far Ings, Barton and North Killingholme Haven clay pits (Natural England, 2021b).

1.4.10 Diving birds occurring in the Humber Estuary include Common Scoter and Goldeneye (5-year mean peak of 682 and 329 birds respectively) with Cormorants and Tufted Duck also occurring in relatively large numbers.

1.4.11 Little Tern breed at Easington Lagoon, which is located approximately 20 km from the proposed development (Natural England, 2021b), with data suggesting this species forages within 5 km of nesting sites (Woodward *et al*., 2019). Sandwich Tern (5-year mean peak of 686 birds) and Common Tern (5-year mean peak of 476 birds) are also regularly recorded, particularly in passage periods in the Humber Estuary.

Immingham area

1.4.12 Pre and post consent monitoring of coastal waterbird surveys as part of the IOH development have been undertaken annually since winter 1997/98. The foreshore in the area of the proposed development overlaps with part of 'Sector B' (between Marsh Lane (Immingham) Western Jetty to the IOT Jetty (as shown in Figure A.5). The most recent 5-years of data (2017/18 to 2021/22) has been analysed for this sector (Table A.8). During this period, surveys were undertaken between October and March twice a month[4]. During each survey, either five counts (October and March) or four counts (November to February) were undertaken every two hours after high water. In addition, the 2021/22 survey season started early in August rather than October. The surveys have been continued on a monthly basis in 2022 rather than stopping in March as per previous years. On this basis, the results from passage and summer months (August and September 2021 and April to September 2022) have been presented separately (Table A.9). Annex A.1 presents monthly peak counts for the period October 2021 to September 2022 in Sector B. In order to provide contextual information on bird numbers in the wider area, Annex A.2 provides a summary of bird data for Sector A and C (the location of these sectors are shown in Figure A.5).

1.4.13 To summarise the findings from the survey work, the annual peak count (maximum count from each winter period between October and March) for birds feeding, roosting as well as the combined total[5] is presented in Table A.8. The 5-year average of the annual peak counts for each species (referred to as the mean peak-MP) [6] is also presented in Table A.8. This table also compares the 5-year mean peak against the thresholds and values outlined below, to provide objective criteria to help determine the value of the area in an international (bullet one), national (bullet two) and regional context (bullet three):

- **Internationally Important Threshold Level**: The threshold for an

[6] It is standard practice to present the average of the annual peaks for a certain duration of time (sometimes referred to as the mean of peaks). This is calculated as the average of the maximum annual counts and for the most recent 5-years of available data if possible. Mean peaks (using five years of winter values) is the approach presented in the WeBS annual reports. For most migratory species, the WeBS 5-year mean of peak is also the value that is used when identifying qualifying features for each SPA. Using mean of peaks is also useful for characterising the relative importance of sectors within a site, as it gives a good indication of how many individuals of a given species a sector typically supports (Austin and Ross-Smith, 2014).

individual species (or subspecies) is set at 1% of the biogeographic population[7];

- **Nationally Important Threshold Level:** The threshold for an individual species (or subspecies) is set at 1% of the British population i.e. if a site supports more than 1% of the British population it is considered Nationally Important (for that species or subspecies);
- **Latest Humber Estuary WeBS Core Counts 5-year average:** The 5-year mean peak from the latest Humber Estuary WeBS Core Counts. Core Count surveys are typically undertaken around high water. Within this assessment, this is from 2015/16 to 2019/20 (Frost *et al.,* 2021). It should be noted that as a result of COVID-19 lockdowns, the BTO were unable to undertake comprehensive counts and therefore produce robust data for 2020/21 at an estuary-wide scale and therefore the period 2015/16 to 2019/20 is the most recent 5 years of data available from the BTO. For the purposes of this assessment, numbers representing more than 10% of the estuary-wide Core Counts for an individual species are considered regionally important and numbers representing between 1% and 10% are considered locally important [8].

1.4.14 The 5-year mean peak number of birds in Sector B during different months is presented Figure A.6 to show any seasonal trends over the winter period. The distribution of birds within Sector B based on distribution data collected in the surveys is shown in Figure A.7.

1.4.15 During the surveys, over 20 waterbird species have been recorded on the foreshore within Sector B with approximately 15 species considered regularly occurring.

1.4.16 The most abundant wading bird species recorded foraging within Sector B over this period were Black-tailed Godwit and Dunlin (5-year mean peaks of 574 and 369 birds respectively). In the winter of 2017/18 and 2019/20 Black- tailed Godwit were recorded in nationally important numbers (419 and 563 birds respectively), with internationally important numbers occurring in winter 2021/22 (1,300 birds) (Table A.8). Other wading birds recorded included Redshank, Turnstone, Oystercatcher and Curlew. Shelduck were the most abundant wildfowl species recorded foraging (5-year mean peak of 69 birds). Lower numbers of other ducks such as Teal and Mallard were also recorded.

- [7]The thresholds levels are available at: https://www.bto.org/volunteer-surveys/webs/data/species-threshold-levels. It should be noted that, where 1 % of the population is less than 50 birds, 50 is normally used as a minimum qualifying threshold for the designation of sites of national or international importance (accessed 04/04/22).

- [8]The 1% local threshold has been requested to be used in the baseline data analysis by Natural England as part of previous developments on the Humber Estuary.

Table A.8. Coastal waterbird species recorded within Sector B during the last five winters

Species	Peak count per winter (feeding)						Peak count per winter (roosting)						Peak count per winter (combined – non-behavioural)					
	17/18	18/19	19/20	20/21	21/22	MP	17/18	18/19	19/20	20/21	21/22	MP	17/18	18/19	19/20	20/21	21/22	MP
Bar-tailed Godwit	29	2	22	10	8	14	2		12	12	1	5	29	2	22	12	8	15
Black-tailed Godwit	419	286	563	303	1300	574	12	6	222	3	38	56	419	286	563	303	1300	574
Cormorant		4	3	2	2	2	19	14	6	14	14	13	19	14	7	14	14	13
Curlew†	12	12	12	11	12	12	4	6	7	8	7	6	12	12	12	11	12	12
Dunlin	417	270	115	638	406	369	330	120	2	300	494	249	417	270	115	638	494	387
Golden Plover										1		<1				1		<1
Greenshank†			1			<1									1			<1
Grey Heron			1	1		<1	1			1		<1	1		1	1		1
Grey plover†	1	1		1	1	1		1		1		<1	1	1		1	1	1
Knot	3		23	14		8			4	10		3	3		23	14		8
Lapwing†	3					1	3		1			1	3		1			<1
Little Egret									1			<1			1			<1
Mallard†	2	4	8			3		6	2		7	3	2	8	8		7	5
Mute swan								1				<1		1				<1
Oystercatcher†	5	8	10	8	12	9	3	5	6	4	4	4	6	8	10	9	12	9
Redshank	184	204	166	125	142	164	130	110	121	110	153	125	184	204	184	125	160	171
Ringed Plover†	7	12	1	7		5							7	12	1	7		5
Shelduck	84	69	56	70	67	69	69	74	39	45	46	55	84	74	58	86	72	76
Spotted Redshank	1					<1							1					<1
Teal†		11	21	9	21	12	2	1	9	3	27	8	2	11	21	9	27	14
Turnstone†	22	35	33	29	28	29	5	15	5	6	2	7	22	35	33	29	28	29

SPA qualifying species highlighted in **bold.** † Species with this symbol are included within the SPA waterfowl assemblage.

Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year MP.

Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year MP.

Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance (> 10% of the estuary wide WeBS 5-year MP – 455 birds) is higher than the national importance threshold (390 birds). The national importance threshold for Spotted Redshank is set as 1.

Cells highlighted red indicate the count is of international importance.

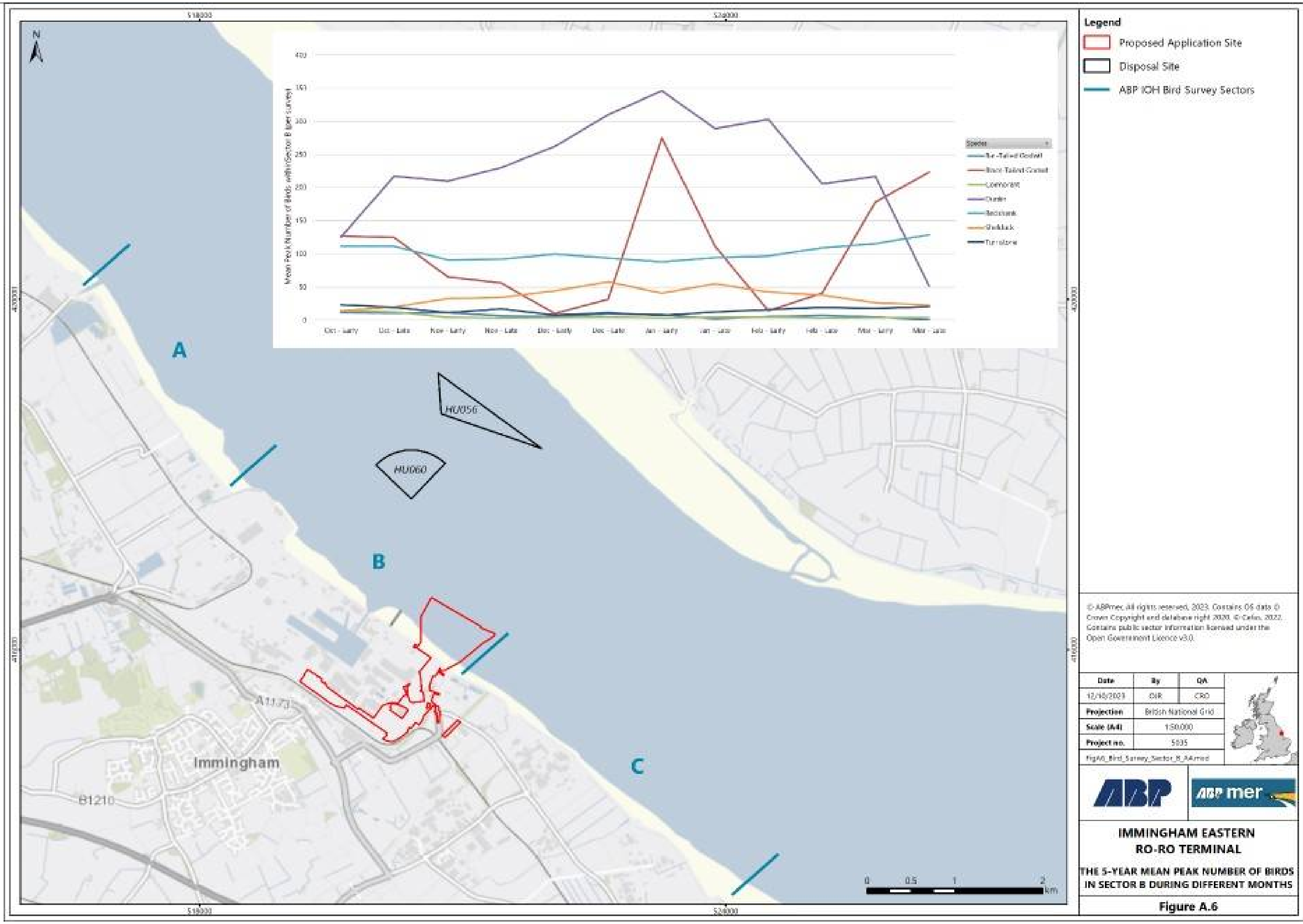

Figure A.6. The 5-year mean peak number of birds in Sector B during different winter months

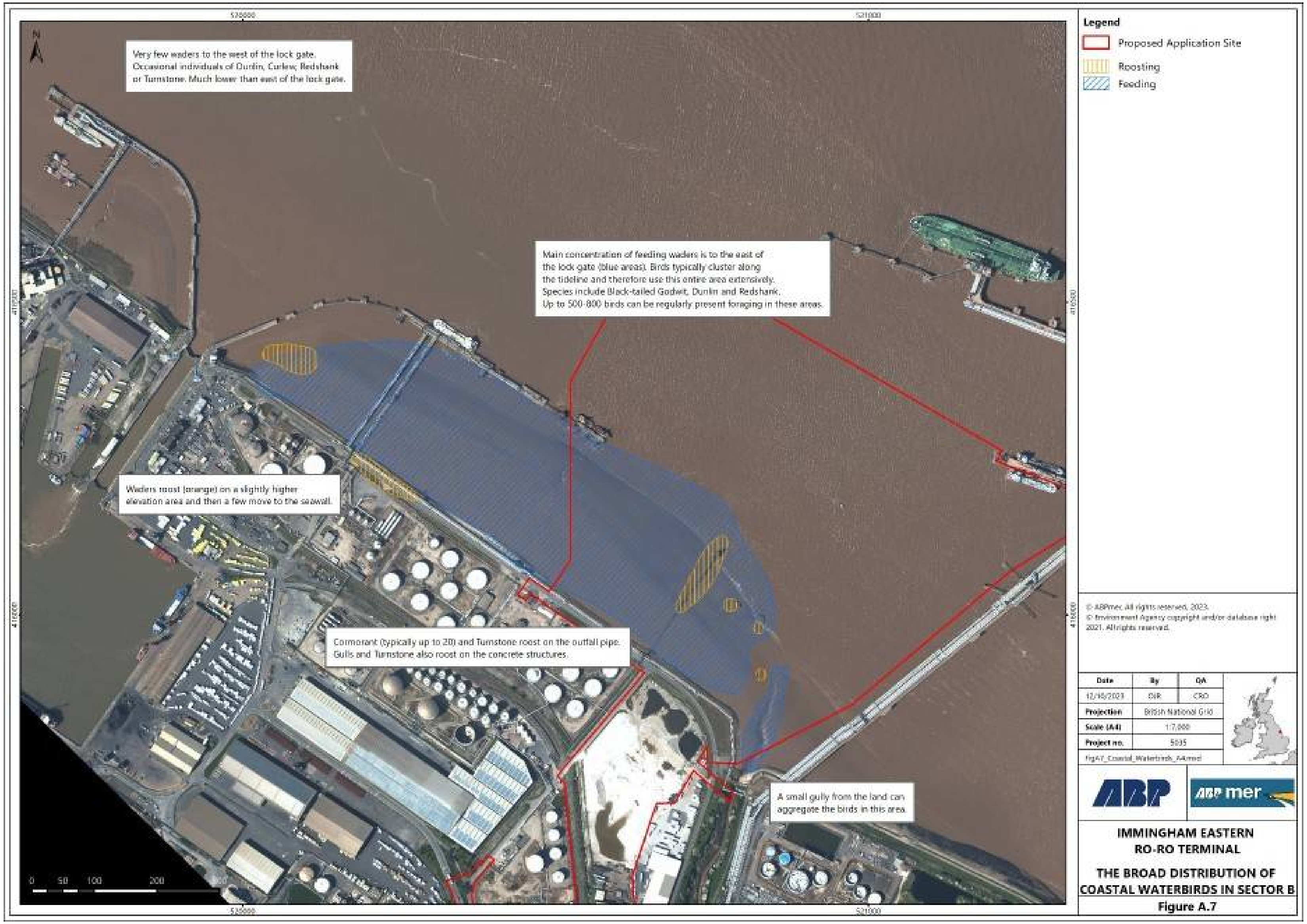

Figure A.7. The broad distribution of coastal waterbirds in Sector B

1.4.17 With respect to roosting birds, Dunlin and Redshank were the most numerous species recorded (5-year mean peaks of 249 and 125 birds respectively). Other species regularly recorded roosting included Shelduck (5-year mean peak of 55 birds) as well as Black-tailed Godwit, Curlew and Turnstone.

1.4.18 As shown in Figure A.6, during the surveys, the largest numbers of wintering Dunlin were generally recorded from December to February. Wintering Black-tailed Godwit numbers were typically highest in October and March but have been recorded in peak numbers in other months in some years.
The numbers of other wintering species were highly variable with no clear pattern.

1.4.19 The data collected during passage and summer periods (August to September 2021 and April to September 2022) recorded a range of species some of which were recorded in relatively large numbers (Table A.9). For example, peak counts of 143 Redshank were recorded in September 2022 (and also August 2022 and September 2021), respectively (which is approaching the winter 5-year mean peak of 171 birds). A peak of 34 Turnstone and 535 Black-tailed Godwit was recorded during September 2022 and April 2022, respectively. These passage peaks are broadly the same number of birds as the winter 5-year mean peak for both species). Other species such as Dunlin were recorded in lower numbers during this period (peak of 108 birds, compared to a 5-year mean peak of 387 birds during winter). Ringed Plover typically have a late spring migration period through the Humber, with the peak count of 72 birds occurring in May. Very few Ringed Plover have been recorded during winter periods within Sector B (5-year mean peak of seven birds).

1.4.20 All of the species observed in Sector B are frequently recorded in large numbers during both passage and winter periods in the Humber Estuary more widely with the estuary-wide peak abundances of passage birds typically showing a high degree of both monthly and annual variability. This would be expected given the more transient nature of passage birds with numbers fluctuating on a daily basis as birds arrive and depart from sites in the Humber Estuary (Woodward *et al.,* 2018).

1.4.21 The highest densities of feeding and roosting birds in the sector typically occur on the intertidal mudflats in the eastern section of the foreshore fronting Immingham Docks (between the Inner Dock entrance and the IOT Jetty). Most foraging waterbirds typically cluster along the tideline and use the entire area extensively for feeding. Unlike other waders recorded in this area which rely on mudflat habitat for feeding, Turnstones will also feed around higher elevation (upper shore) hard substrate habitats in the area (including supporting beams on jetty structures) and the bottom of the seawall (Figure A.7).

1.4.22 Waterbirds will use the foreshore in Sector B for a variety of reasons – for example the extent of available mudflat and feeding resources on the mudflat in the area.

1.4.23 Much lower numbers of waterbirds have been recorded west of the lock gate with flocks of Turnstone (which often show a preference for the sea defence/mud interface in this area) and occasional individuals of Dunlin, Curlew and Redshank recorded. It should also be noted that the foreshore to the east of the IOT jetty within approximately 300 m of the proposed development is used by very low numbers of birds based on data collected as part of the IOH ornithological monitoring of Sector C (which overlaps with this area). Observations from these surveys have recorded typically less than a total of 10 birds with individuals or small flocks of mainly Redshank, Curlew and Oystercatcher occurring.

1.4.24 Waders tend to loaf on a slightly higher elevation area of mudflat before this becomes inundated at high water with low numbers moving to the seawall to roost and others dispersing to other areas. Waterbirds also cluster on the seawall during the ebbing tide waiting for mudflat habitat to be exposed. An outfall pipe is also used by roosting Cormorants and gulls. In addition, Turnstone and gulls use derelict concrete structures present on the mudflat (Figure A.7).

1.4.25 The assemblage recorded in the surveys is broadly similar to that recorded during the WeBS Core Counts for the period 2016/17 to 2020/21 (the most recent 5-years of data available from the BTO for the ‘Immingham Docks Sector K’). The most commonly recorded species were Dunlin (mean peak of 165 birds), Redshank (mean peak of 83 birds), Black-tailed Godwit (mean peak of 47 birds) Shelduck (mean peak of 35 birds), Turnstone (mean peak of 44) and Curlew (mean peak of 11 birds). It is worth noting that this WeBS sector covers a much larger area than Sector B and so it is not directly comparable in terms of spatial extent [9]. Core counts are also only typically undertaken around high water periods and so do not provide information through the tide or during low water periods.

1.4.26 The highest densities of feeding and roosting birds in Sector B typically occur on the intertidal mudflats in the eastern section of the foreshore fronting Immingham Docks (between the Inner Dock entrance and the IOT Jetty). Most foraging waterbirds typically cluster along the tideline and use the entire area extensively for feeding. Unlike other waders recorded in this area which rely on mudflat habitat for feeding, Turnstones will also feed around higher elevation (upper shore) hard substrate habitats in the area (including supporting beams on jetty structures) and the bottom of the seawall.

1.4.27 Waders tend to loaf on a slightly higher elevation area of mudflat before this becomes inundated at high water with low numbers moving to the seawall and others dispersing to other areas. An outfall pipe is also used by roosting Cormorants and gulls. In addition, Turnstone and gulls use derelict

[9] The sector includes foreshore adjacent to the Port of Immingham and also extents east of the IOT terminal jetty (https://app.bto.org/websonline/sites/data/sites-data.jsp#lon=-0.1652575&lat=53.6215984&zoom=14&type=BING).

concrete structures present on the mudflat (Figure A.7).

Table A.9. Coastal waterbird species recorded within Sector B during August to September 2021 and April to September 2022

Species	Peak count per passage month (feeding)								Peak count per passage month (roosting)								Peak count per passage (combined – non-behavioural)							
	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22
Arctic Tern										1								1						
Bar-tailed Godwit		4					2	16								5		4					2	16
Black Headed Gull			30	18	107	171	224	210			2	5	29	34	168	65			30	18	107	171	224	210
Black-tailed Godwit	91	23	535	264	102	44	22	109	63		2	24	29	20	6	7	91	23	535	264	102	44	22	109
Common Gull				1	13	7	1	5			18		4		8	30			18	1	13	7	8	30
Common Sandpiper	4	2				3	1	5								4	4	2				3	1	5
Common Tern										30								30						
Cormorant	11	1	1					1	10	13	9	0	7	7	16	15	11	13	9		7	7	16	15
Curlew†	10	11	13	14	18	18	13	11	3	8	1	6	1	4	4	4	10	12	13	14	18	18	13	11
Dunlin		18	10	12			1	108		20	2	3				2		20	10	12			1	108
Great Black-backed Gull			1	1	1	1	2	2			1		1		3	12			2	1	1	1	3	12
Herring Gull			3	6	2	3	5	7			10	1	1	1	1	2			10	6	2	3	5	7
Knot						1																1		
Lesser Black-backed Gull			4	2	2	6	5	2			5	3	3	9	9	8			8	5	3	9	9	8
Little Egret		1					1	2								1		1					1	2
Little Ringed Plover			4	1	6	3													4	1	6	3		

Mallard†			2					3			4	1							4	1				3
	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22
Mediterranean Gull										0					4								4	
Oystercatcher†	4		8	4	5	5	2		1	0	2	2	1	1	3		4		8	4	5	5	3	
Redshank	97	143	124	1	6	111	143	143	83	110	107	1	1	74	57	123	130	143	140	1	6	111	143	143
Ringed Plover†	1	5		72			3	5				24					1	5		72			3	5
Shelduck	14	25	22	15	7	8	23	21	6	15	15	15	3		8	20	14	25	22	19	7	8	23	21
Teal†			16								2								16					
Turnstone†	30	18	24	2	5	29	17	34	16						4	2	30	18	24	2	5	29	17	34
Whimbrel	1			1								1		2			1			1		2		

SPA qualifying species highlighted in bold. † Species with this symbol are included within the SPA waterfowl assemblage.

(green)	Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary-wide WeBS 5-year MP.
(orange)	Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary-wide WeBS 5-year MP.
(blue)	Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance (> 1% of the WeBS 5-year MP – 455 birds) is higher than the national importance threshold (390 birds). The national importance threshold for Common Sandpiper and Whimbrel is set as 1.

1.5 References

Able UK Limited. (2021). Able Marine Energy Park (Material Change 2 – Tr030006). Updated Environmental Statement: Chapter 10: Aquatic Ecology.

ABPmer. (2009). Humber Estuary: Environmental Management and Monitoring Plan: Data 2009. R. 1587.

ABPmer, (2017). Benthic monitoring at HU056 (data unpublished).

Austin, G and Ross-Smith, V. (2014). Guidance to Interpretation of Wetland Bird Survey Within-Site Trends. BTO Research Report No. 661.

Camphuysen, C. J., & Webb, A. (1999). Multi-species feeding associations in North Sea seabirds: jointly exploiting a patchy environment. ARDEA-WAGENINGEN-, 87(2), 177-198.

Carter, M.I., Boehme, L., Duck, C.D., Grecian, J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C., Moss, S., Thompson, D. and Thompson, P. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS, OESEA-16-76, OESEA-17-78.

English Nature. (2003). The Humber Estuary European Marine Site.

Environment Agency. (2013). Review of fish population data in the Humber Estuary. A report by the University of Hull for the Environment Agency.

Franco, A. Leighton, A. Bailey, M. Thomson, A and Musk, W. (2015). Humber Estuary SAC Intertidal Sediment Survey. IECS Report No. YBB249-F-2015. A report to Natural England.

Frost, T.M., Calbrade, N.A., Birtles, G.A., Hall, C., Robinson, A.E., Wotton, S.R., Balmer, D.E. and Austin, G.E. (2021). Waterbirds in the UK 2019/20: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.

Humber Nature Partnership. (2015). Humber Management Scheme 2015.

Institute of Estuarine and Coastal Studies (IECS). (2010). South Humber Channel Marine Studies: Intertidal and Subtidal Benthic & Fish Surveys 2010: Report to Yorkshire Forward.

JNCC, (2022a).[redacted]. Accessed 4 March 2022

JNCC, (2022b). [redacted] Accessed 4 January 2022.

JNCC, (2022c).[redacted] Accessed 4 January 2022.

JNCC (2022d). [redacted] Accessed 28 January 2022.

Mander, L., Scapin, L., Thaxter, C.B., Forster, R.M., & Burton, N.H. (2021). Long-Term Changes in the Abundance of Benthic Foraging Birds in a Restored Wetland. Frontiers in Ecology and Evolution, 584.

McConnell, B.J., Fedak, M. A., Lovell, P., and Hammond P.S. (1999). Movements \and Foraging Areas of Grey Seals in the North Sea. Journal of Applied Ecology, 36, pp.573-590.

Natural England. (2015). Site Improvement Plan Humber Estuary. Planning for the Future Improvement Programme for England's Natura 2000 Sites (IPENS).

Natural England. (2021a). Natural England Conservation Advice for Marine Protected Areas: Humber Estuary SAC. [Online] Available at: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCod e=UK0030170&SiteName=humber&countyCode=&responsiblePerson=&SeaArea=& IFCAArea=&HasCA=1&NumMarineSeasonality=8&SiteNameDisplay=Humber%20E stuary%20SAC (accessed July 2021).

Natural England. (2021b). Natural England Conservation Advice for Marine Protected Areas: Humber Estuary SPA. [Online] Available at: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCod e=UK9006111&SiteName=humber&countyCode=&responsiblePerson=&SeaArea=& IFCAArea=&HasCA=1&NumMarineSeasonality=15&SiteNameDisplay=Humber%20 Estuary%20SPA (accessed July 2021).

NBN. (2021). NBN Atlas. [redacted]. Accessed October 2021.

Russell, D.J.F. (2016). Movements of grey seal that haul out on the UK coast of the southern North Sea. Report for the Department of Energy and Climate Change (OESEA-14-47).

Special Committee on Seals (SCOS). (2017). Scientific Advice on Matters Related

to the Management of Seal Populations: 2017. [Online] Available at:
[redacted]

Special Committee on Seals (SCOS). (2022). Scientific Advice on Matters Related to the Management of Seal Populations: 2021.

Stillman, R.A., West, A.D., Goss-Custard, J.D., McGrorty, S., Frost, N.J., Morrisey, D.J., Kenny, A.J. and Drewitt, A.L. (2005). Predicting site quality for shorebird communities: a case study on the Humber estuary, UK. Marine Ecological Progress Series, 305, pp.203–217.

Woodward, I.D., Calbrade, N.A and Holt., C.A. (2014). Humber Estuary Bird Decline Investigation 2014. BTO Research Report No. 668. Report of work carried out by The British Trust for Ornithology under contract to Natural England.

Woodward, I.D., Calbrade, N.A and Austin G.E. (2018). Analysis of Wetland Bird Survey (WeBS) Data for The Humber Estuary SSSI, SAC, SPA and Ramsar site: Third appraisal – sector-level trends to winter 2016/17.

Woodward, I.D., Frost, T.M., Hammond, M.J., and Austin, G.E. (2019). Wetland Bird Survey Alerts 2016/2017: Changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Areas of Special Scientific interest (ASSIs). BTO Research Report 721. BTO, Thetford.

1.6 Abbreviations/Acronyms

AA Appropriate Assessment
ABB ABB Power Generation Ltd
ABP Associated British Ports
AL Action Level
AMEP Able Marine Energy
Park BAP Biodiversity Action Plan
BEIS Department for Business, Energy and Industrial
Strategy BNG Biodiversity Net Gain
BTO British Trust for Ornithology
CEDA Central Dredging Association
Cefas Centre for Environment, Fisheries and Aquaculture
Science CEMP Construction Environmental Management Plan
CIEEM Chartered Institute of Ecology and Environmental
Management CoCP Code of Construction Practice
CoSA Conservation of Seals
Act COVID Coronavirus
CRoW Countryside and Rights of Way Act
cSAC Candidate Special Areas of

Conservation
CSIP Cetacean Strandings Investigation
Programme D Diadromous species
dB Decibel
dBA A-weighted decibel
DCO Development Consent Order
DECC Department of Energy and Climate Change
Defra Department for Environment, Food and Rural
Affairs EC European Commission
EcIA Ecological Impact Assessment
EEC European Economic Community
EIA Environmental Impact
Assessment EMP Environmental Management
Plan EMS European Marine Site
ERM ERM Group
ES Environmental Statement
ES Estuarine resident Species
EU European Union
F Freshwater species
FID Flight Initiation Distance,
FOCI Feature of Conservation
Importance GB Great Britain
HEEs High Energy Events
HF High-Frequency
HGVs Heavy Goods Vehicle
HMWB Heavily Modified Water Body
HRA Habitats Regulations
Assessment ID Identity
IECS The Institute of Estuarine & Coastal Studies
IEERT Immingham Eastern Roll-on Roll-off
Terminal
IEMA Institute of Environmental Management and
Assessment IERRT Immingham Eastern Ro-Ro Terminal
IMO International Maritime
Organization INNS Invasive Non-native Species
IOH Immingham Outer Harbour
IOT Immingham Oil Terminal
IPENS Improvement Programme for England's Natura 2000
Sites JCP Joint Cetacean Protocol
JNCC In-combination Climate Change Impacts
LAeq Equivalent Continuous Sound Pressure
Level,
LAmax F Maximum 'A'-weighted Sound Pressure Level (Fast Time
Weighed) LERC Lincolnshire Ecological Records Centre
LGS Local Geological Sites

Lmax. Maximum 'A'-weighted Sound Pressure
Level LNR Local Nature Reserve
LSE Likely Significant Effect
LWS Local Wildlife Site
MAGIC Multi-Agency Geographic Information for the
Countryside MALSF Marine Aggregate Levy Sustainability Fund
MarESA Marine Evidence based Sensitivity
Assessment MCAA Marine and Coastal Access Act
MCCIP Marine Climate Change Impact
Partnership MCZ Marine Conservation Zone
MHWS Mean high Water
Springs MLWN Mean Low Water
Neaps MLWS Mean Low Water
Springs MM Marine Migrant species
MMO Marine Management
Organisation MP Mean Peak
MPA Marine Protected Area
MPS Marine Policy Statement
MS Marine Straggler species
MW Megawatt
NBN National Biodiversity Network
NELC North East Lincolnshire
Council
NERC Natural Environment and Rural
Communities NMFS National Marine Fisheries
Service
NOAA National Oceanic and Atmospheric
Administration NPSfP National Policy Statement for Ports
NSIP Nationally Significant Infrastructure
Projects O&M Operation and Maintenance
PAH Polycyclic Aromatic
Hydrocarbons PCBs Polychlorinated
Biphenyl
PEA Preliminary Ecological Appraisal
PEIR Preliminary Environmental Information Report
PIANC The World Association for Waterborne Transport
Infrastructure PINS Planning Inspectorate
PSA Particle Size Analysis
pSPA Potential Special Protection
Areas PTS Permanent Threshold Shifts
PW Phocid Pinniped
Ramsar Wetlands of international importance, designated under The Convention on Wetlands (Ramsar, Iran, 1971)
REC Regional Environmental
Characterisation RMS Root Mean Square

Ro-Ro Roll On-Roll Off
RSPB Royal Society for the Protection of
Birds SAC Special Area of Conservation
SCANS Small Cetaceans in European Atlantic Waters and the North
Sea SCOS Special Committee on Seals
SEL Sound Exposure Levels
SL Source Level
SMRU Sea Mammal Research
Unit SPA Special Protection Area
SPL Sound Pressure Levels
SSC Suspended Sediment
Concentrations SSSI Site of Special Scientific
Interest SSSI Sites of Special Scientific Interest
STST Selective Tidal Stream Transport’
TBT Tributyltin
TOC Total Organic Carbon
TPH Where Total Petroleum
Hydrocarbons TraC Transitional and Coastal
Waters TSHD Trailer Suction Hopper Dredger
TTS Temporary Threshold Shift
UK United Kingdom
WCA Wildlife and Countryside
Act WeBS Wetland Bird Survey
WFD Water Framework Directive
WODA World Organization of Dredging Associations

Cardinal points/directions are used unless otherwise stated.
SI units are used unless otherwise stated.

1.7 Glossary

Term	Definition
Baseline conditions	Existing conditions and past trends associated with the environment in which a proposed activity may take place
Bathymetry	The measurement of depth of the water
Beam trawls	Fishing net towed along the seafloor to target fish living in or on sand and muddy seabed environments
Benthic habitats	Habitats associated with the bottom of a body of water
Biomass	The weight of living organisms
Coastal lagoon	A shallow body of water separated from a larger body of water by a narrow landform such as sandbars or barrier islands
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)
Day grab	Two stainless bucket sections which are mounted within a stainless steel frame to collect benthic sediment

	samples
Demersal fish	Fish that live and feed on or near the bottom of water bodies
Ecoregion	Relatively large units of land or water containing a distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions
European Marine Site	Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) that are covered by tidal waters and protect some of our most important marine and coastal habitats and species of European importance.
Fluvial	Relating to stream or river processes
Fyke nets	A fish trap consisting of a cylindrical or cone-shaped net mounted on rings or rigid structures. t has wings or leaders which guide the fish towards the entrance of the bags.
Hamon grab	Comprises of a stainless steel box shaped sampling scoop mounted in a triangular frame to collect benthic (generally coarse) sediment samples
Hazard	A substance, operation or piece of equipment which has the potential to cause harm to people or the environment
Infaunal	Aquatic animals that live in the substrate at the bottom of a body of water
Interglacial	Warmer period between two glaciations
Intertidal	The area between high and low tide also known as the foreshore or seashore
Invertebrate	Animals which lack a vertebral column / backbone
Nursery ground	Habitats that enhance the growth and survival of juveniles
Otter trawls	A large fishing net that is dragged behind a vessel mainly used to catch demersal fish living above the seafloor
Pelagic	The water column of coasts, open oceans and lakes
Ramsar	Wetlands of international importance designated under the Ramsar Convention
Resistance	Resistance characteristics indicate whether a receptor can absorb disturbance or stress without changing character
Risk	The likelihood of a specified level of harm occurring within a specified period of time
Salicornia	A genus of flowering plants that grow in salt marshes, on beaches, and among mangroves.
Seine netting	A fishing net that hangs vertically in the water (with its bottom edge held down by weights and its top edge buoyed by floats) used to haul or herd fish
Site of Special Scientific Interest	An area of land which is of special interest for its flora, fauna, geological, geomorphological or physiographical features
Special Area of Conservation	A designated area protecting one or more habitats or species listed in the Habitats Directive
Special Area of	A designated area protecting habitats and species

Conservation	identified in Annexes I and II of the Habitats Directive
Special Protection Area	A designated area protecting one or more rare, threatened or vulnerable bird species listed in Annex I of the Birds Directive
Subtidal	The area where the seabed is below the low tide water mark
Telemetry tags	Tags which are attached to an animal to determine its location through detection of a signal from a transmitter
Turbidity	Turbidity is the measure of relative clarity of a liquid and is a measurement of the amount of light that is scattered by the material in the water
Van Veen grab	A clamshell bucket made of stainless steel to collect benthic sediment samples
Waterbirds	Birds that live on or around water

Annex A.1

Table 1 and Table 2 presents bird count data by month (peak counts) within Sector B between October 2021 and September

Table 1. Coastal waterbird species recorded within Sector B during October 2021 to September 2022 (peak counts – feeding and roosting)

Species	Peak count (feeding)												Peak count(roosting)												Estuarywide WeBS 5yr MP (2015/16 to 2019/20)
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Bar-tailed Godwit	8	3	0	0	1	0	0	0	0	0	2	16	0	1	0	0	0	0	0	0	0	0	0	5	1561
Black-tailed Godwit	589	311	2	1300	10	341	535	264	102	44	22	109	9	38	1	30	2	3	2	24	29	20	6	7	4545
Curlew†	12	8	9	11	11	12	13	14	18	18	13	11	7	4	4	2	5	2	1	6	1	4	4	4	2787
Dunlin	315	406	174	340	215	169	10	12	0	0	1	108	494	400	100	10	150	0	2	3	0	0	0	2	15915
Redshank	108	128	115	105	101	142	124	1	6	111	143	143	153	100	50	3	61	72	107	1	1	74	57	123	2881
Ringed Plover†	0	0	0	0	0	0	0	72	0	0	3	5	0	0	0	0	0	0	0	24	0	0	0	0	808
Shelduck	18	48	48	67	24	23	22	15	7	8	23	21	15	32	46	29	18	12	15	15	3	0	8	20	4355
Teal†	0	1	0	21	21	25	16	0	0	0	0	0	0	1	0	18	27	4	2	0	0	0	0	0	3757
Cormorant	2	0	0	0	0	1	1	0	0	0	0	1	14	4	5	4	7	10	9	0	7	7	16	15	323
Mallard†	0	0	0	0	0	1	2	0	0	0	0	3	0	0	7	2	0	2	4	1	0	0	0	0	1046
Knot	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22500
Turnstone†	28	27	6	24	26	25	24	2	5	29	17	34	2	0	1	0	1	0	0	0	0	0	4	2	239
Oystercatcher†	0	0	0	0	5	12	8	4	5	5	2	0	0	0	0	1	4	3	2	2	1	1	3	0	5816
Grey Plover	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3333
Little Egret	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	205
Common Sandpiper	0	0	0	0	0	0	0	0	0	3	1	5	0	0	0	0	0	0	0	0	0	0	0	0	35
Whimbrel	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	128
Little Ringed Plover	0	0	0	0	0	1	4	1	6	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4

SPA qualifying species highlighted in **bold.** † Species with this symbol are included as named components of the SPA waterfowl assemblage.

Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).

Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).

Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak – 565 birds) is higher than the national importance threshold (390 birds). The national importance threshold for Common Sandpiper and Whimbrel is set as 1.

Cells highlighted red indicate the count is of international importance.

Annex A.1

Table 2. Coastal waterbird species recorded within Sector B during October 2021 to September 2022 (peak counts – all behaviours)

Species	Peak count (combined – non-behaviour)												Estuary wide WeBS 5yr MP (2015/16 to 2019/20)
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	
Bar-tailed Godwit	8	3	0	0	1	0	0	0	0	0	2	16	1561
Black-tailed Godwit	589	311	2	1300	10	344	535	274	107	44	22	109	4545
Curlew†	12	8	9	11	13	12	13	14	18	18	13	13	2787
Dunlin	494	406	174	340	215	169	10	12	0	0	1	108	15915
Redshank	160	128	124	105	101	142	140	1	6	111	143	154	2881
Ringed Plover†	0	0	0	0	0	0	0	72	0	0	3	5	808
Shelduck	18	53	50	72	25	28	22	19	7	8	23	21	4355
Teal†	0	1	0	21	27	25	16	0	0	0	0	0	3757
Cormorant	14	4	5	4	0	10	9	0	7	7	16	15	323
Mallard†	0	0	7	2	0	2	4	1	0	0	0	3	1046
Knot	0	0	0	0	0	0	0	0	0	1	0	0	22500
Turnstone†	28	27	7	24	27	25	24	2	5	29	17	34	239
Oystercatcher†	0	0	0	1	5	12	8	4	5	5	4	0	5816
Grey Plover	0	0	0	1	0	1	0	0	0	0	0	2	3333
Little Egret	0	0	0	0	0	0	0	0	0	0	1	2	205
Common Sandpiper	0	0	0	0	0	1	0	1	0	3	1	5	35
Whimbrel	0	0	0	0	0	0	0	1	0	2	0	0	128
Little Ringed Plover	0	0	0	0	0	0	0	0	0	0	0	0	4

SPA qualifying species highlighted in **bold.** † Species with this symbol are included as named components of the SPA waterfowl assemblage.

Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).

Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).

Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak – 565 birds) is higher than the national importance threshold (390 birds). The national importance threshold for Common Sandpiper and Whimbrel is set as 1.

Cells highlighted red indicate the count is of international importance.

Annex A.2

Table 1 to Table 6 presents summary bird data for Sectors A to

Table 1. Peak counts of coastal waterbird species recorded within Sector A over the 5-year period between 2017/18 to 2021/22

Species	Peak count per winter (feeding)						Peak count per winter (Roosting)						Peak count per winter (combined – all behaviour)					
	17/18	18/19	19/20	20/21	21/22	MP	17/18	18/19	19/20	20/21	21/22	MP	17/18	18/19	19/20	20/21	21/22	MP
Avocet	50	104	223	270	171	164	50	81	251	243	146	154	50	104	251	270	146	164
Bar-tailed Godwit	13	2	14	4	0	7	27	0	0	0	1	6	27	2	14	4	1	10
Black-tailed Godwit	2560	126	2183	515	1950	1467	2720	2070	1950	2350	2828	2384	2720	2070	2183	2350	2828	2430
Common Sandpiper	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cormorant	332	0	4	3	3	68	367	0	2	3	3	75	367	0	4	3	3	75
Curlew†	39	32	63	99	71	61	153	68	82	39	120	92	153	68	82	99	127	106
Curlew sandpiper	6	0	0	0	0	1	1	0	0	0	0	0	6	0	0	0	0	1
Dunlin	1670	680	512	592	557	802	5561	22	22	850	122	1315	5561	680	512	850	557	1632
Golden Plover	0	0	0	0	0	0	0	0	1	3	0	1	0	0	1	3	0	1
Greenshank†	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Grey Heron	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Grey plover†	2	0	1	2	0	1	0	0	0	0	0	0	2	0	1	2	0	1
Greylag Goose	18	0	27	47	21	23	0	0	3	0	2	1	18	0	27	47	21	23
Knot	2	2	22	5	18	10	0	0	68	14	18	20	2	2	68	14	18	21
Lapwing†	634	1054	772	320	201	596	1431	2374	1254	829	2932	1764	1431	2374	1254	829	2932	1764
Little Egret	1	1	0	1	3	1	0	0	0	0	0	0	1	1	0	1	2	1
Little Stint	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Mallard†	0	22	10	6	5	9	0	0	3	0	2	1	0	22	10	6	5	9
Mute swan	0	4	0	0	0	1	0	0	0	0	0	0	0	4	0	0	0	1
Oystercatcher†	20	8	4	5	6	9	0	1	2	4	2	2	20	8	4	5	6	9
Pink-footed Goose	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Purple sandpiper	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Redshank	271	204	112	177	245	202	277	40	124	62	141	129	277	204	124	177	309	218
Ringed Plover†	13	19	24	8	4	14	0	0	2	5	2	2	13	19	24	8	4	14
Sanderling†	0	0	2	0	0	0	0	0	0	3	0	1	0	0	2	3	0	1
Shelduck	125	76	56	28	65	70	14	6	28	14	26	18	125	76	56	28	65	70
Shoveler	0	0	0	14	0	3	0	0	0	14	0	3	0	0	0	14	0	3
Snipe	0	4	15	24	1	9	0	0	0	3	22	5	0	4	15	24	22	13
Spotted Redshank	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Teal†	0	888	391	1620	329	646	0	1016	742	1623	1111	898	0	1016	742	1623	1120	900
Turnstone†	1	17	12	21	2	11	0	0	37	0	0	7	1	17	37	21	2	16
Wigeon†	0	0	4	0	0	1	0	0	0	0	0	0	0	0	4	0	0	1

SPA qualifying species highlighted in bold. † Species with this symbol are included as named components of the SPA waterfowl assemblage.

(green)	Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).
(orange)	Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20). It should be noted that for the Purple Sandpiper, the regional importance threshold is < 1.
(blue)	Cells highlighted blue indicate the count is of national importance. It should be noted that for Avocet and Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak (248 and 455 birds respectively) is higher than the national importance threshold (87 and 390 birds respectively). The national importance threshold for the Little Stint and Spotted Redshank is set as 1.
(red)	Cells highlighted red indicate the count is of international importance.

Annex A.2

Table 2. Peak counts of coastal waterbird species recorded within Sector C over the 5-year period between 2017/18 to 2021/22

Species	Peak count per winter (feeding)						Peak count per winter (Roosting)						Peak count per winter (combined – all behaviour)					
	17/18	18/19	19/20	20/21	21/22	MP	17/18	18/19	19/20	20/21	21/22	MP	17/18	18/19	19/20	20/21	21/22	MP
Avocet	0	0	42	2	0	9	0	0	64	0	0	13	0	0	64	2	0	13
Bar-tailed Godwit	48	30	54	45	141	64	0	2	0	3	0	1	48	30	54	45	141	64
Black-tailed Godwit	503	944	752	2016	2591	1361	280	1	1352	700	238	514	503	944	1352	2016	2637	1490
Cormorant	0	0	0	0	1	0	1	1	0	0	1	1	1	1	0	0	0	0
Curlew†	23	35	24	35	37	31	37	11	14	57	16	27	37	35	24	57	81	47
Dunlin	541	371	571	554	556	519	16	9	110	6	4	29	541	371	571	554	642	536
Gadwall	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Golden Plover	0	0	0	0	13	3	0	0	0	4	0	1	0	0	0	4	13	3
Goldeneye†	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Grey plover†	14	0	11	20	75	24	0	0	0	1	0	0	14	0	11	20	75	24
Greylag Goose	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	1
Knot	0	191	110	16	39	71	0	0	210	2	0	42	0	191	210	16	39	91
Lapwing†	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0
Little Egret	1	0	3	0	1	1	0	0	0	0	1	0	1	0	3	0	0	1
Little Ringed Plover	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mallard†	3	2	3	0	0	2	2	0	2	2	0	1	3	2	3	2	0	2
Mute swan	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Oystercatcher†	5	4	9	7	7	6	2	2	2	7	2	3	5	4	9	7	9	7
Pink-footed Goose	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Redshank	56	38	50	48	80	54	26	5	12	13	44	20	56	38	50	48	80	54
Ringed Plover†	2	3	12	25	2	9	13	1	7	22	16	12	13	3	12	25	15	14
Shelduck	109	152	125	139	128	131	16	26	64	35	42	37	109	152	125	139	128	131
Teal†	1	8	13	3	3	6	0	0	0	0	0	0	1	8	13	3	3	6
Turnstone†	19	15	21	28	41	25	5	0	15	18	23	12	19	15	21	28	41	25

SPA qualifying species highlighted in bold. † Species with this symbol are included as named components of the SPA waterfowl assemblage.

(green)	Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).
(orange)	Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20). It should be noted that for the Little Ringed Plover, the regional importance threshold is < 1.
(blue)	Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak – 455 birds) is higher than the national importance threshold (390 birds).
(red)	Cells highlighted red indicate the count is of international importance.

Annex A.2

Table 3. Coastal waterbird species recorded within Sector A during October 2021 to September 2022 (peak counts – feeding and roosting)

Species	Peak count (feeding)												Peak count(roosting)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Avocet	171	15	0	0	0	115	7	5	6	18	8	225	146	99	0	0	35	92	12	0	24	19	0	165
Barnacle goose	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bar-tailed Godwit	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0
Black-tailed Godwit	1950	4	0	6	30	15	25	44	121	176	420	3620	2828	28	0	578	142	0	0	7	131	166	0	720
Canada Goose	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Sandpiper	0	0	0	0	0	0	1	2	0	1	3	1	0	0	0	0	0	0	0	0	0	0	0	1
Cormorant	1	1	1	0	0	3	0	1	1	0	2	3	1	0	0	0	0	0	0	0	2	1	2	3
Curlew†	54	9	25	71	24	50	47	11	19	33	17	42	35	18	108	120	71	78	4	3	4	3	2	1
Dunlin	181	163	557	181	215	40	30	25	0	9	0	32	122	0	2	36	13	0	0	0	0	0	0	0
Grey Heron	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Grey plover†	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Greylag Goose	21	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	2	2	2	0	0	0	0
Knot	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0
Lapwing†	0	201	21	0	0	4	1	4	49	22	0	3	145	389	509	388	2932	1	2	6	39	68	0	3
Little Egret	1	0	0	0	0	2	0	0	0	0	1	2	0	0	0	0	0	0	0	1	1	0	0	0
Mallard†	0	0	5	0	0	1	2	0	0	0	0	2	2	0	0	0	0	0	2	2	0	0	0	0
Oystercatcher†	0	0	0	1	0	6	4	1	4	6	1	0	0	0	0	0	0	2	5	2	2	1	0	0
Pink-footed Goose	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Purple Sandpiper	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Redshank	169	124	245	123	48	57	64	3	1	201	85	154	141	12	119	27	18	16	8	2	1	10	0	0
Ringed Plover†	0	0	0	0	0	4	14	48	1	6	9	17	0	0	0	0	0	2	1	13	0	0	0	0
Ruff†	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shelduck	11	12	21	14	16	65	26	18	21	23	6	8	2	7	14	9	26	15	25	5	10	9	3	7
Snipe	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0
Teal†	329	174	148	275	164	97	38	0	0	0	0	275	326	831	273	1111	362	100	44	0	0	0	30	285
Turnstone†	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Whimbrel†	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0

SPA qualifying species highlighted in bold. † Species with this symbol are included as named components of the SPA waterfowl assemblage.

Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).

Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20). It should be noted that for the Purple Sandpiper, the regional importance threshold is < 1.

Cells highlighted blue indicate the count is of national importance. It should be noted that for Avocet and Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak (248 and 455 birds respectively) is higher than the national importance threshold (87 and 390 birds respectively). The national importance threshold for the Common Sandpiper and Whimbrel is set as 1.

Cells highlighted red indicate the count is of international importance.

Annex A.2

Table 4. Coastal waterbird species recorded within Sector C during October 2021 to September 2022 (peak counts – feeding and roosting)

Species	Peak count (feeding)												Peak count (roosting)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Avocet	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bar-tailed Godwit	141	14	26	21	23	8	0	0	248	0	3	27	0	0	0	0	0	0	0	0	0	0	0	5
Black-tailed Godwit	2591	720	250	511	940	416	581	106	0	0	39	108	46	30	71	238	0	213	0	0	0	0	0	38
Canada Goose	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Sandpiper	0	0	0	0	0	0	4	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Cormorant	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Curlew†	33	37	21	29	25	33	43	16	4	19	20	23	3	1	2	16	5	12	6	1	3	3	3	4
Dunlin	152	462	126	556	254	61	400	0	0	0	47	131	4	0	2	1	1	3	0	0	0	0	0	0
Golden Plover	0	1	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Goldeneye†	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grey plover†	1	4	41	24	75	60	12	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
Greylag Goose	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Knot	39	0	0	0	0	0	4	26	3	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0
Little Egret	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1
Little Ringed Plover	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Mute swan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Oystercatcher†	0	1	0	2	3	7	5	5	3	3	3	2	0	0	0	0	1	2	2	2	0	0	0	0
Pink-footed Goose	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Redshank	11	80	31	42	22	23	24	0	0	13	9	13	2	0	15	44	1	10	1	0	0	0	0	1
Ringed Plover†	0	0	0	2	0	0	0	0	2	0	0	10	7	12	7	10	16	10	0	0	0	0	2	7
Shelduck	45	128	22	55	78	43	12	5	2	8	116	26	0	3	4	0	1	18	10	0	0	0	3	22
Teal†	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Turnstone†	32	14	14	23	12	35	8	0	0	0	16	31	3	7	0	17	6	23	5	0	0	0	5	6

SPA qualifying species highlighted in bold. † Species with this symbol are included as named components of the SPA waterfowl assemblage.

	Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).
	Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20). It should be noted that for the Little Ringed Plover, the regional importance threshold is < 1.
	Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak – 455 birds) is higher than the national importance threshold (390 birds).
	Cells highlighted red indicate the count is of international importance.

Annex A.2

Table 5. Coastal waterbird species recorded within Sector A during October 2021 to September 2022 (peak counts – all behaviours)

Species	Peak count (all behaviour)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Avocet	146	114	0	0	35	115	14	5	25	34	8	225
Bar-tailed Godwit	1	0	0	0	0	0	0	0	0	0	0	2
Black-tailed Godwit	2828	28	0	578	142	15	25	51	131	176	420	3620
Common Sandpiper	0	0	0	0	0	0	1	2	0	1	3	1
Cormorant	1	1	1	0	0	3	0	1	1	1	2	4
Curlew†	81	27	112	127	80	101	47	11	19	33	17	42
Dunlin	181	163	557	217	215	40	30	25	0	9	0	37
Grey Heron	1	0	0	0	0	0	0	0	0	0	0	0
Grey plover†	0	0	0	0	0	0	0	0	0	0	0	1
Greylag Goose	21	0	0	0	0	2	2	2	0	0	0	0
Knot	0	0	0	0	18	0	0	0	3	0	0	0
Lapwing	145	389	530	388	2932	4	3	10	49	70	0	6
Little Egret	1	0	0	0	0	2	0	1	1	0	1	2
Mallard†	2	0	5	0	0	1	2	2	0	0	0	2
Oystercatcher†	0	0	0	1	0	6	6	3	5	6	1	0
Pink-footed Goose	0	1	0	0	0	0	0	0	0	0	0	0
Purple Sandpiper	0	1	0	0	0	0	0	0	0	0	0	0
Redshank	169	124	309	124	48	63	64	3	1	201	85	154
Ringed Plover†	0	0	7	0	16	4	14	61	1	6	9	17
Ruff	0	0	0	0	0	0	0	1	0	0	0	0
Shelduck	12	12	21	14	26	65	20	18	21	23	6	8
Snipe	1	0	0	0	22	0	0	0	0	0	0	0
Teal†	329	835	380	1120	362	114	78	0	0	0	30	391
Turnstone†	0	0	0	2	0	0	1	0	0	1	0	0
Whimbrel†	0	0	0	0	0	0	0	2	0	1	1	0

SPA qualifying species highlighted in bold. † Species with this symbol are included as named components of the SPA waterfowl assemblage.

(green)	Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).
(orange)	Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20). It should be noted that for the Purple Sandpiper, the regional importance threshold is < 1.
(blue)	Cells highlighted blue indicate the count is of national importance. It should be noted that for Avocet and Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak (248 and 455 birds respectively) is higher than the national importance threshold (87 and 390 birds respectively). The national importance threshold for the Common Sandpiper and Whimbrel is set as 1.
(red)	Cells highlighted red indicate the count is of international importance.

Annex A.2

Table 6. Coastal waterbird species recorded within Sector C during October 2021 to September 2022 (peak counts – all behaviours)

Species	Peak count (all behaviour)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Avocet	0	0	0	0	0	0	2	1	0	0	0	0
Bar-tailed Godwit	141	14	26	21	23	8	0	106	248	0	3	27
Black-tailed Godwit	2637	750	310	511	940	629	581	0	0	0	39	108
Canada Goose	0	0	0	0	0	0	0	4	0	0	0	0
Common Sandpiper	0	0	0	0	0	0	0	0	0	2	0	4
Cormorant	0	0	0	0	0	0	1	0	0	0	0	1
Curlew†	33	37	23	34	25	33	49	17	4	19	20	23
Dunlin	152	642	126	556	254	61	400	0	0	0	47	131
Golden Plover	0	0	0	0	13	0	0	0	0	0	0	0
Goldeneye†	0	1	0	0	0	0	0	0	0	0	0	0
Grey plover†	1	4	41	24	75	60	12	0	0	0	0	4
Greylag Goose	0	0	0	0	0	2	0	0	0	0	0	0
Knot	39	0	0	0	0	0	0	26	3	0	0	24
Little Egret	0	0	0	0	0	0	0	1	0	1	1	0
Little Ringed Plover	0	0	0	0	0	0	0	0	0	0	0	1
Mute swan	0	0	0	0	0	1	0	0	0	0	0	0
Oystercatcher†	0	1	0	2	3	9	5	7	3	3	3	2
Redshank	12	80	31	46	22	24	24	0	0	13	9	13
Ringed Plover†	7	12	0	10	15	10	0	0	0	0	2	10
Shelduck	45	128	22	55	79	43	6	5	2	8	116	34
Teal†	0	0	0	0	0	3	0	0	0	0	0	0
Turnstone†	36	21	14	30	14	41	8	0	0	0	16	37
Whimbrel†	0	0	0	0	0	0	4	3	0	1	0	0

SPA qualifying species highlighted in bold. † Species with this symbol are included as named components of the SPA waterfowl assemblage.

Cells highlighted green indicate the count is of local importance (> 1%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20).

Cells highlighted orange indicate the count is of regional importance (> 10%) of the current estuary wide WeBS 5-year mean peak (2015/16 to 2019/20). It should be noted that for the Little Ringed Plover, the regional importance threshold is < 1.

Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance threshold (> 10% of the estuary wide WeBS 5-year mean peak – 455 birds) is higher than the national importance threshold (390 birds).

Cells highlighted red indicate the count is of international importance.

Table 6. Coastal waterbird species recorded within Sector C during October 2021 to Sep

Table 6. Coastal waterbird species recorded within Sector C during October 2021 to Sep

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Appendix B: SPA Assemblage Species Screening Rationale

Appendix B: Immingham Eastern Ro-Ro Terminal (IERRT) – SPA Assemblage Features Screening Summary

This appendix provides a summary on the rationale for screening in SPA assemblage species as part of Stage 1 (Screening) of the HRA (Section 3). The species list provided in the '*Annex B: Humber Estuary Special Protection Area: non-breeding waterbird assemblage (Version 1.2, June 2023)*' note provided by Natural England has been used in Table 1.

Table 1. Humber Estuary SPA Assemblage Species

SPA Assemblage Feature	Signpost to HRA
Species listed individually under the assemblage feature on the SPA citation	
Avocet, *Recurvirostra avosetta* (non-breeding)	This species is recorded in the Immingham region but is considered rare in the vicinity of the proposed development. For example, only two individuals have been recorded in the relevant Count Sector B as part of the Immingham Outer Harbour (IOH) bird monitoring between 2010/11 and 2021/22. This species has been screened out of the IERRT Habitats Regulations Assessment (HRA) due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).
Bar-tailed Godwit, *Limosa lapponica* (non-breeding)	Bar-tailed Godwit have been recorded in Sector B in locally important numbers in some years (i.e., in abundances representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak)). This qualifying species has been screened into and assessed within the HRA.
Bittern, *Botaurus stellaris* (non-breeding)	This species does not normally occur on open mudflat habitat and has not been recorded in the IOH bird monitoring that has been undertaken in the Immingham area. This species has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).
Black-tailed Godwit, *Limosa limosa islandica* (non-breeding	Black-tailed Godwit have been recorded in nationally or internationally important numbers in Sector B as well regionally important numbers (i.e., in abundances representing > 10% of the estuary wide population (based on the WeBS 5-year mean peak)). This qualifying species has been screened into and assessed within the HRA.
Brent Goose, *Branta bernicla* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Curlew, *Numenius arquata* (non-breeding)	The numbers of Curlew recorded in Sector B are lower than 1% of the estuary wide population (based on the WeBS 5-year mean peak)). However, this species has been screened into and assessed as part of the waterbird assemblage within the HRA as this species is regularly recorded on the foreshore.
Dunlin, *Calidris alpina alpina* (non-breeding)	Dunlin have been regularly recorded in Sector B in locally important numbers (i.e., in abundances representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak)). This qualifying species has been screened into and assessed within the HRA.
Golden Plover, *Pluvialis apricaria* (non-breeding)	This species has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).

Appendix B

SPA Assemblage Feature	Signpost to HRA
Goldeneye, *Bucephala clangula* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Greenshank, *Tringa Nebularia* (non-breeding)	This species was not specifically considered within the HRA as only a single individual has been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) over the last five years (see Section 1.4 of Appendix A of this HRA).
Grey Plover, *Pluvialis squatarola* (non-breeding)	This species was not specifically considered within the HRA as only a single individual has been recorded annually within the bird count sector adjacent to the proposed works (IOH Sector B) over the last five years (see Section 1.4 of Appendix A of this HRA).
Knot, *Calidris canutus* (non-breeding)	The numbers of Knot recorded in Sector B are lower than 1% of the estuary wide population (based on the WeBS 5-year mean peak)). However, this qualifying feature has been screened into and assessed within the HRA on a precautionary basis.
Lapwing, *Vanellus vanellus* (non-breeding)	This species was not specifically considered within the HRA as only 1-3 individuals have been recorded annually within the bird count sector adjacent to the proposed works (IOH Sector B) over the last five years (see Section 1.4 of Appendix A of this HRA).
Mallard, *Anas platyrhynchos* (non-breeding	The numbers of Mallard recorded in Sector B are lower than 1% of the estuary wide population (based on the WeBS 5-year mean peak)). However, this species has been screened into and assessed as part of the waterbird assemblage within the within the HRA on a precautionary basis as this species is regularly recorded on the foreshore.
Oystercatcher, *Haematopus ostralegus* (non-breeding)	The numbers of Oystercatcher recorded in Sector B are lower than 1% of the estuary wide population (based on the WeBS 5-year mean peak)). However, this species has been screened into and assessed as part of the waterbird assemblage within the within the HRA on a precautionary basis as this species is regularly recorded on the foreshore.
Pochard, *Aythya farina* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Redshank, *Tringa totanus* (non-breeding	Redshank have been regularly recorded in Sector B in locally important numbers (i.e., in abundances representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak)). This qualifying species has been screened into and assessed within the HRA .
Ringed Plover, *Charadrius hiaticula* (non-breeding)	Ringed Plover has been occasionally recorded in locally important numbers in some years (i.e., in abundances representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak)). This species has been screened into and assessed as part of the waterbird assemblage within the within the HRA.
Ruff, *Philomachus pugnax* (non-breeding)	This species is rarely recorded on mudflat habitat in the Immingham area, for example only one individual has been recorded in Count Sector B in the IOH monitoring between 2010/11 and 2021/22. This species has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).

Appendix B

SPA Assemblage Feature	Signpost to HRA
Sanderling, *Calidris alba* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Scaup, *Aythya marila* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Shelduck, *Tadorna tadorna* (non-breeding)	Shelduck have been regularly recorded in Sector B in locally important numbers (i.e., in abundances representing > 1% of the estuary wide population (based on the WeBS 5-year mean peak)). This qualifying species has been screened into and assessed within the HRA.
Teal, *Anas crecca* (non-breeding)	The numbers of Teal recorded in Sector B are lower than 1% of the estuary wide population (based on the WeBS 5-year mean peak)). However, this species has been screened into and assessed as part of the waterbird assemblage within the within the HRA on a precautionary basis as this species is regularly recorded on the foreshore.
Turnstone, *Arenaria interpres* (non-breeding)	Turnstone have been recorded in Sector B in regionally important numbers (i.e., in abundances representing > 10% of the estuary wide population (based on the WeBS 5-year mean peak)). This species has been screened into and assessed as part of the waterbird assemblage within the HRA.
Whimbrel, *Numenius phaeopus* (non-breeding)	This species was not specifically considered within the HRA as only 1-2 individuals have been recorded in passage during August to September 2021 and April to September 2022 respectively within the bird count sector adjacent to the proposed works (IOH Sector B) over the last five years (see Section 1.4 of Appendix A of this HRA).
Wigeon, *Anas Penelope* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Species which are not listed on the SPA citation but occur at site levels of more than 1% of the national population according to the most recent Humber Estuary Wetland Bird Survey (WeBS) 5-year average count	
Green Sandpiper, *Tringa ochropus* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Table 9.19 and Table 9.20 in Chapter 9 of the ES).
Greylag Goose, *Anser anser* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Little Egret, *Egretta garzetta* (non-breeding)1	This species was not specifically considered within the HRA as only 1-2 individual has been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) over the last five years (see Section 1.4 of Appendix A of this HRA).
Pink-footed Goose, *Anser brachyrhynchus* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).

SPA Assemblage Feature	Signpost to HRA

Appendix B

Shoveler, *Anas clypeata* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Crane, *Grus grus* (non-breeding)	This species was not specifically considered within the HRA as it has not been recorded within the bird count sector adjacent to the proposed works (IOH Sector B) for the last five years (see Section 1.4 of Appendix A of this HRA).
Non-breeding waterbirds but are listed on the citation qualifying under article 4.1 and 4.2 of the Directive	
Hen Harrier, *Circus cyaneus* (non-breeding)1	This species has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).
Marsh Harrier, *Circus aeruginosus* (breeding)	This species has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).
Little Tern, *Sterna albifrons* (breeding)	Little Tern breed at Easington Lagoon, which is located approximately 20 km from the proposed development, with data suggesting this species forages within 5 km of nesting sites. This species is considered very rare within the Immingham area and has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).
Avocet, *Recurvirostra avosetta* (breeding)	This species has been screened out of the HRA due to the lack of a viable impact pathway (see Table 2 of the HRA for further detail).

Appendix C: European/Ramsar Designated Sites Citations

STANDARD DATA FORM for sites within the 'UK national site network of European sites'

Special Protection Areas (SPAs) are classified and Special Areas of Conservation (SACs) are designated under:

- the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters);
- the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) in Scotland;
- the Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) in Northern Ireland; and
- the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in the UK offshore area.

Each SAC or SPA (forming part of the UK national site network of European sites) has its own Standard Data Form containing site-specific information. The information provided here generally follows the same documenting format for SACs and SPAs, as set out in the Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011 (2011/484/EU).

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

More general information on SPAs and SACs in the UK is available from the SPA homepage and SAC homepage on the JNCC website. These webpages also provide links to Standard Data Forms for all SAC and SPA sites in the UK.

https://jncc.gov.uk/

NATURA 2000 - STANDARD DATA FORM

For Special Protection Areas (SPA), Proposed Sites for Community Importance (pSCI), Sites of Community Importance (SCI) and for Special Areas of Conservation (SAC)

SITE **UK0030170**

SITENAME **Humber Estuary**

TABLE OF CONTENTS

1. SITE IDENTIFICATION

1.1 Type	**1.2 Site code**
B	UK0030170

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1.3 Site name

Humber Estuary

1.1 First Compilation date	1.5 Update date
2007-08	2015-12

1.6 Respondent:

Name/Organisation: Joint Nature Conservation Committee

Address: Joint Nature Conservation Committee Monkstone House City Road Peterborough PE1 1JY

Email:

Date site proposed as SCI:	2007-08
Date site confirmed as SCI:	2008-12
Date site designated as SAC:	2009-12
National legal reference of SAC designation:	Regulations 11 and 13-15 of the Conservation of Habitats and Species Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/490/contents/made).

2. SITE LOCATION

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2.1 Site-centre location [decimal degrees]:

Longitude

-0.734722222

Latitude

53.58916667

2.2 Area [ha]:

36657.15

2.3 Marine area [%]

91.6

2.4 Sitelength [km]:

0.0

2.5 Administrative region code and name

NUTS level 2 code	Region Name
UKE1	East Yorkshire and Northern Lincolnshire
UKF3	Lincolnshire
UKZZ	Extra-Regio

2.6 Biogeographical Region(s)

Atlantic (100.0 %)

3. ECOLOGICAL INFORMATION

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3.1 Habitat types present on the site and assessment for them

Annex I Habitat types						Site assessment			
Code	PF	NP	Cover [ha]	Cave [number]	Data quality	A|B|C|D	A|B|C		
						Representativity	Relative Surface	Conservation	Global
1110			1656.9	0	P	C	A	C	C
1130			36657.15	0	G	B	B	B	B
1140			9384.23	0	G	B	B	B	B
1150	X		7.33	0	G	C	C	B	C
1210				0		D			
1310			47.65	0	P	C	C	B	C
1320			135.63	0	G	D			
1330			784.46	0	G	C	B	C	C
2110			18.33	0	G	C	A	C	C

2120			14.66	0	G	C	B	C	C
2130	X		14.66	0	G	C	C	C	C
2160			65.98	0	G	C	B	C	C

- **PF:** for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter "X" in the column PF to indicate the priority form.
- **NP:** in case that a habitat type no longer exists in the site enter: x (optional) **Cover:** decimal values can be
- entered **Caves:** for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available.
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation)

3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them

Species					Population in the site						Site assessment			
G	Code	Scientific Name	S	NP	T	Size		Unit	Cat.	D.qual.	A|B|C|D	A|B|C		
						Min	Max				Pop.	Con.	Iso.	Glo.
F	1102	Alosa alosa			p				P	DD	D			
F	1103	Alosa fallax			p				P	DD	D			
M	1364	Halichoerus grypus			p	1800	1800	i		G	C	B	B	C
F	1099	Lampetra fluviatilis			p				P	DD	A	B	C	C
F	1095	Petromyzon marinus			p	251	500	i		M	B	C	C	C
M	1365	Phoca vitulina			p				P	DD	D			

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public
- access enter: yes **NP:** in case that a species is no longer present in the site enter: x (optional) **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species
- use permanent) **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see reference portal)
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are
- deficient (DD) or in addition to population size information **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field "Abundance categories" has to be filled in)

4. SITE DESCRIPTION

4.1 General site character

Habitat class	% Cover
N03	4.4
N07	0.4
N04	0.4
N02	94.9
Total Habitat Cover	100.10000000000002

Other Site Characteristics

1 Terrestrial: Soil & Geology: shingle,sedimentary,sandstone,neutral,mud,sand,alluvium,clay 2 Terrestrial: Geomorphology and landscape: coastal,floodplain,lowland 3 Marine: Geology: gravel,mud,sedimentary,sand,sandstone/mudstone,clay,shingle,limestone/chalk 4 Marine: Geomorphology: shingle bar,lagoon,islands,estuary,subtidal sediments (including sandbank/mudbank),intertidal sediments (including sandflat/mudflat),cliffs

4.2 Quality and importance

Sandbanks which are slightly covered by sea water all the time for which the area is considered to support a significant presence. Estuaries for which this is considered to be one of the best areas in the United Kingdom. Mudflats and sandflats not covered by seawater at low tide for which this is considered to be one o the best areas in the United Kingdom. Coastal lagoons for which the area is considered to support a significa presence. Salicornia and other annuals colonising mud and sand for which the area is considered to support significant presence. Atlantic salt meadows (Glauco-Puccinellietalia maritimae) for which the area is considered to support a significant presence. Embryonic shifting dunes for which the area is considered to support a significant presence. which is considered to be rare as its total extent in the United Kingdom is estimated to be less than 1000 hectares. Shifting dunes along the shoreline with Ammophila arenaria (?white dunes?) for which the area is considered to support a significant presence. Dunes with Hippophae rhamnoides for which the area is considered to support a significant presence. which is considered to be rare as its total extent in the United Kingdom is estimated to be less than 1000 hectares. Fixed dunes with herbaceous vegetation (?grey dunes?) for which the area is considered to support a significant presence. Petromyzon marinus for which the area is considered to support a significant presence. Lampet fluviatilis for which the area is considered to support a significant presence. Halichoerus grypus for which th area is considered to support a significant presence.

4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

Negative Impacts			
Rank	Threats and pressures [code]	Pollution (optional) [code]	inside/outside [i|o|b]
H	M01		B
H	E02		O
H	J02		B
H	H02		B
H	K01		I

Positive Impacts			
Rank	Activities, management [code]	Pollution (optional) [code]	inside/outside [i|o|b]
H	D05		I
H	A02		I
H	B02		I
H	A04		I

Rank: H = high, M = medium, L = low

Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,

T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

4.5 Documentation

Conservation Objectives - the Natural England links below provide access to the Conservation Objectives (and other site-related information) for its terrestrial and inshore Natura 2000 sites, including conservation advice packages and supporting documents for European Marine Sites within English waters and for cross-border sites. See also the 'UK Approach' document for more information (link via the JNCC website).

Link(s): http://publications.naturalengland.org.uk/category/6490068894089216

http://publications.naturalengland.org.uk/category/3212324
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

5. SITE PROTECTION STATUS (optional)

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5.1 Designation types at national and regional level:

Code	Cover [%]		Code	Cover [%]	Code	Cover [%]
UK01	1.8		UK04	100.0		

6. SITE MANAGEMENT

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6.1 Body(ies) responsible for the site management:

Yes

No, but in preparation X No

6.3 Conservation measures (optional)

For available information, including on Conservation Objectives, see Section 4.5.

EXPLANATION OF CODES USED IN THE SPECIAL AREA OF CONSERVATION (SAC) AND SPECIAL PROTECTION AREA (SPA) STANDARD DATA FORMS

The codes in the table below generally follow those explained in the official European Union guidelines for the Standard Data Form (also referencing the relevant page number).

1.1 Site type

CODE	DESCRIPTION	PAGE NO
A	SPA (classified Special Protection Area)	53
B	cSAC, SCI or SAC (candidate Special Area of Conservation, Site of Community Importance, designated Special Area of Conservation)	53
C	SPA area/boundary is the same as the cSAC/SCI/SAC i.e. a co-classified/designated site (Note: this situation only occurs in Gibraltar)	53

3.1 Habitat code

CODE	DESCRIPTION	PAGE NO
1110	Sandbanks which are slightly covered by sea water all the time	57
1130	Estuaries	57
1140	Mudflats and sandflats not covered by seawater at low tide	57
1150	Coastal lagoons	57
1160	Large shallow inlets and bays	57
1170	Reefs	57
1180	Submarine structures made by leaking gases	57
1210	Annual vegetation of drift lines	57
1220	Perennial vegetation of stony banks	57
1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts	57
1310	Salicornia and other annuals colonizing mud and sand	57
1320	Spartina swards (Spartinion maritimae)	57
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	57
1340	Inland salt meadows	57
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	57
2110	Embryonic shifting dunes	57
2120	Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")	57
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	57
2140	Decalcified fixed dunes with Empetrum nigrum	57
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	57
2160	Dunes with Hippopha• rhamnoides	57
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	57
2190	Humid dune slacks	57
21A0	Machairs (* in Ireland)	57
2250	Coastal dunes with Juniperus spp.	57
2330	Inland dunes with open Corynephorus and Agrostis grasslands	57
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	57
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea	57
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	57
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	57
3160	Natural dystrophic lakes and ponds	57
3170	Mediterranean temporary ponds	57
3180	Turloughs	57
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	57
4010	Northern Atlantic wet heaths with Erica tetralix	57
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	57
4030	European dry heaths	57
4040	Dry Atlantic coastal heaths with Erica vagans	57
4060	Alpine and Boreal heaths	57

4080	Sub-Arctic Salix spp. scrub	57
5110	Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)	57
5130	Juniperus communis formations on heaths or calcareous grasslands	57
6130	Calaminarian grasslands of the Violetalia calaminariae	57
6150	Siliceous alpine and boreal grasslands	57
6170	Alpine and subalpine calcareous grasslands	57
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	57
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	57
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	57
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	57
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	57
6520	Mountain hay meadows	57
7110	Active raised bogs	57
7120	Degraded raised bogs still capable of natural regeneration	57
7130	Blanket bogs (* if active bog)	57
7140	Transition mires and quaking bogs	57
7150	Depressions on peat substrates of the Rhynchosporion	57
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	57
7220	Petrifying springs with tufa formation (Cratoneurion)	57
7230	Alkaline fens	57
7240	Alpine pioneer formations of the Caricion bicoloris-atrofuscae	57
8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)	57
8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	57
8210	Calcareous rocky slopes with chasmophytic vegetation	57
8220	Siliceous rocky slopes with chasmophytic vegetation	57
8240	Limestone pavements	57
8310	Caves not open to the public	57
8330	Submerged or partially submerged sea caves	57
9120	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	57
9130	Asperulo-Fagetum beech forests	57
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	57
9180	Tilio-Acerion forests of slopes, screes and ravines	57
9190	Old acidophilous oak woods with Quercus robur on sandy plains	57
91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	57
91C0	Caledonian forest	57
91D0	Bog woodland	57
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	57
91J0	Taxus baccata woods of the British Isles	57

3.1 Habitat representativity (abbreviated to ‘Representativity’ in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent representatively	57
B	Good representatively	57
C	Significant representatively	57
D	Non-significant presence representatively	57

3.1 Relative surface

CODE	DESCRIPTION	PAGE NO
A	> 15%-100%	58
B	> 2%-15%	58
C	≤ 2%	58

3.1 Degree of conservation (abbreviated to ‘Conservation’ in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	59

B	Good conservation	59
C	Average or reduced conservation	59

3.1 Global assessment (abbreviated to 'Global' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	59
B	Good value	59
C	Significant value	59

3.2 Population (abbreviated to 'Pop.' in data form)

CODE	DESCRIPTION	PAGE NO
A	> 15%-100%	62
B	> 2%-15%	62
C	≤ 2%	62
D	Non-significant population	62

3.2 Degree of conservation (abbreviated to 'Con.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	63
B	Good conservation	63
C	Average or reduced conservation	63

3.2 Isolation (abbreviated to 'Iso.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Population (almost) Isolated	63
B	Population not-isolated, but on margins of area of distribution	63
C	Population not-isolated within extended distribution range	63

3.2 Global Grade (abbreviated to 'Glo.' or 'G.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	63
B	Good value	63
C	Significant value	63

3.3 Other species – essentially covers bird assemblage types

CODE	DESCRIPTION	PAGE NO
WATR	Non-breeding waterbird assemblage	UK specific code
SBA	Breeding seabird assemblage	UK specific code
BBA	Breeding bird assemblage (applies only to sites classified pre 2000)	UK specific code

4.1 Habitat class code

CODE	DESCRIPTION	PAGE NO
N01	Marine areas, Sea inlets	65
N02	Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	65
N03	Salt marshes, Salt pastures, Salt steppes	65
N04	Coastal sand dunes, Sand beaches, Machair	65
N05	Shingle, Sea cliffs, Islets	65
N06	Inland water bodies (Standing water, Running water)	65
N07	Bogs, Marshes, Water fringed vegetation, Fens	65
N08	Heath, Scrub, Maquis and Garrigue, Phygrana	65
N09	Dry grassland, Steppes	65
N10	Humid grassland, Mesophile grassland	65
N11	Alpine and sub-Alpine grassland	65
N14	Improved grassland	65
N15	Other arable land	65
N16	Broad-leaved deciduous woodland	65
N17	Coniferous woodland	65

4.3 Threats code

5.1 Designation type codes

STANDARD DATA FORM for sites within the 'UK national site network of European sites'

Special Protection Areas (SPAs) are classified and Special Areas of Conservation (SACs) are designated under:

- the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters);
- the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) in Scotland;
- the Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) in Northern Ireland; and
- the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in the UK offshore area.

Each SAC or SPA (forming part of the UK national site network of European sites) has its own Standard Data Form containing site-specific information. The information provided here generally follows the same documenting format for SACs and SPAs, as set out in the Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011 (2011/484/EU).

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

More general information on SPAs and SACs in the UK is available from the SPA homepage and SAC homepage on the JNCC website. These webpages also provide links to Standard Data Forms for all SAC and SPA sites in the UK.

[redacted]

NATURA 2000 - STANDARD DATA FORM

For Special Protection Areas (SPA), Proposed Sites for Community Importance (pSCI), Sites of Community Importance (SCI) and for Special Areas of Conservation (SAC)

SITE **UK9006111**

SITENAME **Humber Estuary**

TABLE OF CONTENTS

1. SITE IDENTIFICATION

1.1 Type	1.2 **Site code**
A	UK9006111

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1.3 Site name

Humber Estuary

1.1 First Compilation date	1.2 Update date
2007-08	2015-12

1.6 Respondent:

Name/Organisation: Joint Nature Conservation Committee

Address: Joint Nature Conservation Committee Monkstone House City Road Peterborough PE1 1JY

Email:

1.7 Site indication and designation / classification dates

Date site classified as SPA:	2007-08
National legal reference of SPA designation	Regulations 12A and 13-15 of the Conservation Habitats and Species Regulations 2010, (http://www.legislation.gov.uk/uksi/2010/490/contents/made) as amended by The Conservation of Habitats and Species (Amendment) Regulations 2011 (http://www.legislation.gov.uk/uksi/2011/625/contents/made) .

2. SITE LOCATION

2.1 Site-centre location [decimal degrees]:

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Longitude
0.0569

Latitude
53.5497

2.2 Area [ha]:

37630.24

2.3 Marine area [%]

89.5

2.4 Sitelength [km]:

0.0

2.5 Administrative region code and name

NUTS level 2 code	Region Name
UKZZ	Extra-Regio
UKF3	Lincolnshire
UKE1	East Yorkshire and Northern Lincolnshire

2.6 Biogeographical Region(s)

Atlantic (100.0 %)

3. ECOLOGICAL INFORMATION

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3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them

Species					Population in the site						Site assessment		
G	Code	Scientific Name	S	NP	T	Size		Unit	Cat.	D.qual.	A|B|C|D	A|B|C	
						Min	Max				Pop.	Con.	Iso.
B	A052	Anas crecca			w	2322	2322	i		G	C		C
B	A050	Anas penelope			w	5044	5044	i		G	C		C
B	A053	Anas platyrhynchos			w	2456	2456	i		G	C		C
B	A169	Arenaria interpres			w	629	629	i		G	C		C
B	A059	Aythya ferina			w	719	719	i		G	C		C
B	A062	Aythya marila			w	127	127	i		G	C		C
B	A021	Botaurus stellaris			r	2	2	cmales	P	G	B		C
B	A021	Botaurus stellaris			w	4	4	i		G	B		C
B	A675	Branta bernicla			w	2098	2098	i		G	C		C

		bernicla											
B	A067	Bucephala clangula			w	467	467	i		G	B		C
B	A144	Calidris alba			c	818	818	i		G	B		C
B	A144	Calidris alba			w	486	486	i		G	B		C
B	A672	Calidris alpina alpina			c	20269	20269	i		G	B		C
B	A672	Calidris alpina alpina			w	22222	22222	i		G	B		C
B	A143	Calidris canutus			w	28165	28165	i		G	B		C
B	A143	Calidris canutus			c	18500	18500	i		G	B		C
B	A137	Charadrius hiaticula			c	1766	1766	i		G	C		C
B	A137	Charadrius hiaticula			w	403	403	i		G	C		C
B	A081	Circus aeruginosus			r	10	10	bfemales	P	G	B		B
B	A082	Circus cyaneus			w	8	8	i		G	C		C
B	A130	Haematopus ostralegus			w	3503	3503	i		G	C		C
B	A157	Limosa lapponica			w	2752	2752	i		G	B		C
B	A616	Limosa limosa islandica			w	1113	1113	i		G	B		C
B	A616	Limosa limosa islandica			c	915	915	i		G	B		C
B	A160	Numenius arquata			w	3253	3253	i		G	C		C
B	A158	Numenius phaeopus			c	113	113	i		G	C		C
B	A151	Philomachus pugnax			c	128	128	i		G	C		C
B	A140	Pluvialis apricaria			w	30709	30709	i		G	B		C
B	A141	Pluvialis squatarola			w	1704	1704	i		G	B		C
B	A141	Pluvialis squatarola			c	1590	1590	i		G	B		C
B	A132	Recurvirostra avosetta			w	59	59	i		G	C		B
B	A132	Recurvirostra avosetta			r	64	64	p		G	C		B
B	A195	Sterna albifrons			r	51	51	p		G	B		C
B	A048	Tadorna tadorna			w	4464	4464	i		G	B		C
B	A164	Tringa nebularia			c	77	77	i		G	C		C
B	A162	Tringa totanus			w	4632	4632	i		G	B		C

B	A162	Tringa totanus			c	7462	7462	i		G	B		C
B	A142	Vanellus vanellus			w	22765	22765	i		G	C		C

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public
- access enter: yes **NP:** in case that a species is no longer present in the site enter: x (optional) **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species
- use permanent) **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see reference portal)
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are
- deficient (DD) or in addition to population size information **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field "Abundance categories" has to be filled in)

3.3 Other important species of flora and fauna (optional)

Species					Population in the site				Motivation					
Group	CODE	Scientific Name	S	NP	Size		Unit	Cat.	Species Annex		Other categories			
					Min	Max		C|R|V|P	IV	V	A	B	C	D
B	WATR	Waterbird assemblage			153934	153934	i						X	

- **Group:** A = Amphibians, B = Birds, F = Fish, Fu = Fungi, I = Invertebrates, L = Lichens, M =
- Mammals, P = Plants, R = Reptiles **CODE:** for Birds, Annex IV and V species the code as provided in
- the reference portal should be used in addition to the scientific name **S:** in case that the data on
- species are sensitive and therefore have to be blocked for any public access enter: yes **NP:** in case
- that a species is no longer present in the site enter: x (optional) **Unit:** i = individuals, p = pairs or other units according to the standard list of population units and codes in accordance with Article 12 and 17
- reporting, (see reference portal) **Cat.:** Abundance categories: C = common, R = rare, V = very rare, P =
- present **Motivation categories: IV, V:** Annex Species (Habitats Directive), **A:** National Red List data; **B:** Endemics; **C:** International Conventions; **D:** other reasons

4. SITE DESCRIPTION

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4.1 General site character

Habitat class	% Cover
N06	0.6
N03	4.6
N04	0.8
N02	93.6
N07	0.3
Total Habitat Cover	99.89999999999998

Other Site Characteristics

1 Terrestrial: Soil & Geology: mud,shingle,alluvium,sandstone,sand,neutral,clay,limestone,sedimentary,sandstone,shingle,sand,neu Terrestrial: Geomorphology and landscape: lowland,floodplain,coastal,lowland,floodplain,coastal 3 Marine: Geology: sand,gravel,mud,sedimentary,clay,sandstone/mudstone,shingle,limestone/chalk,clay,sedimentary,san Marine: Geomorphology: shingle bar,islands,intertidal sediments (including sandflat/mudflat),cliffs,estuary,intertidal sediments (including sandflat/mudflat),islands,lagoon,estuary,subtidal sediments (including sandbank/mudbank),shingle bar,cliffs

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC) During the breeding season the area regularly supports: Botaurus stellaris (Europe - breeding) 10.5% of the population in Great Britain 2000-2002 Circu aeruginosus 6.3% of the population in Great Britain 1998-2002 Recurvirostra avosetta (Western Europe/Western Mediterranean - breeding) 8.6% of the population in Great Britain 1998-2002 Sterna albifro (Eastern Atlantic - breeding) 2.1% of the population in Great Britain 1998-2002 Over winter the area regular supports: Botaurus stellaris (Europe - breeding) 4% of the population in Great Britain 1998/9 to 2002/3 C cyaneus 1.1% of the population in Great Britain 1997/8 to 2001/2 Limosa lapponica (Western Palearctic - wintering) 4.4% of the population in Great Britain 1996/7 to 2000/1 Pluvialis apricaria [North-western Europe breeding] 12.3% of the population in Great Britain 1996/7 to 2000/1 Recurvirostra avosetta (Western Europe/Western Mediterranean - breeding) 1.7% of the population in Great Britain 1996/7 to 2000/1 On passage the area regularly supports: Philomachus pugnax (Western Africa - wintering) 1.4% of the populatio in Great Britain 1996-2000 ARTICLE 4.2 QUALIFICATION (79/409/EEC) Over winter the area regularly supports: Calidris alpina alpina (Northern Siberia/Europe/Western Africa) 1.7% of the population 1996/7 to 2000/1 Calidris canutus (North-eastern Canada/Greenland/Iceland/North-western Europe) 6.3% of the population 1996/7 to 2000/1 Limosa limosa islandica (Iceland - breeding) 3.2% of the population 1996/7 to 2000/1 Tadorna tadorna (North-western Europe) 1.5% of the population 1996/7 to 2000/1 Tringa totanus (Eastern Atlantic - wintering) 3.6% of the population 1996/7 to 2000/1 On passage the area regularly supports: Calidris alpina alpina (Northern Siberia/Europe/Western Africa) 1.5% of the population 1996-2000 Calidris canutus (North-eastern Canada/Greenland/Iceland/North-western Europe) 4. of the population 1996-2000 Limosa limosa islandica (Iceland - breeding) 2.6% of the population 1996-2000 Tringa totanus (Eastern Atlantic - wintering) 5.7% of the population 1996-2000 A 4.2 QUALIFICATION (79/409/EEC): AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS Over winter the area regularly supports: 153934 waterfowl (5 year peak mean 1991/92-1995/96) Including: Bota stellaris , Branta bernicla bernicla , Tadorna tadorna , Anas penelope , Anas crecca , Anas platyrhynchos , Aythya ferina , Aythya marila , Bucephala clangula , Haematopus ostralegus , Recurvirostra avosetta , Charadrius hiaticula , Pluvialis apricaria [North-western Europe - breeding], Pluvialis squatarola , Vanellus vanellus , Calidris canutus , Calidris alba , Calidris alpina alpina , Philomachus pugnax , Limosa limosa islandica , Limosa lapponica , Numenius phaeopus , Numenius arquata , Tringa totanus , Tringa nebularia , Arenaria interpres

4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

Negative Impacts			
Rank	Threats and pressures [code]	Pollution (optional) [code]	inside/outside [i|o|b]
H	K01		I
H	I01		B
H	G01		I
H	M02		B
H	M01		B

Positive Impacts			
Rank	Activities, management [code]	Pollution (optional) [code]	inside/outside [i|o|b]
H	A02		I
H	D05		I
H	B02		I
H	D05		I
H	A04		I
H	A03		I

Rank: H = high, M = medium, L = low

Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification, T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions i = inside, o = outside, b = both

4.5 Documentation

Conservation Objectives - the Natural England links below provide access to the Conservation Objectives (and other site-related information) for its terrestrial and inshore Natura 2000 sites, including conservation advice packages and supporting documents for European Marine Sites within English waters and for cross-border sites. See also the 'UK Approach' document for more information (link via the JNCC

Link(s): http://publications.naturalengland.org.uk/category/6490068894089216

http://publications.naturalengland.org.uk/category/3212324
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

5. SITE PROTECTION STATUS (optional)

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5.1 Designation types at national and regional level:

Co
UK

6.

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6.1 Body(ies) responsible for the site management:

Organisation: Address: Email:	Natural England

6.2 Management Plan(s):

An actual management plan does exist:

☐
☐

Yes

No, but in preparation X No

6.3 Conservation measures (optional)

For available information, including on Conservation Objectives, see Section 4.5.

7. MAP OF THE SITES

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INSPIRE ID:

Map delivered as PDF in electronic format (optional)

X

Yes No Reference(s) to the original map used for the digitalisation of the electronic boundaries (optional).

EXPLANATION OF CODES USED IN THE SPECIAL AREA OF CONSERVATION (SAC) AND SPECIAL PROTECTION AREA (SPA) STANDARD DATA FORMS

The codes in the table below generally follow those explained in the official European Union guidelines for the Standard Data Form (also referencing the relevant page number).

1.1 Site type

CODE	DESCRIPTION	PAGE NO
A	SPA (classified Special Protection Area)	53
B	cSAC, SCI or SAC (candidate Special Area of Conservation, Site of Community Importance, designated Special Area of Conservation)	53
C	SPA area/boundary is the same as the cSAC/SCI/SAC i.e. a co-classified/designated site (Note: this situation only occurs in Gibraltar)	53

3.1 Habitat code

CODE	DESCRIPTION	PAGE NO
1110	Sandbanks which are slightly covered by sea water all the time	57
1130	Estuaries	57
1140	Mudflats and sandflats not covered by seawater at low tide	57
1150	Coastal lagoons	57
1160	Large shallow inlets and bays	57
1170	Reefs	57
1180	Submarine structures made by leaking gases	57
1210	Annual vegetation of drift lines	57
1220	Perennial vegetation of stony banks	57
1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts	57
1310	Salicornia and other annuals colonizing mud and sand	57
1320	Spartina swards (Spartinion maritimae)	57
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	57
1340	Inland salt meadows	57
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	57
2110	Embryonic shifting dunes	57
2120	Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")	57
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	57
2140	Decalcified fixed dunes with Empetrum nigrum	57
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	57
2160	Dunes with Hippopha• rhamnoides	57
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	57
2190	Humid dune slacks	57
21A0	Machairs (* in Ireland)	57
2250	Coastal dunes with Juniperus spp.	57
2330	Inland dunes with open Corynephorus and Agrostis grasslands	57
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	57
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea	57
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	57
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	57
3160	Natural dystrophic lakes and ponds	57
3170	Mediterranean temporary ponds	57
3180	Turloughs	57
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	57
4010	Northern Atlantic wet heaths with Erica tetralix	57
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	57
4030	European dry heaths	57
4040	Dry Atlantic coastal heaths with Erica vagans	57
4060	Alpine and Boreal heaths	57

4080	Sub-Arctic Salix spp. scrub	57
5110	Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)	57
5130	Juniperus communis formations on heaths or calcareous grasslands	57
6130	Calaminarian grasslands of the Violetalia calaminariae	57
6150	Siliceous alpine and boreal grasslands	57
6170	Alpine and subalpine calcareous grasslands	57
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	57
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	57
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	57
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	57
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	57
6520	Mountain hay meadows	57
7110	Active raised bogs	57
7120	Degraded raised bogs still capable of natural regeneration	57
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8220	Siliceous rocky slopes with chasmophytic vegetation	57
8240	Limestone pavements	57
8310	Caves not open to the public	57
8330	Submerged or partially submerged sea caves	57
9120	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	57
9130	Asperulo-Fagetum beech forests	57
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	57
9180	Tilio-Acerion forests of slopes, screes and ravines	57
9190	Old acidophilous oak woods with Quercus robur on sandy plains	57
91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	57
91C0	Caledonian forest	57
91D0	Bog woodland	57
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	57
91J0	Taxus baccata woods of the British Isles	57

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B	Good representatively	57
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D	Non-significant presence representatively	57

3.1 Relative surface

CODE	DESCRIPTION	PAGE NO
A	> 15%-100%	58
B	> 2%-15%	58
C	≤ 2%	58

3.1 Degree of conservation (abbreviated to ‘Conservation’ in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	59

B	Good conservation	59
C	Average or reduced conservation	59

3.1 Global assessment (abbreviated to 'Global' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	59
B	Good value	59
C	Significant value	59

3.2 Population (abbreviated to 'Pop.' in data form)

CODE	DESCRIPTION	PAGE NO
A	> 15%-100%	62
B	> 2%-15%	62
C	≤ 2%	62
D	Non-significant population	62

3.2 Degree of conservation (abbreviated to 'Con.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	63
B	Good conservation	63
C	Average or reduced conservation	63

3.2 Isolation (abbreviated to 'Iso.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Population (almost) Isolated	63
B	Population not-isolated, but on margins of area of distribution	63
C	Population not-isolated within extended distribution range	63

3.2 Global Grade (abbreviated to 'Glo.' or 'G.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	63
B	Good value	63
C	Significant value	63

3.3 Other species – essentially covers bird assemblage types

CODE	DESCRIPTION	PAGE NO
WATR	Non-breeding waterbird assemblage	UK specific code
SBA	Breeding seabird assemblage	UK specific code
BBA	Breeding bird assemblage (applies only to sites classified pre 2000)	UK specific code

4.1 Habitat class code

CODE	DESCRIPTION	PAGE NO
N01	Marine areas, Sea inlets	65
N02	Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	65
N03	Salt marshes, Salt pastures, Salt steppes	65
N04	Coastal sand dunes, Sand beaches, Machair	65
N05	Shingle, Sea cliffs, Islets	65
N06	Inland water bodies (Standing water, Running water)	65
N07	Bogs, Marshes, Water fringed vegetation, Fens	65
N08	Heath, Scrub, Maquis and Garrigue, Phygrana	65
N09	Dry grassland, Steppes	65
N10	Humid grassland, Mesophile grassland	65
N11	Alpine and sub-Alpine grassland	65
N14	Improved grassland	65
N15	Other arable land	65
N16	Broad-leaved deciduous woodland	65
N17	Coniferous woodland	65

N19	Mixed woodland	65
N21	Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas)	65
N22	Inland rocks, Screes, Sands, Permanent Snow and ice	65
N23	Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites)	65
N25	Grassland and scrub habitats (general)	65
N26	Woodland habitats (general)	65

4.3 Threats code

CODE	DESCRIPTION	PAGE NO
A01	Cultivation	65
A02	Modification of cultivation practices	65
A03	Mowing / cutting of grassland	65
A04	Grazing	65
A05	Livestock farming and animal breeding (without grazing)	65
A06	Annual and perennial non-timber crops	65
A07	Use of biocides, hormones and chemicals	65
A08	Fertilisation	65
A10	Restructuring agricultural land holding	65
A11	Agriculture activities not referred to above	65
B01	Forest planting on open ground	65
B02	Forest and Plantation management & use	65
B03	Forest exploitation without replanting or natural regrowth	65
B04	Use of biocides, hormones and chemicals (forestry)	65
B06	Grazing in forests/ woodland	65
B07	Forestry activities not referred to above	65
C01	Mining and quarrying	65
C02	Exploration and extraction of oil or gas	65
C03	Renewable abiotic energy use	65
D01	Roads, paths and railroads	65
D02	Utility and service lines	65
D03	Shipping lanes, ports, marine constructions	65
D04	Airports, flightpaths	65
D05	Improved access to site	65
E01	Urbanised areas, human habitation	65
E02	Industrial or commercial areas	65
E03	Discharges	65
E04	Structures, buildings in the landscape	65
E06	Other urbanisation, industrial and similar activities	65
F01	Marine and Freshwater Aquaculture	65
F02	Fishing and harvesting aquatic ressources	65
F03	Hunting and collection of wild animals (terrestrial), including damage caused by game (excessive density), and taking/removal of terrestrial animals (including collection of insects, reptiles, amphibians, birds of prey, etc., trapping, poisoning, poaching, predator control, accidental capture (e.g. due to fishing gear), etc.)	65
F04	Taking / Removal of terrestrial plants, general	65
F05	Illegal taking/ removal of marine fauna	65
F06	Hunting, fishing or collecting activities not referred to above	65
G01	Outdoor sports and leisure activities, recreational activities	65
G02	Sport and leisure structures	65
G03	Interpretative centres	65
G04	Military use and civil unrest	65
G05	Other human intrusions and disturbances	65
H01	Pollution to surface waters (limnic & terrestrial, marine & brackish)	65
H02	Pollution to groundwater (point sources and diffuse sources)	65
H03	Marine water pollution	65
H04	Air pollution, air-borne pollutants	65
H05	Soil pollution and solid waste (excluding discharges)	65

5.1 Designation type codes

Information Sheet on Ramsar Wetlands (RIS)

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

---

1. Name and address of the compiler of this form:

FOR OFFICE USE ONLY. DD MM YY

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough
Cambridgeshire PE1 1JY
UK

Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948
Email: RIS@JNCC.gov.uk

Designation date

Site Reference Number

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2. Date this sheet was completed/updated:

Designated: 31 August 2007

---

3. Country:

UK (England)

---

4. Name of the Ramsar site:

Humber Estuary

---

5. Designation of new Ramsar site or update of existing site:

This RIS is for: Updated information on an existing Ramsar site

---

6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area:

The boundary has been extended

** Important note: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including

in the application of the Criteria, since the previous RIS for the site:

7. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

i) **hard copy** (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* □;
ii) **an electronic format** (e.g. a JPEG or ArcView image) Yes
iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** *yes* ✓ -or- *no* □;

b) Describe briefly the type of boundary delineation applied:
e.g. the boundary is the same as an existing protected area (nature reserve, national park etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The site boundary is the same as, or falls within, an existing protected area.

For precise boundary details, please refer to paper map provided at

designation

8. Geographical coordinates (latitude/longitude): 053 32 59 N 000 00 03 E

9. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Kingston-upon-Hull

The Humber Estuary is located on the boundary between the East Midlands Region and the Yorkshire and the Humber Region, on the east coast of England bordering the North Sea.

Administrative region: City of Kingston upon Hull; East Riding of Yorkshire; Humberside; Lincolnshire; North East Lincolnshire; North Lincolnshire

10. Elevation (average and/or max. & min.) (metres): **11. Area** (hectares): 37987.8

Min. -13
Max. 10
Mean No information available

12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The Humber Estuary is the largest macro-tidal estuary on the British North Sea coast. It drains a catchment of some 24,240 square kilometres and is the site of the largest single input of freshwater from Britain into the North Sea. It has the second-highest tidal range in Britain (max 7.4 m) and approximately one-third of the estuary is exposed as mud or sand flats at low tide. The inner estuary supports extensive areas of reedbed with areas of mature and developing saltmarsh backed in places by limited areas of grazing marsh in the middle and outer estuary. On the north Lincolnshire coast the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools. The Estuary regularly supports internationally important numbers of waterfowl in winter and nationally important breeding populations in summer.

13. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

1, 3, 5, 6, 8

14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 1

The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.

It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. Wave exposed sandy shores are found in the outer/open coast areas of the estuary. These change to the more moderately exposed sandy shores and then to sheltered muddy shores within the main body of the estuary and up into the tidal rivers. The lower saltmarsh of the Humber is dominated by common cordgrass *Spartina anglica* and annual glasswort *Salicornia* communities. Low to mid marsh communities are mostly represented by sea aster *Aster tripolium*, common saltmarsh grass *Puccinellia maritima* and sea purslane *Atriplex portulacoides* communities. The upper portion of the saltmarsh community is atypical, dominated by sea couch *Elytrigia atherica* (*Elymus pycnanthus*) saltmarsh community. In the upper reaches of the estuary, the tidal marsh community is dominated by the common reed *Phragmites australis* fen and sea club rush *Bolboschoenus maritimus* swamp with the couch grass *Elytrigia repens (Elymus repens)* saltmarsh community. Within the Humber Estuary Ramsar site there are good examples of four of the five physiographic types of saline lagoon.

Ramsar criterion 3

The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*.

Ramsar criterion 5

Assemblages of international importance:

153,934 waterfowl, non-breeding season

(5 year peak mean 1996/97-2000/2001)

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Eurasian golden plover, *Pluvialis apricaria*

altifrons subspecies – NW Europe, W Continental Europe, NW Africa population

17,996 individuals, passage, representing an average of 2.2% of the population

(5 year peak mean 1996-2000)

Red knot, *Calidris canutus islandica* subspecies

18,500 individuals, passage, representing an average of 4.1% of the population

(5 year peak mean 1996-2000) Dunlin, *Calidris alpina*

alpina subspecies – Western Europe (non-breeding) population

20,269 individuals, passage, representing an average of 1.5% of the population

(5 year peak mean 1996-2000)

Black-tailed godwit, *Limosa limosa*
islandica subspecies
915 individuals, passage, representing and average of 2.6% of the population
(5 year peak mean 1996-2000)

Common redshank, *Tringa totanus*
brittanica subspecies
7,462 individuals, passage, representing an average of 5.7% of the population
(5 year peak mean 1996-2000)

Common shelduck, *Tadorna tadorna*
Northwestern Europe (breeding) population
4,464 individuals, wintering, representing an average of 1.5% of the population
(5 year peak mean 1996/7-2000/1)

Eurasian golden plover, *Pluvialis apricaria*
altifrons subspecies – NW Europe, W Continental Europe, NW Africa population
30,709 individuals, wintering, representing an average of 3.8% of the population
(5 year peak mean 1996/7-2000/1)

Red knot, *Calidris canutus islandica* subspecies
28,165 individuals, wintering, representing an average of 6.3% of the population
(5 year peak mean 1996/7-2000/1)

Dunlin, *Calidris alpina*
alpina subspecies – Western Europe (non-breeding) population
22,222 individuals, wintering, representing an average of 1.7% of the population
(5 year peak mean 1996/7-2000/1)

Black-tailed godwit, *Limosa limosa*
islandica subspecies
1,113 individuals, wintering, representing an average of 3.2% of the population
(5 year peak mean 1996/7-2000/1)

Bar-tailed godwit , *Limosa lapponica*
lapponica subspecies
2,752 individuals, wintering, representing an average of 2.3% of the population
(5 year peak mean 1996/7-2000/1)

Common redshank, *Tringa totanus*
brittanica subspecies
4,632 individuals, wintering, representing an average of 3.6% of the population
(5 year peak mean 1996/7-2000/1)

Ramsar criterion 8

The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas. Ramsar criterion 5

Assemblages of international importance:

Species with peak counts in winter:
153934 waterfowl (5 year peak mean 1998/99-2002/2003)

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Qualifying Species/populations (as identified at designation):

Species with peak counts in spring/autumn:

European golden plover , *Pluvialis apricaria apricaria*, P. a. altifrons Iceland & Faroes/E Atlantic	17996 individuals, representing an average of 2.2% of the population (1996-2000)
Red knot , *Calidris canutus islandica*, W & Southern Africa (wintering)	18500 individuals, representing an average of 4.1% of the population (1996-2000)
Dunlin , *Calidris alpina alpina*, W Siberia/W Europe	20269 individuals, representing an average of 1.5% of the population (1996-2000)
Black-tailed godwit , *Limosa limosa islandica*, Iceland/W Europe	915 individuals, representing an average of 2.6% of the population (1996-2000)
Common redshank , *Tringa totanus totanus*,	7462 individuals, representing an average of 5.7% of the population (1996-2000)

Species with peak counts in winter:

Common shelduck , *Tadorna tadorna*, NW Europe	4464 individuals, representing an average of 1.5% of the population (1996/7 to 2000/1)
European golden plover , *Pluvialis apricaria apricaria*, P. a. altifrons Iceland & Faroes/E Atlantic	
Red knot , *Calidris canutus islandica*, W & Southern Africa (wintering)	
Dunlin , *Calidris alpina alpina*, W Siberia/W Europe	

Black-tailed godwit , *Limosa limosa islandica*, Iceland/W Europe	1113 individuals, representing an average of 3.2% of the population (1996/7 to 2000/1)
Bar-tailed godwit , *Limosa lapponica lapponica*, W Palearctic	2752 individuals, representing an average of 2.3% of the population (1996/7 to 2000/1)

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.
See Sections 21/22 for details of noteworthy species Details of bird species occuring at levels of National importance are given in Section 22

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15. **Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation)**:**

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

Atlantic

b) biogeographic regionalisation scheme (include reference citation):

Council Directive 92/43/EEC

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16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Soil & geology	neutral, shingle, sand, mud, clay, alluvium, sedimentary, sandstone, sandstone/mudstone, limestone/chalk, gravel, nutrient-rich
Geomorphology and landscape	lowland, coastal, floodplain, shingle bar, intertidal sediments (including sandflat/mudflat), estuary, islands, cliffs
Nutrient status	eutrophic
pH	circumneutral
Salinity	brackish / mixosaline, fresh, saline / euhaline
Soil	mainly mineral
Water permanence	usually permanent
Summary of main climatic features	Annual averages (Cleethorpes, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/cleethorpes.html) Max. daily temperature: 13.1° C Min. daily temperature: 6.4° C Days of air frost: 29.0 Rainfall: 565.4 mm Hrs. of sunshine: 1521.9

General description of the Physical Features:

The Humber estuary is approximately 70 km long from the limit of saline intrusion on the River Ouse at Boothferry to the estuary mouth at Spurn Head, where it enters the North Sea. The area of the estuary is approx. 365 km2, and it has a width of 6.6 km at the mouth.

The Humber is a macro-tidal estuary with a tidal range of 7.4 m, the second-largest range in the UK and comparable to other macro-tidal estuaries worldwide. It is a shallow and well mixed estuary, with an average depth of 6.5m rising to 13.2 m at the mouth.

The Humber is the second-largest coastal plain estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. Suspended sediment concentrations are high, and are derived from a variety of sources, including marine sediments and eroding boulder clay along the Holderness coast. This is the northernmost of the English east coast estuaries whose structure and function is intimately linked with soft eroding shorelines.

Upstream from the Humber Bridge, the navigation channel undergoes major shifts from north to south banks. This section of the estuary is noteworthy for extensive mud and sand bars, which in places form semi-permanent islands.

The estuary covers the full salinity range from fully marine at the mouth of the estuary (Spurn Head) to the limit of saline intrusion on the Rivers Ouse and Trent)). A salinity gradient from north to south bank is observed in the outer estuary, due to the incoming tide flowing along the north bank, while the fresh water keeps to the south bank as it discharges to the sea. As salinity declines upstream, reedbeds and brackish saltmarsh communities fringe the estuary..

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17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The Humber catchment covers an area of ca. 24,240 km2, more than 20% of the land area of England. Average annual precipitation in the upland areas of the catchment is as much as 1000 mm. Average freshwater flow into the Humber estuary from the rivers is 250 m3s-1, ranging from 60 m3s-1 in drier periods to 450 m3s-1 in wet periods. Peak flows of up to 1500 m3s-1 have been recorded during floods. The rivers Trent and Ouse, which provide the main fresh water flow into the Humber, drain large industrial and urban areas to the south and west (River Trent), and less densely populated agricultural areas to the north and west (River Ouse). The Trent/Ouse confluence is known as Trent Falls.

On the north bank of the Humber estuary the principal river is the river Hull, which flows through the city of Kingston-upon-Hull, and has a tidal length of 32 km, up to the Hempholme Weir. The Hull provides only about 1% of the freshwater input to the estuary. On the south bank, the River Ancholme enters the Humber at South Ferriby, but the tide is excluded by a sluice and a tidal lock. Altogether, the total tidal length of rivers and estuary is 313 km.

There are several major urban centres within the river catchments. Nottingham, Leicester, and the West Midlands/Birmingham conurbation are drained by the Trent, the Leeds-Bradford area in West Yorkshire is drained by the Aire/Calder and the Sheffield/Rotherham/Doncaster area in South Yorkshire is drained by the Don. There are also large rural regions, whose populations are currently experiencing high population growth, while the urban areas are showing a small decline. The 1992 population for the Ouse catchment was 4.1 million, and for the Trent catchment was 7.1 million. The population of Humberside, which comprises North and North-east Lincolnshire, the East Riding of Yorkshire, and Kingston-upon-Hull (Hull), was just under 0.9 million. Land use around the estuary itself is 50-98% agricultural, within only two areas of high population/ industry – the major conurbation around Kingston-upon-Hull (Hull) on the north bank, and several large industrial areas around Grimsby/ Immingham/ Cleesthorpes on the south bank.

The area around the Humber estuary is low-lying, and much land-claim of wetlands and supratidal zones, as well as parts of the intertidal zone, was carried out in the past two centuries. The mid to outer estuary (Humber Bridge to Spurn Point) changed from a region of low water erosion in the 19th century to one of accretion in the 20th century, nonetheless a net loss of intertidal zone of some 3000 ha has taken place since the mid-19th century. Around the estuary some 894 km2 of land are below the 5 m contour, protected by extensive coastal defences. Most of the sediment entering the estuary comes from the North Sea, and a large part of it is believed to come from the continuing erosion of the Holderness Cliffs, which form the coastline to the north of the estuary mouth at Spurn Head. The estuary currently has approximately 1,775 ha of saltmarsh

18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Sediment trapping

19. Wetland types:

Marine/coastal wetland

Code	Name	% Area
F	Estuarine waters	66.8
G	Tidal flats	26.4
H	Salt marshes	4.7
E	Sand / shingle shores (including dune systems)	0.8
7	Gravel / brick / clay pits	0.5
Q	Saline / brackish lakes: permanent	0.3
J	Coastal brackish / saline lagoons	0.3
Other	Other	0.1
9	Canals and drainage channels	0.01
Y	Freshwater springs	0.01

20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

Description

Much of the intertidal area of the Humber Estuary consists of mudflats with fringing saltmarsh. There are smaller areas of intertidal sand flats, and sand dunes. The saltmarsh is both eroding and accreting; although coastal squeeze is resulting in net losses, and cord grass Spartina anglica is a major colonising species. In areas of reduced salinity such as the Upper Humber there are extensive areas of common reed Phragmites australis with some sea club-rush Bolboschoenus maritimus. Mid-level saltmarsh tends to be much more floristically diverse, and in the higher level marsh with its dendritic network of drainage channels, salt pans and borrow pits grasses dominate with thrift Armeria maritima where the marsh is grazed by cattle and sheep. Extensive areas of eel grass Zostera marina and Z. nolti have been known to occur at Spurn Bight, although in recent years records are limited.

Behind the sandflats of the Cleethorpes coast the mature sand-dune vegetation contains some locally and nationally rare species including chestnut flat sedge Blysmus rufus, bulbous meadow grass Poa bulbosa and dense silky-bent Apera interrupta. The sand dunes, which cap the shingle spit that forms Spurn Peninsula are dominated by marram grass Ammophila arenaria and patches of dense sea buckthorn Hippophae rhamnoides.

Ecosystem services

Aesthetic Education

Food

Recreation Storm/wave protection

21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

None reported

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

Birds

Species Information Species
Information Birds Species currently occurring at levels of national importance:

Great bittern, *Botaurus stellaris stellaris* subspecies – W Europe, NW Africa (breeding) population 2 booming males, breeding, representing an average of 10.5% of the GB population (3 year mean 2000-2002)

Eurasian marsh harrier, *Circus aeruginosus* Europe population 10 females, breeding, representing an average of 6.3% of the GB population (5 year mean 1998-2002)

Pied avocet, *Recurvirostra avosetta* Western Europe (breeding) population 64 pairs, breeding, representing an average of 8.6% of the GB population (5 year mean 1998-2002)

Little tern, *Sterna albifrons albifrons* subspecies, Western Europe (breeding) population 51 pairs, breeding, representing an average of 2.1% of the GB population (5 year mean 1998-2002)

Dark-bellied brent goose, *Branta bernicla*
bernicla subspecies
2,098 individuals, wintering, representing an average of 2.1% of the GB population
(5 year peak mean 1996/7-2000/1)

Eurasian wigeon, *Anas penelope* Northwestern Europe (non-breeding) population 5,044 individuals, wintering, representing an average of 1.2% of the GB population (5 year peak mean 1996/7-2000/1)

Common teal, *Anas crecca crecca* subspecies, Northwestern Europe (non-breeding population) 2,322 individuals, wintering, representing an average of 1.2% of the GB population
(5 year peak mean 1996/7-2000/1)

Common pochard, *Aythya ferina* Northeastern & Northwestern Europe (non-breeding) population 719 individuals, wintering, representing an average of 1.2% of the GB population (5 year peak mean 1996/7-2000/1)

Greater scaup, *Aythya marila marila* subspecies, Western Europe (non-breeding) population 127 individuals, wintering, representing an average of 1.7% of the GB population (5 year peak mean 1996/7-2000/1)

Common goldeneye, *Bucephala clangula clangula* subspecies, Northwestern & Central Europe (non-breeding) population 467 individuals, wintering, representing an average of 1.9% of the GB population (5 year peak mean 1996/7-2000/1)

Great bittern, *Botaurus stellaris stellaris* subspecies – W Europe, NW Africa (breeding) population 4 individuals, wintering, representing an average of 4.0% of the GB population (5 year peak mean 1998/9-2002/3)

Hen harrier, *Circus cyaneus* Europe population 8 individuals, wintering, representing an average of 1.1% of the GB population (5 year peak mean 1997/8-2001/2)

Eurasian oystercatcher, *Haematopus ostralegus*
ostralegus subspecies
3,503 individuals, wintering, representing an average of 1.1% of the GB population
(5 year peak mean 1996/7-2000/1)

Pied avocet, *Recurvirostra avosetta* Western Europe (breeding) population 59 individuals, wintering, representing an average of 1.7% of the GB population (5 year peak mean 1996/7-2000/1)

Great ringed plover, *Charadrius hiaticula*
hiaticula subspecies
403 individuals, wintering, representing an average of 1.2% of the GB population
(5 year peak mean 1996/7-2000/1)

Grey plover, *Pluvialis squatarola squatarola* subspecies, Eastern Atlantic (non-breeding) population 1,704 individuals, wintering, representing an average of 3.2% of the GB population (5 year peak mean 1996/7-2000/1)

Northern lapwing, *Vanellus vanellus* Europe (breeding) population 22,765 individuals, wintering, representing an average of 1.1% of the GB population (5 year peak mean 1996/7-2000/1)

Sanderling, *Calidris alba* Eastern Atlantic (non-breeding) population 486 individuals, wintering, representing an average of 2.3% of the GB population (5 year peak mean 1996/7-2000/1)

Curlew, *Numenius arquata arquata* subspecies
3,253 individuals, wintering, representing an average of 2.2% of the GB population
(5 year peak mean 1996/7-2000/1)

Ruddy turnstone, *Arenaria interpres interpres* subspecies, Northeastern Canada & Greenland (breeding) population 629 individuals, wintering, representing an average of 1.3% of the GB population (5 year peak mean 1996/7-2000/1)

Great ringed plover, *Charadrius hiaticula*
psammodroma subspecies
1,766 individuals, passage, representing an average of 5.9% of the GB population
(5 year peak mean 1996-2000)

Grey plover, *Pluvialis squatarola squatarola* subspecies, Eastern Atlantic (non-breeding) population 1,590 individuals, passage, representing an average of 2.3% of the GB population (5 year peak mean 1996-2000)

Sanderling, *Calidris alba* Eastern Atlantic (non-breeding) population 818 individuals, passage, representing an average of 2.7% of the GB population (5 year peak mean 1996-2000)

Ruff, *Philomachus pugnax* Western Africa (non-breeding) population 128 individuals, passage, representing an average of 1.4% of the GB population (5 year peak mean 1996-2000)

Whimbrel, *Numenius phaeopus*
islandicus subspecies
113 individuals, passage, representing an average of 2.3% of the GB population
(5 year peak mean 1996-2000)

Common greenshank, *Tringa nebularia* Northwestern Europe (breeding) population 77 individuals, passage, representing an average of 5.5% of the GB population (5 year peak mean 1996-2000)

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23. Social and cultural values:

Describe if the site has any general social and/or cultural values e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic Aquatic vegetation (e.g. reeds, willows, seaweed) Archaeological/historical site Environmental education/ interpretation Fisheries production Livestock grazing Non-consumptive recreation Sport fishing Sport hunting Tourism Transportation/navigation

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? No

If Yes, describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

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24. Land tenure/ownership:

Ownership category	On-site	Off-site
Non-governmental organisation (NGO)	+	+
Local authority, municipality etc.	+	+
National/Crown Estate	+	+
Private	+	+
Public/communal	+	+

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25. Current land (including water) use:

Activity	On-site	Off-site
Nature conservation	+	+
Tourism	+	+
Recreation	+	+
Current scientific research	+	
Cutting of vegetation (small-scale/subsistence)	+	
Fishing: commercial	+	+
Fishing: recreational/sport	+	+
Gathering of shellfish	+	+
Bait collection	+	+
Permanent arable agriculture		+

Permanent pastoral agriculture	+	+
Hunting: recreational/sport	+	+
Industrial water supply	+	+
Industry	+	+
Sewage treatment/disposal	+	+
Harbour/port	+	+
Flood control	+	+
Irrigation (incl. agricultural water supply)		+
Mineral exploration (excl. hydrocarbons)		+
Oil/gas exploration	+	+
Transport route	+	+
Domestic water supply		+
Urban development		+
Non-urbanised settlements		+
Military activities	+	+
Horticulture (incl. market gardening)		+

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

Explanation of reporting category:

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

NA = Not Applicable because no factors have been reported.

Adverse Factor Category	Reporting Category	Description of the problem (Newly reported Factors only)	On-Site	Off-Site	Major Impact?
Disturbance to vegetation through cutting / clearing	1	Reedbeds being cut and cleared on margins of pits associated with angling. Management agreements and enforcement to address.	+		
Vegetation succession	1	Lack of reedbed management leading to scrub encroachment. Management agreement to address.	+		
Water diversion for irrigation/domestic/industrial use	1	Abstraction causes reduced freshwater input. Review of consents well advanced but not yet implemented.	+	+	
Overfishing	2	Substantial lamprey by-catch in eel nets in River Ouse.		+	
Pollution – domestic sewage	1	Reduced dissolved oxygen in River Ouse is a barrier to fish migration. Review of consents well advanced but not yet implemented.	+	+	+
Pollution – agricultural fertilisers	1	Reduced dissolved oxygen in River Ouse is a barrier to fish migration. To be addressed through Catchment Sensitive Farming Initiatives and implementation of Water Framework Directive.	+	+	+

Recreational/tourism disturbance (unspecified)	1	Particularly illegal access by motorised recreational vehicles and craft. Control through management scheme.	+		
Other factor	1	Coastal squeeze causing loss of intertidal habitats and saltmarsh due to sea level rise and fixed defences. The Humber Flood Risk Management Strategy has been developed and is being implemented.	+		+

For category 2 factors only. What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors? Overfishing - Overfishing – to be considered through an 'in-combination' assessment of possible factors as part of the Review of Consents exercise.
Is the site subject to adverse ecological change? YES

27. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

Conservation measure	On-site	Off-site
Site/ Area of Special Scientific Interest (SSSI/ASSI)	+	+
National Nature Reserve (NNR)	+	
Special Protection Area (SPA)	+	
Land owned by a non-governmental organisation for nature conservation	+	+
Management agreement	+	+
Site management statement/plan implemented	+	
Area of Outstanding National Beauty (AONB)		+
Special Area of Conservation (SAC)	+	
IUCN (1994) category IV	+	

b) Describe any other current management practices:

The management of Ramsar sites in the UK is determined by either a formal management plan or through other management planning processes, and is overseen by the relevant statutory conservation agency. Details of the precise management practises are given in these documents.

28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

29. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Fauna.

Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.

Seal populations are monitored by the Sea Mammal Research Unit

Humber Wader Ringing Group

Spurn Bird Observatory National Nature Reserve monitoring

Environment.

Institute of Estuarine & Coastal Studies, Hull: various Industrial Concerns: monitoring on behalf of companies such as Associated British Ports and BP Environment Agency monitoring: various Geomorphological studies associated with shoreline management planning National Nature Reserve monitoring

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

There are a four National Nature Reserves with associated facilities within the Ramsar site (Spurn, Far Ings, Donna Nook and Saltfleetby – Theddlethorpe Dunes) and a number of other visitor, information and/or education centres including the Spurn Bird Observatory, the Cleethorpes Discovery Centre, Water's Edge and Far Ings. A wide range of Humber wide and area-specific information is available through a range of media (eg leaflets, displays, internet etc) including 'Humber Estuary European Marine Site Codes of Conduct' developed with a range of stakeholders to cover a range of recreational and educational activities and 'Coastal Futures' – a partnership project working with local communities affected by flood risk and associated issues including managed realignment includes proactive education work within schools.

31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Activities, Facilities provided and Seasonality.

Sailing: marinas at Brough, Winteringham, Hull, Grimsby and South Ferriby.

Bathing etc: Cleethorpes (some 6m visitors/yr).

Walking/Horse riding: throughout

Beach fishing, match sea-fishing, non-commercial bait

digging. Non-commercial samphire collection

Wildfowling

Tourist amusements: Cleethorpes.

Bird watching: throughout but particularly at Blacktoft Sands RSPB reserve and the four National Nature Reserves.

32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Head, Natura 2000 and Ramsar Team, Department for Environment, Food and Rural Affairs, European Wildlife Division, Zone 1/07, Temple Quay House, 2 The Square, Temple Quay, Bristol, BS1 6EB

33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Site Designations Manager, English Nature, Sites and Surveillance Team, Northminster House, Northminster Road, Peterborough, PE1 1UA, UK

34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **15** above), list full reference citation for the scheme.

Site-relevant references

Site-relevant references

Allen, J, Boyes, S, Burdon, D, Cutts, N, Hawthorne, E, Hemingway, K, Jarvis, S, Jennings, K, Mander, L, Murby, P, Proctor, N, Thomson, S & Waters, R (2003) *The Humber estuary: a comprehensive review of its nature conservation interest.* (Contractor: Institute of Estuarine & Coastal Studies, University of Hull.) English Nature Research Reports, No. 547.

[redacted]

Barne, JH, Robson, CF, Kaznowska, SS, Doody, JP & Davidson, NC (eds.) (1995) *Coasts and seas of the United Kingdom. Region 6 Eastern England: Flamborough Head to Great Yarmouth.* Joint Nature Conservation Committee, Peterborough. (Coastal Directories Series.)

Buck, AL (ed.) (1993) *An inventory of UK estuaries. Volume 5. Eastern England.* Joint Nature Conservation Committee, Peterborough

Burd, F (1989) *The saltmarsh survey of Great Britain. An inventory of British saltmarshes.* Nature Conservancy Council, Peterborough (Research & Survey in Nature Conservation, No. 17)

Catley, G (2000) *Humber estuary wetland bird survey: twelve months of high and low tide counts, September 1998 to August 1999.* English Nature Research Reports, No. 339

Cave, R, Ledoux, L, Jickells, T & Andrews, J (2002) *The Humber catchment and its coastal area.* HumCat Consortium

Covey, R (1998) *Chapter 6. Eastern England (Bridlington to Folkestone) (MNCR Sector 6)*. In*: Benthic marine ecosystems of Great Britain and the north-east Atlantic,* ed. by K. Hiscock, 179-198. Joint Nature Conservation Committee, Peterborough. (Coasts and Seas of the United Kingdom. MNCR series)

Cayford, J.T. & Waters, R.J. 1996. *Population estimates for waders Charadrii wintering in Great Britain, 1987/88 – 1991/92.* Biological Conservation 77: 7-17.

Davidson, N.C., Laffoley, D. d'A., Doody, J.P., Way, L.S., Gordon, J., Key, R., Pienkowski, M.W., Mitchell, R. & Duff, K.L. 1991. *Nature conservation and estuaries in Great Britain.* Peterborough, Nature Conservancy Council.

Doody, JP, Johnston, C & Smith, B (1993*) Directory of the North Sea coastal margin.* Joint Nature Conservation Committee, Peterborough

English Nature (2003) *The Humber Estuary European Marine Site: English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats &c) Regulations 1994. Interim advice, April 2003.* English Nature, Peterborough. [redacted]

English Nature & Institute of Estuarine and Coastal Studies (2003) *The Humber bibliography. www.humber-bib.hull.ac.uk*

Environment Agency (2005) *Planning for the rising tides. The Humber Flood Risk Manageemnt Strategy Consultation Document*. Environment Agency North East Region, Leeds. *www.environment-agency.gov.uk/regions/northeast/411697.ac.uk/coastalobs/media/pdf/humberestuarysmp.pdf*

Environment Agency (2000) *Planning for the rising tides. The Humber Estuary Shoreline Management Plan.* Environment Agency North East Region, Leeds. *www.hull.ac.uk/coastalobs/media/pdf/humberestuarysmp.pdf*

Environment Agency, Countryside Agency, English Nature & Lincolnshire Council (2004) *The Alkborough Flats Project. Alkborough Flats Project Partners. www.english-nature.co.uk/about/teams/team_photo/alkborough.pdf*

Gibbons, D.W., Reid, J.B. & Chapman, R.A. 1993. *The New Atlas of Breeding Birds in Britain and Ireland: 1988–1991.* London, T. & A.D. Poyser.

Hagemeijer, W.J.M. & Blair, M.J. (eds) 1997. *The EBCC Atlas of European Breeding Birds: Their Distribution and Abundance.* London, T & A.D. Poyser

Hoyo, J. del, Elliot A. & Sargatal, J. eds. 1996. *Handbook of the Birds of the World. Volume 3: Hoatzin to Auks.* Barcelona, Lynx Edicions.

Hull Biodiversity Partnership (2004) *Hull Biodiversity Action Plan - Estuarine habitats. Hull Biodiversity Partnership,* Hull. [redacted]

Humber Management Scheme (2005) *Humber Management Scheme web pages. Humber Management Scheme*, Doncaster.

[redacted]

Institute of Estuarine and Coastal Studies (1994) *Humber estuary and coast management issues*. Institute of Estuarine and Coastal Studies /Humberside County Council

JNCC. 1999. *The Birds Directive – selection guidelines for Special Protection Areas.* JNCC Peterborough.

Jones, NV (ed.) (1988) *A dynamic estuary: man, nature and the Humber.* Hull University Press, Hull

Jones, NV & Elliott, M (eds.) (2000) *The Humber estuary and adjoining Yorkshire and Lincolnshire coasts. A volume based on a local meeting of the Estuarine and Coastal Sciences Association, Hull, UK, April 1996.* Coastal Zone Topics: Process, Ecology & Management, 4

Kershaw, M. & Cranswick, P.A. 2003. *Numbers of Wintering Waterbirds in Great Britain and the Isle of Man, 1994/1995 – 1998/1999): I. Wildfowl and selected waterbirds.* Biological Conservation 111: 91 – 104.

Kirby, J.S., Evans, R.J. & Fox, A.D. 1993. *Wintering seaducks in Britain and Ireland: populations, threats, conservation and research priorities.* Aquatic Conservation: Marine and Freshwater Ecosystems 3: 105-117.

Lack, P. 1986. *The Atlas of Wintering Birds in Britain and Ireland.* T & A D Poyser, Calton.

Lloyd, C., Tasker, M.L. & Partridge, K. 1991. *The status of seabirds in Britain and Ireland*. London, T. & A.D. Poyser.

May, VJ & Hansom, JD (eds.) (2003) *Coastal geomorphology of Great Britain*. Joint Nature Conservation Committee, Peterborough (Geological Conservation Review Series, No. 28)

McLeod, CR, Yeo, M, Brown, AE, Burn, AJ, Hopkins, JJ & Way, SF (eds.) (2004) *The Habitats Directive: selection of Special Areas of Conservation in the UK. 2nd edn.* Joint Nature Conservation Committee, Peterborough.
[redacted]

Moser, M. 1988. *Limits to the numbers of Grey Plovers Pluvialis squatarola wintering on British estuaries: an analysis of long-term population trends*. Journal of Applied Ecology 25: 473-485.

Musgrove, AJ, Langston, RHW, Baker, H & Ward, RM (eds.) (2003) *Estuarine waterbirds at low tide. The WeBS Low Tide Counts 1992–93 to 1998–99.* WSG/BTO/WWT/RSPB/JNCC, Thetford (International Wader Studies, No. 16)

Musgrove, AJ, Pollitt, MS, Hall, C, Hearn, RD, Holloway, SJ, Marshall, PE, Robinson, JA & Cranswick, PA (2001) *The Wetland Bird Survey 1999–2000: wildfowl and wader counts*. British Trust for Ornithology, Wildfowl and Wetlands Trust, Royal Society for the Protection of Birds & Joint Nature Conservation Committee, Slimbridge.
[redacted]

National Rivers Authority & Humberside County Council (1994) *The Humber Estuary Standing Conference, proceedings November 1993*

National Rivers Authority & Humberside County Council (1995) *The Humber Estuary Standing Conference, proceedings November 1994*

National Rivers Authority & Humberside County Council (1996) *The Humber Estuary Standing Conference, proceedings November 1995*

National Rivers Authority (1994) *Humber estuary catchment management plan consultation report.* National Rivers Authority

National Rivers Authority (1995) *Humber estuary catchment management plan action plan.* National Rivers Authority

National Rivers Authority (1995) *The Humber estuary tidal defence strategy – final report.* Sir William Halcrow & Partners Ltd

Ogilvie, M.A. & the Rare Breeding Birds Panel. 2002. *Rare Breeding Birds in the United Kingdom in 2000.* British Birds 95: 542 – 582.

Owen, M., Atkinson-Willes, G.L. & Salmon, D.G. 1986. *Wildfowl in Great Britain; second edition.* Cambridge, Cambridge University Press.

Pollitt, M.S., Cranswick, P.A., Musgrove, A., Hall, C., Hearn, R., Robinson, J. and Holloway, S. 2000. *The Wetland Bird Survey 1998-99: Wildfowl and Waders Counts*. BTO/WWT/RSPB/JNCC, Slimbridge.

Pollitt, M.S., Hall, C., Holloway, S.J., Hearn, R.D., Marshall, P.E., Musgrove, A.J., Robinson, J.A. & Cranswick, P.A. 2003. *The Wetland Bird Survey 2000-01: Wildfowl and Wader Counts.* BTO/WWT/RSPB/JNCC, Slimbridge.

Prater, A.J. 1981. *Estuary Birds of Britain and Ireland.* London, T & A.D. Poyser

Prime, JH & Hammond, PS (1990) *The diet of grey seals from the south-western North Sea assessed from analyses of hard parts found in faeces.* Journal of Applied Ecology, 27, 435-447

Ratcliffe, DA (ed.) (1977) A Nature Conservation Review. *The selection of biological sites of national importance to nature conservation in Britain.* Cambridge University Press (for the Natural Environment Research Council and the Nature Conservancy Council), Cambridge (2 vols.)

Rehfisch, M.M., Austin, G.E., Armitage, M.J.S., Atkinson, P.W., Holloway, S.J., Musgrove, A.J. & Pollitt, M.S. 2003. *Numbers of Wintering Waterbirds in Great Britain and the Isle of Man, (1994/5 – 1998/1999): II. Coastal Waders (Charadrii).* Biological Conservation 112: 329 – 341.

Ridgill, S.C. & Fox, A.D. 1990. *Cold Weather Movements of Waterfowl in Western Europe.* IWRB Special Publication No 13. IWRB, Slimbridge.

Scott, D.A. & Rose, D.A. 1996. *Atlas of Anatidae populations in Africa and western Eurasia.* Wetlands International Publication No. 41. Wageningen, The Netherlands.

Shennan, I & Andrews, JE (eds.) (2000) *Holocene land-ocean interaction and environmental change around the North Sea. Geological Society,* London (Special Publication)

Spurn Heritage Coast Project (1996) *Spurn Heritage Coast Management Strategy*

Stroud, DA, Chambers, D, Cook, S, Buxton, N, Fraser, B, Clement, P, Lewis, P, McLean, I, Baker, H & Whitehead, S (eds.) (2001) *The UK SPA network: its scope and content*. Joint Nature Conservation Committee, Peterborough (3 vols.)
[redacted]

Snow, D.W. & Perrins, C.M. 1998. *The Birds of the Western Palearctic. Volume 1: Non-Passerines.* Concise Edition. Oxford & New York, Oxford University Press.

Stone, B.H., Sears, J., Cranswick, P.A., Gregory, R.D., Gibbons, D.W., Rehfisch, M.M., Aebischer, N.J. & Reid, J.B. 1997. *Population estimates of birds in Britain and in the United Kingdom.* British Birds 90: 1-22.

Stoyle, M.G. 2002. *A report on the 2002 breeding season at the Little Tern colony,* Beacon Lagoons Nature Reserve, Easington, East Yorkshire. Spurn Bird Observatory Trust.

Stroud, D.A., Chambers, D., Cook, S., Buxton, N., Fraser, B., Clement, P., Lewis, P., McLean, I., Baker, H. & Whitehead, S. 2001. *The UK SPA network: its scope and content. Volumes 1-3.* JNCC, Peterborough.

Tubbs, C.R. 1991. *The population history of Grey Plovers Pluvialis squatarola in the Solent, southern England.* Wader Study Group Bulletin 61: 15-21.

Wetlands International. 2002. *Waterbird Population Estimates – Third Edition.* Wetlands International Global Series No. 12. Wageningen, The Netherlands.

White, LT (1998) *The Humber Wildfowl Refuge Committee Education Project* (unpublished)

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STANDARD DATA FORM for sites within the 'UK national site network of European sites'

Special Protection Areas (SPAs) are classified and Special Areas of Conservation (SACs) are designated under:

- the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales (including the adjacent territorial sea) and to a limited extent in Scotland (reserved matters) and Northern Ireland (excepted matters);
- the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) in Scotland;
- the Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995 (as amended) in Northern Ireland; and
- the Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) in the UK offshore area.

Each SAC or SPA (forming part of the UK national site network of European sites) has its own Standard Data Form containing site-specific information. The information provided here generally follows the same documenting format for SACs and SPAs, as set out in the Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011 (2011/484/EU).

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

More general information on SPAs and SACs in the UK is available from the SPA homepage and SAC homepage on the JNCC website. These webpages also provide links to Standard Data Forms for all SAC and SPA sites in the UK.

https://jncc.gov.uk/

NATURA 2000 - STANDARD DATA FORM

For Special Protection Areas (SPA), Proposed Sites for Community Importance (pSCI), Sites of Community Importance (SCI) and for Special Areas of Conservation (SAC)

SITE **UK9020329**

SITENAME **Greater Wash**

TABLE OF CONTENTS

1. SITE IDENTIFICATION

1.1 Type	1.2 Site code
A	UK9020329

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1.3 Site name

Greater Wash

1.1 First Compilation date	1.2 Update date
2018-03	-

1.6 Respondent:

Name/Organisation: Joint Nature Conservation Committee

Address: Joint Nature Conservation Committee Monkstone House City Road Peterborough PE1 1JY

Email:

1.7 Site indication and designation / classification dates

Date site classified as SPA:	2018-03
National legal reference of SPA designation	Regulations 15 and 17-19 of The Conservation of Habitats and Species Regulations 2017 (https://www.legislation.gov.uk/uksi/2017/1012/contents/made), and Regulations 12, 19 and 20 of The Conservation of Offshore Marine Habitats and Species Regulations 2017 (http://www.legislation.gov.uk/uksi/2017/1013/contents/made).

2. SITE LOCATION

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2.1 Site-centre location [decimal degrees]:

Longitude
0.7264

Latitude 53.2356

2.2 Area [ha]:

353577.86

2.3 Marine area [%]

100.0

2.5 Administrative region code and name

NUTS level 2 code	Region Name
UKH1	East Anglia
UKF3	Lincolnshire
UKZZ	Extra-Regio
UKE1	East Yorkshire and Northern Lincolnshire

2.6 Biogeographical Region(s)

Atlantic (100.0 %)

3. ECOLOGICAL INFORMATION

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3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them

Species					Population in the site						Site assessment			
G	Code	Scientific Name	S	NP	T	Size		Unit	Cat.	D.qual.	A|B|C|D	A|B|C		
						Min	Max				Pop.	Con.	Iso.	Glo.
B	A001	Gavia stellata			w	1407	1407	i		G	B		C	
B	A177	Larus minutus			w	1255	1255	i		M			C	
B	A065	Melanitta nigra			w	3449	3449	i		G	A		C	
B	A195	Sterna albifrons			r	798	798	p		G	A		C	
B	A193	Sterna hirundo			r	510	510	p		G	B		C	
B	A191	Sterna sandvicensis			r	3852	3852	p		G	A		C	

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public
- access enter: yes **NP:** in case that a species is no longer present in the site enter: x (optional) **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species
- use permanent) **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see reference portal)
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are
- deficient (DD) or in addition to population size information **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field

"Abundance categories" has to be filled in)

4. SITE DESCRIPTION

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4.1 General site character

Habitat class	% Cover
N01	99.0
N02	1.0
Total Habitat Cover	100

Other Site Characteristics

3 Marine: Geology: a mixture of coarse sediments, sand, mud, muddy sand and mixed sediments. 4 Marine: Geomorphology: intertidal mudflats and sandflats, subtidal sandbanks and biogenic reef, including Sabellaria reefs and mussel beds.

4.2 Quality and importance

ARTICLE 4.1 QUALIFICATION (79/409/EEC): During the breeding season the area supports Annex I populations of little tern (Sternula albifrons) (798 pairs, 5-year peak mean 2009-2013, 42% of GB breeding population), common tern (Sterna hirundo) (510 pairs, 5-year peak mean 2010-2014, 5.1% of GB breeding population) and Sandwich tern (Sterna sandvicensis) (3,852 pairs, 5-year peak mean 2010-2014, 35% of GB breeding population) (stage 1.1). During the winter, the site also supports populations of overwintering Annex I species: little gull (Hydrocoloeus minutus) (1,255 peak mean 2004/05-2005/06, no current GB population estimate) (stage 1.4) and red-throated diver (Gavia stellata) (1,407 individuals, 5-year peak mean 2002/03-2005/06, 8.3% of GB non-breeding population) (stage 1.1). ARTICLE 4.2 QUALIFICATION (2009/147/EC): Site regularly supports 3,449 Common scoter (Melanitta nigra) (5-year peak mean 2002/03-2007/08, 0.6% of biogeographic population), a regularly occurring migratory species not listed in Annex I of the EC Birds Directive is also supported within the site (stage 1.4).

4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

Negative Impacts			
Rank	Threats and pressures [code]	Pollution (optional) [code]	inside/outside [i|o|b]
M	G01		b
M	D03		b
H	C03		b
L	H03		b
L	F02		i

Positive Impacts			
Rank	Activities, management [code]	Pollution (optional) [code]	inside/outside [i|o|b]

Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

4.5 Documentation

The weblink 'http://jncc.defra.gov.uk/page-6895' allows access to site specific information for all marine MPAs in UK offshore waters.

Link(s): http://consult.defra.gov.uk/natural-england-marine/greater-wash-potential-special-protection-area-com/supporting_docu

http://publications.naturalengland.org.uk/publication/4597871528116224

6. SITE MANAGEMENT

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6.1 Body(ies) responsible for the site management:

Organisation: Address: Email:	Natural England
Organisation: Address: Email:	For information about relevant management offshore please contact JNCC

6.2 Management Plan(s):

An actual management plan does exist:

☐ Yes

☐ No, but in preparation X No

☐

6.3 Conservation measures (optional)

For available information on relevant conservation measures of the site, including the Conservation Objectives, see section 4.5.

7. MAP OF THE SITES

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INSPIRE ID:

Map delivered as PDF in electronic format (optional)

☐ Yes ☒ No

Reference(s) to the original map used for the digitalisation of the electronic boundaries (optional).

EXPLANATION OF CODES USED IN THE SPECIAL AREA OF CONSERVATION (SAC) AND SPECIAL PROTECTION AREA (SPA) STANDARD DATA FORMS

The codes in the table below generally follow those explained in the official European Union guidelines for the Standard Data Form (also referencing the relevant page number).

1.1 Site type

CODE	DESCRIPTION	PAGE NO
A	SPA (classified Special Protection Area)	53
B	cSAC, SCI or SAC (candidate Special Area of Conservation, Site of Community Importance, designated Special Area of Conservation)	53
C	SPA area/boundary is the same as the cSAC/SCI/SAC i.e. a co-classified/designated site (Note: this situation only occurs in Gibraltar)	53

3.1 Habitat code

CODE	DESCRIPTION	PAGE NO
1110	Sandbanks which are slightly covered by sea water all the time	57
1130	Estuaries	57
1140	Mudflats and sandflats not covered by seawater at low tide	57
1150	Coastal lagoons	57
1160	Large shallow inlets and bays	57
1170	Reefs	57
1180	Submarine structures made by leaking gases	57
1210	Annual vegetation of drift lines	57
1220	Perennial vegetation of stony banks	57
1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts	57
1310	Salicornia and other annuals colonizing mud and sand	57
1320	Spartina swards (Spartinion maritimae)	57
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	57
1340	Inland salt meadows	57
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	57
2110	Embryonic shifting dunes	57
2120	Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")	57
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	57
2140	Decalcified fixed dunes with Empetrum nigrum	57
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	57
2160	Dunes with Hippopha• rhamnoides	57
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	57
2190	Humid dune slacks	57
21A0	Machairs (* in Ireland)	57
2250	Coastal dunes with Juniperus spp.	57
2330	Inland dunes with open Corynephorus and Agrostis grasslands	57
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	57
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea	57
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	57
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	57
3160	Natural dystrophic lakes and ponds	57
3170	Mediterranean temporary ponds	57
3180	Turloughs	57
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	57
4010	Northern Atlantic wet heaths with Erica tetralix	57
4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	57
4030	European dry heaths	57
4040	Dry Atlantic coastal heaths with Erica vagans	57
4060	Alpine and Boreal heaths	57

4080	Sub-Arctic Salix spp. scrub	57
5110	Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)	57
5130	Juniperus communis formations on heaths or calcareous grasslands	57
6130	Calaminarian grasslands of the Violetalia calaminariae	57
6150	Siliceous alpine and boreal grasslands	57
6170	Alpine and subalpine calcareous grasslands	57
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	57
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	57
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	57
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	57
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	57
6520	Mountain hay meadows	57
7110	Active raised bogs	57
7120	Degraded raised bogs still capable of natural regeneration	57
7130	Blanket bogs (* if active bog)	57
7140	Transition mires and quaking bogs	57
7150	Depressions on peat substrates of the Rhynchosporion	57
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	57
7220	Petrifying springs with tufa formation (Cratoneurion)	57
7230	Alkaline fens	57
7240	Alpine pioneer formations of the Caricion bicoloris-atrofuscae	57
8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)	57
8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	57
8210	Calcareous rocky slopes with chasmophytic vegetation	57
8220	Siliceous rocky slopes with chasmophytic vegetation	57
8240	Limestone pavements	57
8310	Caves not open to the public	57
8330	Submerged or partially submerged sea caves	57
9120	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	57
9130	Asperulo-Fagetum beech forests	57
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	57
9180	Tilio-Acerion forests of slopes, screes and ravines	57
9190	Old acidophilous oak woods with Quercus robur on sandy plains	57
91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	57
91C0	Caledonian forest	57
91D0	Bog woodland	57
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	57
91J0	Taxus baccata woods of the British Isles	57

3.1 Habitat representativity (abbreviated to 'Representativity' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent representatively	57
B	Good representatively	57
C	Significant representatively	57
D	Non-significant presence representatively	57

3.1 Relative surface

CODE	DESCRIPTION	PAGE NO
A	> 15%-100%	58
B	> 2%-15%	58
C	≤ 2%	58

3.1 Degree of conservation (abbreviated to 'Conservation' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	59

B	Good conservation	59
C	Average or reduced conservation	59

3.1 Global assessment (abbreviated to 'Global' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	59
B	Good value	59
C	Significant value	59

3.2 Population (abbreviated to 'Pop.' in data form)

CODE	DESCRIPTION	PAGE NO
A	> 15%-100%	62
B	> 2%-15%	62
C	≤ 2%	62
D	Non-significant population	62

3.2 Degree of conservation (abbreviated to 'Con.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent conservation	63
B	Good conservation	63
C	Average or reduced conservation	63

3.2 Isolation (abbreviated to 'Iso.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Population (almost) Isolated	63
B	Population not-isolated, but on margins of area of distribution	63
C	Population not-isolated within extended distribution range	63

3.2 Global Grade (abbreviated to 'Glo.' or 'G.' in data form)

CODE	DESCRIPTION	PAGE NO
A	Excellent value	63
B	Good value	63
C	Significant value	63

3.3 Other species – essentially covers bird assemblage types

CODE	DESCRIPTION	PAGE NO
WATR	Non-breeding waterbird assemblage	UK specific code
SBA	Breeding seabird assemblage	UK specific code
BBA	Breeding bird assemblage (applies only to sites classified pre 2000)	UK specific code

4.1 Habitat class code

CODE	DESCRIPTION	PAGE NO
N01	Marine areas, Sea inlets	65
N02	Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	65
N03	Salt marshes, Salt pastures, Salt steppes	65
N04	Coastal sand dunes, Sand beaches, Machair	65
N05	Shingle, Sea cliffs, Islets	65
N06	Inland water bodies (Standing water, Running water)	65
N07	Bogs, Marshes, Water fringed vegetation, Fens	65
N08	Heath, Scrub, Maquis and Garrigue, Phygrana	65
N09	Dry grassland, Steppes	65
N10	Humid grassland, Mesophile grassland	65
N11	Alpine and sub-Alpine grassland	65
N14	Improved grassland	65
N15	Other arable land	65
N16	Broad-leaved deciduous woodland	65
N17	Coniferous woodland	65

N19	Mixed woodland	65
N21	Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas)	65
N22	Inland rocks, Screes, Sands, Permanent Snow and ice	65
N23	Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites)	65
N25	Grassland and scrub habitats (general)	65
N26	Woodland habitats (general)	65

4.3 Threats code

CODE	DESCRIPTION	PAGE NO
A01	Cultivation	65
A02	Modification of cultivation practices	65
A03	Mowing / cutting of grassland	65
A04	Grazing	65
A05	Livestock farming and animal breeding (without grazing)	65
A06	Annual and perennial non-timber crops	65
A07	Use of biocides, hormones and chemicals	65
A08	Fertilisation	65
A10	Restructuring agricultural land holding	65
A11	Agriculture activities not referred to above	65
B01	Forest planting on open ground	65
B02	Forest and Plantation management & use	65
B03	Forest exploitation without replanting or natural regrowth	65
B04	Use of biocides, hormones and chemicals (forestry)	65
B06	Grazing in forests/ woodland	65
B07	Forestry activities not referred to above	65
C01	Mining and quarrying	65
C02	Exploration and extraction of oil or gas	65
C03	Renewable abiotic energy use	65
D01	Roads, paths and railroads	65
D02	Utility and service lines	65
D03	Shipping lanes, ports, marine constructions	65
D04	Airports, flightpaths	65
D05	Improved access to site	65
E01	Urbanised areas, human habitation	65
E02	Industrial or commercial areas	65
E03	Discharges	65
E04	Structures, buildings in the landscape	65
E06	Other urbanisation, industrial and similar activities	65
F01	Marine and Freshwater Aquaculture	65
F02	Fishing and harvesting aquatic ressources	65
F03	Hunting and collection of wild animals (terrestrial), including damage caused by game (excessive density), and taking/removal of terrestrial animals (including collection of insects, reptiles, amphibians, birds of prey, etc., trapping, poisoning, poaching, predator control, accidental capture (e.g. due to fishing gear), etc.)	65
F04	Taking / Removal of terrestrial plants, general	65
F05	Illegal taking/ removal of marine fauna	65
F06	Hunting, fishing or collecting activities not referred to above	65
G01	Outdoor sports and leisure activities, recreational activities	65
G02	Sport and leisure structures	65
G03	Interpretative centres	65
G04	Military use and civil unrest	65
G05	Other human intrusions and disturbances	65
H01	Pollution to surface waters (limnic & terrestrial, marine & brackish)	65
H02	Pollution to groundwater (point sources and diffuse sources)	65
H03	Marine water pollution	65
H04	Air pollution, air-borne pollutants	65
H05	Soil pollution and solid waste (excluding discharges)	65

H06	Excess energy	65
H07	Other forms of pollution	65
I01	Invasive non-native species	65
I02	Problematic native species	65
I03	Introduced genetic material, GMO	65
J01	Fire and fire suppression	65
J02	Human induced changes in hydraulic conditions	65
J03	Other ecosystem modifications	65
K01	Abiotic (slow) natural processes	65
K02	Biocenotic evolution, succession	65
K03	Interspecific faunal relations	65
K04	Interspecific floral relations	65
K05	Reduced fecundity/ genetic depression	65
L05	Collapse of terrain, landslide	65
L07	Storm, cyclone	65
L08	Inundation (natural processes)	65
L10	Other natural catastrophes	65
M01	Changes in abiotic conditions	65
M02	Changes in biotic conditions	65
U	Unknown threat or pressure	65
XO	Threats and pressures from outside the Member State	65

5.1 Designation type codes

CODE	DESCRIPTION	PAGE NO
UK00	No Protection Status	67
UK01	National Nature Reserve	67
UK04	Site of Special Scientific Interest (GB)	67
UK05	Marine Conservation Zone	67
UK06	Nature Conservation Marine Protected Area	67
UK86	Special Area (Channel Islands)	67
UK98	Area of Special Scientific Interest (NI)	67
IN00	Ramsar Convention site	67
IN08	Special Protection Area	67
IN09	Special Area of Conservation	67

Appendix D: Summary Table of Sites, Features an

Key

N/A	Effects are not relevant to this feature	N/R
No LSE	Likely Significant Effect can be excluded	LSE
No AEOI	Adverse Effect On Integrity can be excluded	AEOI
C	Construction	O

Table D1. European sites and qualifying features, and each pathway of effect considered

Site	Qualifying features	HRA Stage	Physical loss of habitat and associated species (Section 4.3)		Physical damage through disturbance and/or smothering of habitat (Section 4.4)		Physical loss or damage of habitat through alterations in physical processes (Section 4.5)	
			C	O	C	O	C	O
Humber Estuary	H1110. Sandbanks which are slightly covered by sea	Stage 1 Screening	No LSE	No LSE	LSE	N/A	LSE	No LSE
SAC	water all the time; Subtidal sandbanks	Stage 2 Appropriate Assessment	N/R	N/R	No AEOI	N/R	No AEOI	N/A
	H1130. Estuaries	Stage 1	LSE	No	LSE	LSE	LSE	No

		Screening		LSE				LSE
		Stage 2 Appropriate Assessment	No AEOI	N/R	No AEOI	No AEOI	No AEOI	N/R
	H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats	Stage 1 Screening Stage 2 Appropriate Assessment	LSE No AEOI	No LSE N/R	LSE No AEOI	LSE No AEOI	LSE No AEOI	No LSE N/R
	H1150. Coastal lagoons	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R
	H1310. Salicornia and other annuals colonising	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE
	mud and sand; Glasswort and other annuals colonising mud and sand	Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R
		Stage 1	No	No	No LSE	No LSE	No	No
		Screening	LSE	LSE			LSE	LSE
Site	**Qualifying features**	**HRA Stage**	**Physical loss of habitat and associated species (Section 4.3)**		**Physical damage through disturbance and/or smothering of habitat (Section 4.4)**		**Physical loss or damage of habitat through alterations in physical processes (Section 4.5)**	

Site	Qualifying features	HRA Stage	Physical loss of and associated (Section 4.3)		Physical damag disturbance anc smothering of h (Section 4.4)		Physical loss or of habitat throu alterations in pl processes (Secti		Direct changes qualifying habit beneath marine infrastructure d shading (Sectio		Physical chang habitats resultir		Non-toxic conta through elevate suspended sedi		Toxic contamin through release				Disturbance thr underwater nois		Biological distu due to potential	
			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
	H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	H2110. Embryonic shifting dunes	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	H2120. Shifting dunes along the shoreline with	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE
	Ammophila arenaria ("white dunes"); Shifting dunes with Marram	Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	H2130. Fixed dunes with herbaceous vegetation	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE
	("grey dunes"); Dune grassland	Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	H2160. Dunes with *Hippophae rhamnoides*;	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE
	Dunes with sea-buckthorn	Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	S1095. *Petromyzon marinus*; Sea lamprey	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	LSE	No LSE	LSE	No LSE	N/A	N/A	LSE	No LSE	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	No AEOI	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R
	S1099. *Lampetra fluviatilis*; River lamprey	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	LSE	No LSE	LSE	No LSE	N/A	N/A	LSE	No LSE	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	No AEOI	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R
	S1364. *Halichoerus grypus*; Grey seal	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	LSE	No LSE	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R
The Wash and North	S1365 Harbour seal *Phoca vitulina*	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	LSE	No LSE	N/A	N/A
Norfolk Coast SAC		Stage 2	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R
		Stage 1 Screenin g	No LSE	No LSE	No LSE	No LSE	No LSE	No LS E	No LS E	No LS E	No LS E	No LS E	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A

											depos pollut		conce 4.8)		contar sedim oil, fue releas		Airbor disturb		vibrati		introd non-n (Sectio	
			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
Humber Estuary SPA	A021 *Botaurus stellaris*; Great bittern (Non-breeding)	Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A021 *Botaurus stellaris*; Great bittern (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A048 *Tadorna tadorna*; Common shelduck (Non-breeding)	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	A081 *Circus aeruginosus*; Eurasian marsh harrier (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A082 *Circus cyaneus*; Hen harrier (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A132 *Recurvirostra avosetta*; Pied avocet (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A132 *Recurvirostra avosetta*; Pied avocet (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A140 *Pluvialis apricaria*; European golden plover (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A143 *Calidris canutus*; Red knot (Non-breeding)	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	A149 *Calidris alpina alpina*; Dunlin (Non-breeding)	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
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Site	Qualifying features	HRA Stage			disturl smoth (Sectio		alterat proces		benea infrast shadir		depos polluta		suspe conce 4.8)		contar sedim oil, fue releas		Airbor disturl		vibrati		introd non-na (Sectio	
			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	A151 *Philomachus pugnax*; Ruff (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A156 *Limosa limosa islandica*; Black-tailed godwit (Non-breeding)	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	A157 *Limosa lapponica*; Bar-tailed godwit (Non-breeding)	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	A162 *Tringa totanus*; Common redshank (Non-breeding)	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	A195 *Sterna albifrons*; Little tern (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	Waterbird assemblage	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
Humber Estuary Ramsar	Criterion 1 – natural wetland habitats that are of international importance: Near-natural estuary with component habitats, specifically dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	Stage 1 Screening	LSE	No LSE	LSE	LSE	LSE	No LSE	No LSE	LSE	No LSE	LSE	LSE	No LSE	LSE	No LSE	N/A	N/A	N/A	N/A	LSE	LSE
		Stage 2 Appropriate Assessment	No AEOI	N/R	No AEOI	No AEOI	No AEOI	N/R	N/R	No AEOI	N/R	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI
Site	Qualifying features	HRA Stage	Physical loss of and associated (Section 4.3)		Physical damag disturbance and smothering of h (Section 4.4)		Physical loss of of habitat throu alterations in pl		Direct changes qualifying habit		Physical change		Non-toxic conta through elevate		Toxic contamina through release contaminants b				Disturbance thr underwater nois		Biological distu due to potential	

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			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
	Criterion 3 – supports populations of plants and/or animal species of international importance: Breeding colony of grey seals *Halichoerus grypus* at Donna Nook.	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	LSE	No LSE	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R
	Criterion 5 – Bird Assemblages of International Importance: Wintering waterfowl.	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance: Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Redshank (passage) Shelduck, Golden Plover, Red Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit (overwintering).	Stage 1 Screening	LSE	LSE	LSE	No LSE	LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	LSE	LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	No AEOI	No AEOI	No AEOI	N/R	No AEOI	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	No AEOI	N/R	N/R	N/R	N/R
	Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path: River lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*.	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	LSE	No LSE	LSE	No LSE	N/A	N/A	LSE	No LSE	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	No AEOI	N/R	No AEOI	N/R	N/R	N/R	No AEOI	N/R	N/R	N/R
Greater Wash SPA	A001 *Gavia stellata*; Red-throated diver (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A065 *Melanitta nigra*; Common scoter (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A177 *Hydrocoloeus minutus*; Little gull (Non-breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Site	Qualifying features	HRA Stage	Physical loss of and associated (Section 4.3)		Physical damag disturbance anc smothering of h (Section 4.4)		Physical loss o of habitat throu alterations in pr		Direct changes qualifying habit		Physical chang		Non-toxic conta through elevate		Toxic contamin through release contaminants b				Disturbance thr		Biological distu due to potential	

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			C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O	C	O
	A191 *Sterna sandvicensis*; Sandwich tern (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A193 *Sterna hirundo*; Common tern (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
	A195 *Sternula albifrons*; Little tern (Breeding)	Stage 1 Screening	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	No LSE	N/A	N/A	N/A	N/A	No LSE	No LSE	N/A	N/A	N/A	N/A
		Stage 2 Appropriate Assessment	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R

Appendix E: Mitigation Effectiveness Document

Appendix E: Waterbird Mitigation Effectiveness Summary

This appendix summarises information on the potential effectiveness of the following proposed mitigation measures in reducing potential effects on waterbird features:

- Winter marine construction restriction (from 1 October to 31 March);
- Noise suppression system for piling;
- Acoustic barrier/ screening; and
- Soft starts for any piling.

Winter marine construction restriction (from 1 October to 31 March)

Temporal extent effectiveness

Data shows that this restriction period (October to March inclusive) correlates with the months where the largest number of the most SPA qualifying species occur (i.e., Black-tailed Godwit, Dunlin and Shelduck – all of which have been recorded in numbers exceeding 1% of estuary-wide populations and with specific respect to Black- tailed Godwit in nationally or internationally important numbers in some years). For example, based on monthly peak counts for the 12-month period from October 2021 to September 2022 in Sector B (see Annex A.1 of Appendix A of this HRA), it should be noted that:

- Black-tailed Godwit: Four of the five largest monthly counts occur in winter period (1 October to 31 March) with internationally, nationally or locally important numbers recorded over this period;
- Dunlin: Larger numbers were recorded during all the months of the winter period (1 October to 31 March) compared to months outwith this period; and
- Shelduck: Four of the five largest monthly counts occur in winter period (1 October to 31 March).

It is recognised that during the colder winter months, coastal waterbirds are more susceptible to effects of disturbance due to higher energetic costs and greater feeding requirements for thermoregulation along with a range of other factors highlighted in paragraph 4.10.35 of the HRA. In addition, wintering waterbirds typically show a high level of site fidelity and utilise relatively small home ranges (as discussed in paragraph 4.10.34 of the HRA). This can also make them vulnerable to the effects of disturbance (as discussed in paragraph 4.10.34 of the HRA).

The shoulder months to the winter restriction period (such as August, September, April and May) typically support waterbirds on passage where migrating birds stop over to feed and rest on migration to and from breeding areas[1]. It is noted that nationally important numbers of Black tailed Godwit were recorded in April and numbers considered locally important in May, June and September in Sector B. Redshank were recorded in broadly comparable numbers that are considered locally important in most months (see Annex A.1 of Appendix A of this HRA).

Evidence with respect to Black-tailed Godwit (which has been subject to a wide range of individual and population studies) suggests that this species typically uses the same stop-over sites each year with peak spring passage period for birds typically occurring in March and April on the East coast of England (Gill *et al*., 2019; Gunnarsson *et al.,* 2005; Keeble, 2018; Alves *et al.,* 2012). During this period there is a high seasonal turnover of birds at stop over sites (with birds typically staying anything from a week to several months at these sites before moving on) (Keeble, 2018).

Visiting passage birds typically stop over at sites for short durations of time and therefore will only be exposed to potential disturbance at any given stop over for a relatively short period (compared to winter birds which typically utilise a localised winter home range for typically 5-6 months or more). This makes individual passage birds less susceptible to disturbance effects at individual stop over locations (due to relatively limited temporal exposure) with conditions at wintering and breeding sites often considered more important in terms of adverse effects on survival or breeding success due to environmental pressures. Nevertheless, it is acknowledged that waterbirds are still considered vulnerable to disturbance during passage periods at stop-over sites given the need for birds to intensively feed (to accumulate body reserves ready for the energetic demands associated with long distance migratory flights) (Newton, 2006).

It should be noted that use a noise suppression system during piling and acoustic barriers/ screening on barges year-round is proposed as mitigation, as well as soft start procedures during piling, to help minimise the effects of noise disturbance on these species. The effectiveness of these measures is described below. With the use of the measures, potential noise and visual disturbance responses are generally expected to be restricted to a relatively localised area of foreshore which will only represent a small proportion of intertidal mudflat habitat in the Immingham area and therefore extensive alternative feeding habitat is available for passage birds to accumulate body reserves for onward migratory flight (see paragraph 9.8.248 of Chapter 9 of the ES). Furthermore, construction work will be temporary and not continuous, with significant periods during a 24-hour period when no work will be undertaken (e.g., see paragraph 9.8.195 of Chapter 9 of the ES and paragraph 4.11.36 of the HRA). Given that data suggests that birds are relatively site faithful in terms of utilising the same passage stopover sites each year, passage birds would also be expected to have some pre-existing habituation to port related disturbance stimuli. Potential effects are therefore considered to be relatively minor, localised and not of a magnitude that will compromise relevant site conservation objectives in terms of distribution or population changes. Therefore, there is considered no potential AEOI on the qualifying interest features as a result of construction related disturbance during passage months.

Turnstone (an SPA assemblage species) typically occurs year-round in locally or regionally important numbers (peak counts of approximately 20-30 birds in most months). However, this species is considered highly tolerant to disturbance (as highlighted in Table 28 of the HRA) with the measures described above also benefiting this species.

Spatial extent and activities

The mitigation measures apply a 200 m disturbance buffer, with no construction activity being undertaken within 200 m of exposed mudflat over the winter period (1 October to 31 March inclusive) until an acoustic barrier/visual screen has been installed on both sides of the semi-completed jetty structure. As highlighted above and in paragraph 4.10.18 of the HRA and paragraph 9.8.236 of the ES, evidence suggests that the response of waterbirds to disturbance stimuli is limited at distances over 200 m (see paragraphs 4.10.3 to 4.10.15 of the HRA, and paragraphs 9.8.222 to 9.8.234), particularly in areas subject to already high levels of existing anthropogenic activity (as found in the Port of Immingham area). The restriction will mean that piling cannot be undertaken within this zone over the winter. Piling is considered to have a high potential for disturbance (due to the high noise levels associated with this activity). In light of this, it is important to note that a noise suppression system will be used for piling undertaken out of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the piling. Based on Natural England guidance *'peak levels below 55 dBA can be regarded as not significant, while peak noise levels approaching 70 dBA and greater are most likely to cause an adverse effect'.* On this basis, the noise suppression system will limit noise levels at distances of 200 m or more below this 70 dB level. Noise levels will also be less than existing background noise levels of operational port activities).

This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity will then be undertaken on the approach jetty itself, behind the screens, with no use of large heavy plant. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 65 dB(A) (which will also be less than existing background noise levels of operational port activities).

Noise suppression system for piling

The noise suppression system is expected to offer a 10 dB reduction in the unmitigated LAmax sound power level associated with piling.

The noise suppression system will be used for piling undertaken outside of the 200 m restriction zone. The noise suppression system is predicted to reduce noise levels to <70 dB LAmax at distances greater than approximately 200 m from the marine piling which will be in the range of existing background noise levels of operational port activities (see Figure ~~E.~~1). It should be noted that the orange zone shown on Figure ~~E.~~1 corresponds to noise levels less than (but *not* equal to) 70 dB LAmax.

Appendix E

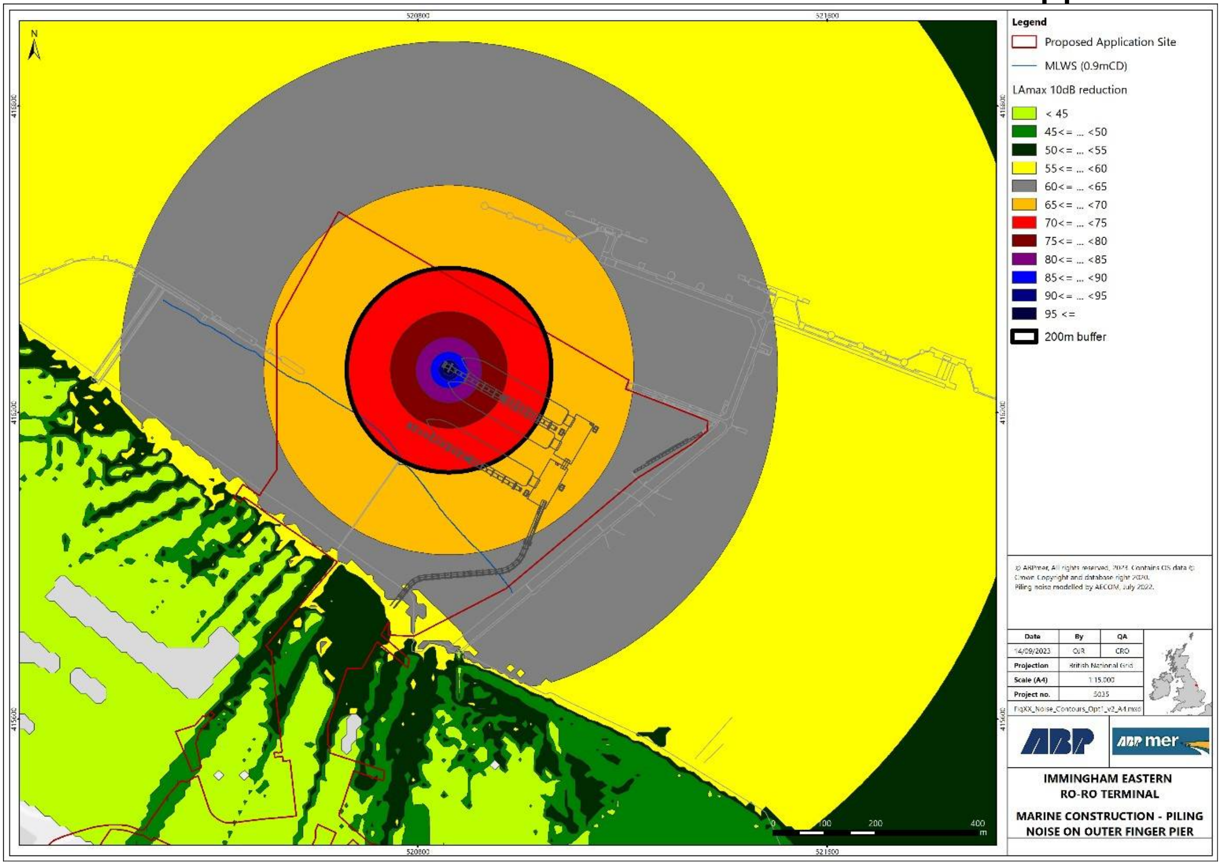

Figure E.1. Predicted airborne noise (LAmax) during piling at the outer finger pier with noise suppression system

Acoustic barrier/ screening

Screens and other barriers are a widely used measure to help reduce potential disturbance to coastal waterbirds (Ikuta and Blumstein, 2003; Liley and Tyldesley, 2013; Hockin *et al.,* 1992) and have been successfully applied as mitigation to reduce disturbance at a number of port locations located near intertidal waterbird populations (GoBe Consultants Ltd, 2011, ABPmer, 2014; MMO, 2018).

Soft starts for any piling

The application of soft start procedures for piling activities is a widely established measure to help reduce disturbance to waterbirds. It is acknowledged that initial sudden noise associated with an activity elicits a greater response than further subsequent noise (due to increasing tolerance of the birds to the stimuli) (Collop *et al*., 2017; IECS, 2009; Hockin *et al*., 1999). On this basis, soft starts will allow the more gradual increase in noise levels which would help reduce potential 'startling' effects to waterbird associated with the first sudden bangs of piling (during periods which are not subject to seasonal restrictions).

The use of soft starts is also an established mitigation measure to help reduce potential underwater noise effects on marine mammals and fish (Tougaard *et al.,* 2012).

Wider mitigation

It is important to understand that the proposed restrictions and mitigation for overwintering coastal waterbirds (noted above) sit within a much wider package of mitigation measures for other receptors, including migratory fish and marine mammals that are sensitive to underwater noise and vibration. To address this issue, ABP has committed to a range of restrictions relating to the timing and duration of percussive piling. Together with the restrictions that are currently proposed for birds, the construction of IERRT is already highly constrained as shown in Table E.2. Any further seasonal or timing restrictions could extend the overall construction period for the project. Given the complex and comprehensive nature of the overall mitigation measures, the addition of further restrictions is likely to have a disproportionate effect on the overall construction programme.

Overall, therefore, the proposed restrictions are considered appropriate and acceptable for the IERRT project.

The justification for the mitigation measures proposed for migratory fish is set out in paragraph 9.9.3 (and the proceeding bullet points) of Chapter 9 of the ES [APP-045]. April and May, during which percussive piling is not allowed in the water column, coincides with the greatest number of different migratory fish in the Humber Estuary and also the vulnerable life stages of a number of species[2]. June, and August to October, during which there is a limit on the duration (i.e., number of hours) of piling that can be undertaken, coincides with silver eels, river lamprey and returning adult Atlantic salmon moving through the estuary.

The night-time percussive piling restriction is proposed to protect the upstream migration of river lamprey which takes place almost exclusively at night, and there is also an increase in glass eel migratory activity during the night-time.

The level of protection for different species (including fish) is provided in paragraph 9.6.9 to 9.6.15 of Chapter 9 of the ES [APP-045]. This is also summarised Table E.1 below.

Table E.1. Protection afforded to fish species in the Humber Estuary

Fish Species	**Protection**
European eel	Eels (England and Wales) Regulations 2009, Natural Environment and Rural Communities (NERC) Act 2006 species of principle importance
Atlantic salmon	Annex II and V of the EC Habitats Directive, NERC species of principle importance
Sea lamprey and river lamprey	Annex II and V of the EC Habitats Directive, NERC species of principle importance

Twaite and allis shad	Annex II and V of the EC Habitats Directive, Wildlife and Countryside Act 1981, NERC species of principle importance
Brown / sea trout	NERC species of principle importance
European smelt	NERC species of principle importance, Marine Conservation Zone (MCZ) Feature of Conservation Interest (FOCI)

With specific respect to the Humber Estuary, sea lamprey and river lamprey are qualifying features of the Humber Estuary SAC. However, given the level of protection afforded under all the other legislation, all migratory diadromous species are considered to be of high importance.

The proposed mitigation measures for both coastal waterbirds and migratory fish are considered appropriate and proportionate to the level of impact predicted to occur during construction of the IERRT project. They are based on a detailed analysis of extensive survey data, scientific evidence, and a high level of experience studying bird responses to port activity. The measures are designed to reduce the impacts as far as reasonably practicable whilst also noting that the IERRT is a nationally significant infrastructure project which has to be delivered.

In terms of balancing the mitigation measures for birds and migratory fish, it is important to appreciate that in order to mitigate impacts on birds, all construction activity (not just piling) is prohibited within 200 m of exposed mudflat (i.e., the area where birds are considered to be affected by the works) for half the year (October to March) until an acoustic barrier/visual screen has been installed on both sides of the semi-completed approach jetty and linkspan. The restriction for migratory fish applies to percussive piling only, and percussive piling is only prohibited for two months of the year (April to May).

Appendix E

Table E.2. Schedule of proposed seasonal restrictions on construction activity

Construction activity	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Outer pier			☼		☼	☼	☼		
Approach jetty and inner pier	Dry only	Dry only	☼		☼	☼	>200 m ☼	>200 m	>200 m

Please note: - This table does not include other proposed mitigation measures that apply year-round (e suppression system etc.)

Key	Restriction detail	Receptor (relevant qualifying in
	No restrictions – all construction activity allowed	N/A
☼	Night-time piling restriction – percussive piling not allowed between sunset and sunrise	Migratory fish (including river lamp qualifying features of the Humber
	Duration of percussive piling restricted over a four-week period: • 140 hr (one rig in operation) • 196 hr (two rigs in operation)	Migratory fish (including river lamp qualifying features of the Humber
	Percussive piling not allowed	Migratory fish (including river lamp qualifying features of the Humber
Dry only	Percussive piling not allowed unless on dry intertidal areas outside the waterbody at periods of low water	Migratory fish (including river lamp qualifying features of the Humber
>200 m	Construction activity (including piling) not allowed within 200 m of exposed mudflat. Note: • Construction can take place on seaward sections of approach jetty and inner pier when works are >200 m from exposed mudflat (approximately 2 hours either side of high water) • Restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed approach jetty and linkspan	Overwintering birds (including qua Estuary SPA and Ramsar site)

Appendix E

References

ABPmer (2014). Bird Disturbance Monitoring of the 'RWE Pontoon' at the Port of Mostyn. First Yearly Summary: October 2013 to March 2014. Gwynt y Môr Offshore Wind Farm Ltd.

Alves, J. A., Gunnarsson, T. G., Potts, P. M., Gélinaud, G., Sutherland, W. J., & Gill, J. A. (2012). Overtaking on migration: does longer distance migration always incur a penalty?. Oikos, 121(3), 464-470.
Gill, J. A., Alves, J. A., & Gunnarsson, T. G. (2019). Mechanisms driving phenological and range change in migratory species. *Philosophical Transactions of the Royal Society B*, *374*(1781), 20180047.

Collop, C., Stillman, R.A., Garbutt, A., Yates, M.G., Rispin, E., and Yates, T. (2016). Variability in the area, energy and time costs of wintering waders responding to disturbance. Ibis, 158(4), pp.711-725.

Ikuta, L. A., & Blumstein, D. T. (2003). Do fences protect birds from human disturbance?. Biological Conservation, 112(3), 447-452.

Gill, J. A., Alves, J. A., & Gunnarsson, T. G. (2019). Mechanisms driving phenological and range change in migratory species. Philosophical Transactions of the Royal Society B, 374(1781), 20180047.

GoBe Consultants Ltd (2011); Port of Mostyn – Wind Farm Service Vessel Pontoon Facility - Environmental Statement. Prepared for RWE Npower Renewables Ltd.

Gunnarsson, T.G., Gill, J.A., Potts, P.M., Atkinson, P.W., Croger, R.E., Gélinaud, G., Gardarsson, A. and Sutherland, W.J. (2005). Estimating population size in black-tailed godwits Limosa limosa islandica by colour-marking. Bird Study, 52(2), pp.153-158.

Hockin, D., Ounsted, M., Gorman, M., Keller, V., and Barker, M.A. (1992). Examination of the effects of disturbance of birds with reference to its importance in ecological assessments. Journal of Environmental Management. 36, pp.253-286.

JNCC. (2010). Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise.

Keeble, E (2018). Black-tailed Godwits as an example of seasonal turnover of waders on the tour Estuary. Suffolk bird report, 2018.

Liley, D. & Tyldesley, D. (2013). Solent Disturbance and Mitigation Project: Phase III. Towards an Avoidance and Mitigation Strategy. Unpublished report. Footprint Ecology/David Tyldesley & Associate people hidden from view to the bird.

Marine Management Organisation (MMO) (2018). Record of Appropriate Assessment Regulation 63 of the Conservation of Habitats and Species Regulations 2017, Statutory Instrument 2017/1012. MLA/2016/00463.

Newton, I. (2006). Can conditions experienced during migration limit the population levels of birds?. Journal of Ornithology, 147, 146-166.

Tougaard, J., Carstensen, J., Teilmann, J., Skov, H., and Rasmussen, P. (2009). Pile driving zone of responsiveness extends beyond 20 km for harbor porpoises (Phocoena (L.)). The Journal of the Acoustical Society of America, 126, pp.11–14.

Appendix E

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