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Rev: 0

14.0 MARINE ECOLOGY

14.1 Introduction

14.1.1 This chapter of the Environmental Statement (ES) identifies the potential impacts and effects on marine ecology as part of the Environmental Impact Assessment (EIA) of the Proposed Development. The assessment has been undertaken in accordance with best practice guidance and professional judgement and has considered the worst-case scenario for all impact pathways.

14.1.2 This chapter of the ES provides an assessment of the potential impacts and effects as a result of the construction, operation (including maintenance) and decommissioning of the Proposed Development on marine ecology.

14.1.3 A detailed description of the Proposed Development can be found within Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2).

14.1.4 For the purposes of this assessment, the marine environment is defined as any area seaward of the mean high-water springs (MHWS) mark of any tidally influenced water body. Terrestrial and aquatic designations, habitats, and species i.e., those above the MHWS are considered in Chapter 12: Ecology and Nature Conservation (including aquatics and saltmarsh habitats recorded in Greatham Creek above MHWS) (ES Volume I, EN070009/APP/6.2). Impact pathways to coastal seabirds and associated designated sites are considered in Chapter 13: Ornithology (ES Volume I, EN070009/APP/6.2), whilst marine water quality is considered within Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

14.1.5 This chapter describes the assessment methodology used, the datasets that have informed the baseline characterisation and impact assessments, development design measures, mitigation measures and the determination of any likely significant effects on the marine environment that could result from the Proposed Development.

14.1.6 This chapter is supported by the following figures (ES Volume II, EN070009/APP/6.3) and appendices (ES Volume III, EN070009/APP/6.4):

- Figure 14-1: Study Area;
- Figure 14-2: Designated Sites with Marine Ecological Features;
- Figure 14-3: Teesside Offshore Wind Farm and Net Zero Teesside EUNIS Subtidal Benthic EUNIS Biotope and Sediment Class;
- Figure 14-4: Important Intertidal and Subtidal Benthic Habitats;
- Figure 14-5: Mean percentage of at-sea population of harbour seals from haulouts in the British Isles (Source: Carter et al., 2022);
- Figure 14-6: Mean percentage of at-sea population of grey seals from haulouts in the British Isles (Source: Carter et al., 2022);
- Figure 14-7: Airborne Noise Modelling Locations for Seals;

- Appendix 9E: Outline Water Management Plan;
- Framework Construction Environmental Management Plan (CEMP) (EN070009/APP/5.12); and
- Indicative Lighting Strategy (Construction) (EN070009/APP/5.12) Indicative Lighting Strategy (Operation) (EN070009/APP/5.8).

14.2 Legislation, Planning Policy Context and Other Guidance

14.2.1 This Section identifies and describes legislation, planning policy and guidance that is of relevance to the assessment of marine ecology effects.

14.2.2 This assessment has been undertaken within the context of relevant planning policies, at both national and local levels, guidance documents and legislative instruments. The background for this is detailed within Chapter 7: Legislative and Planning Policy Context (ES Volume I, EN070009/APP/6.2). A summary of the legislative background and policies relating to marine ecology is provided below.

Legislative Background

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations')

14.2.3 The EIA Regulations require that applications for granting development consent must consider environmental information. The regulations provide procedures regarding the establishment of whether an EIA is required, considerations of screening and applications for scoping opinion and consultation (HM Government, 2017a). This chapter considers the environmental information required for development consent regarding marine ecology.

Other Relevant International and National Legislation

14.2.4 The following international and national legislation is considered to be relevant to the Proposed Development in respect of marine ecology:

- The Marine and Coastal Access Act 2009 (HM Government, 2009a), which provides the legal mechanism to help ensure clean, healthy, safe, and productive and biologically diverse oceans and seas;
- The Conservation of Habitats and Species Regulations 2017 (HM Government, 2017b) (amended 2019 (HM Government, 2019)) (the Habitats Regulations), which transposes the Habitats Directive (92/43/EEC) into UK legislation out to the 12 nautical mile (NM) limit;
- The Wildlife and Countryside Act (WCA) 1981 (HM Government, 1981), which includes provisions relating to nature conservation;
- The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (HM Government, 2017c), which transposes the EU Water Framework Directive (2000/60/EC) into UK legislation;

- The Marine Strategy Regulations 2010 (HM Government, 2010), which transposes the Marine Strategy Framework Directive (2008/56/EC) into UK legislation;
- The Natural Environment and Rural Communities (NERC) Act 2006 (HM Government, 2006), which lists habitats and species of principal importance (SPI) for the purpose of conservation of biodiversity and requires public authorities to consider what actions can be taken to further the general biodiversity objective for the conservation and enhancement of biodiversity;
- The Environment Act 2021 (HM Government, 2021a), which sets clear statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste, and includes the introduction of Biodiversity Net Gain (BNG);
- The Conservation of Seals Act 1970 (as amended) (HM Government, 1970), which provides protection and conservation for seals in England, Wales and Scotland, and adjacent territorial waters;
- The Salmon and Freshwater Fisheries Act 1975 (as amended) (HM Government, 1975), which relates to the protection of salmon and freshwater fisheries, as well as preventing the obstruction of fish migratory route;
- The Eels (England and Wales) Regulations 2009 (HM Government, 2009b), which implement Council Regulation (EC) No 1100/2007 (EC) No 1100/2007 establishing measures for the recovery of the stock of European eel including providing for the free passage of eels; and
- Local byelaws relating to fishing practices in coastal areas (0 NM to 6 NM) enforced through the North Eastern Inshore Fisheries and Conservation Authority (IFCA, 2023).

14.2.5 The following are international legislations and agreements, to which the UK is a signatory, which are concerned with the preservation of marine ecological receptors during the planning and execution of projects in UK waters:

- The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1992 (ASCOBANS) (United Nations Environment Programme (UNEP), 1992); and
- Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention') adopted in 1998 and amended in 2007.

Planning Policy Context

National Planning Policy

14.2.6 The key national planning policy related to the Proposed Development in relation to marine ecology are outlined below. There are no additional specific requirements in "National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023)" relating to marine ecology which are not already provided within the National Policy Statement for Energy (EN-1).

Overarching National Policy Statement for Energy (EN-1) (2023)

14.2.7 The NPS for EN-1 provides renewed overarching policy to support the urgent need for large-scale energy infrastructure in the UK whilst meeting government objectives. This includes ensuring the development of energy infrastructure does not negatively affect the surrounding natural environment and sensitive habitats. The policy states that when a development is subject to EIA, the applicant must make sure that:

- "the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance…., on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats." (Paragraph 5.4.17 of NPS EN-1); and
- "Energy projects will need to ensure vessels used by the project follow existing regulations and guidelines to manage ballast water." (Paragraph 5.4.23 of NPS EN-1).

Marine Protected Areas

14.2.8 The policy also provides guidance on considering protected areas:

- Paragraph 5.4.10: "Marine Protected Area (MPA) is a term used to describe the network of HRA sites, SSSIs and MCZs in the English and Welsh marine environment"; and
- Paragraph 5.4.11: "It is important that relevant guidance on managing environmental impacts of infrastructure in marine protected areas is followed, and that equal consideration of the effect of proposals should be given to all MPAs regardless of the legislation they were designated under. This is because all sites contribute to the network of MPAs and therefore to overall network integrity."

14.2.9 Adherence to these policies must be demonstrated through robust application of the mitigation hierarchy and can be achieved by project applicants developing appropriate mitigation, to ensure that, verbatim of those outlined in paragraph 5.4.36 of NPS EN-1:

- during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;
- the timing of construction has been planned to avoid or limit disturbance;
- during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements;
- habitats will, where practicable, be restored after construction works have finished;
- opportunities will be taken to enhance existing habitats rather than replace them, and where practicable, create new habitats of value within the site

landscaping proposals. Where habitat creation is required as mitigation, compensation, or enhancement, the location and quality will be of key importance. In this regard habitat creation should be focused on areas where the most ecological and ecosystems benefits can be realised; and

- mitigations required as a result of legal protection of habitats or species will be complied with.

National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4) (2023)

14.2.10 The NPS for Gas and Oil Pipelines (EN-4) provides national policy for natural gas supply infrastructure and gas and oil pipelines.

- Paragraph 2.21.24 states "Additional considerations apply during the construction of a pipeline (which, without mitigation, can affect both landscape, visual amenity and ecology) ."; and
- Paragraph 2.13.15 states: "Where it is not considered practicable to select a route that avoids below surface usage, applicants must demonstrate in the ES that mitigating measures will be put in place to avoid adverse effects both on other below ground works and on the pipeline……Mitigating Measures may include:
  - …HDD techniques".

National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023)

14.2.11 The NPS for EN-5 provides policy to support the growth of electricity network infrastructure, including offshore wind and low carbon infrastructure.

- Paragraph 2.9.6: "Particular consideration should be given to feeding and hunting grounds, migration corridors and breeding grounds, where they are functionally linked to sites designated or allocated under the 'national site network' provisions of the Conservation of Habitats and Species Regulations."
- Paragraph 2.9.19: "… applicants should:
  - …consider environmental issues from the earliest stage to balance the technical benefits and capital cost requirements for new developments against the consequential environmental effects in order to keep adverse effects to a reasonably practicable minimum;
  - seek to avoid altogether internationally and nationally designated areas of the highest amenity, cultural or scientific value by the overall planning of the system connections;
  - protect as far as reasonably practicable….important existing habitats and landscape features including….nature conservation areas; and
  - keep the visual, noise and other environmental effects to a reasonably practicable minimum."

- Paragraph 2.11.1: "Where biodiversity impacts are identified… the Secretary of State should be satisfied that all feasible options for mitigation have been considered and evaluated appropriately".

The National Planning Policy Framework (2023)

14.2.12 The NPPF (2023) sets out policies and decisions which should contribute to and enhance the local natural environment, including minimising impacts on biodiversity and protecting and enhancing sites of biodiversity value. This includes ensuring plans distinguish between the hierarchy of international, national and local designated sites.

14.2.13 Policies and advice are also set out to protect and enhance biodiversity, including identifying biodiverse habitats and ecological networks, whilst promoting the conservation and restoration of such priority habitats.

UK Government 25-Year Environment Plan, 2018

14.2.14 The Governments' 25-Year Environment Plan, which aligns with the Clean Growth Strategy, is relevant to the Proposed Development (HM Government, 2018). The Clean Growth Strategy is aimed towards the decarbonisation of the power sector to reduce emissions. The Proposed Development's Hydrogen (H_2) Production Facility will produce low carbon H_2 and will export carbon dioxide (CO_2) to the Northern Endurance Partnership (NEP) offshore storage facility via NEP infrastructure. Therefore, the Proposed Development will contribute towards reducing emissions.

The UK Marine Policy Statement (2011)

14.2.15 The UK MPS (HM Government, 2011) was adopted in 2011. It provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made (HM Government, 2011). The UK is divided into a number of marine plan areas with associated plan authorities that are responsible for preparing marine plans. In England, the Marine Management Organisation (MMO) is the plan authority. Marine plans are a material planning consideration.

The North East Inshore Marine Plan (2021)

14.2.16 The Proposed Development Site lies within the North East Inshore Marine Plan (HM Government, 2021b), which stretches from Flamborough Head in Yorkshire to the Scottish Border. The Plan Area includes three main tidal rivers, including the River Tees.

14.2.17 The North East Inshore Marine Plan (HM Government, 2021b) is intended to provide a strategic approach to decision-making, considering future use and providing a clear approach to managing resources, activities and interactions within the area. Policies in the plan which are of relevance to marine ecology are outlined in Table 14-1.

14.2.18 As part of a Development Consent Order (DCO) application, it is a requirement of Section 104 of The Planning Act 2008 to have regard for the appropriate marine

policies that are determined in accordance with Section 59 of the Marine and Coastal Access Act (MCAA 2009). Therefore, a marine plan policy assessment has been undertaken to determine the potential effects of the Proposed Development on policies included in the North-East Inshore Marine Plan (HM Government, 2021). The assessment is presented in Appendix 7A (ES Volume III, EN070009/APP/6.4).

Table 14-1: Policies in the North East Inshore Marine Plan (HM Government, 2021b) which are Relevant to Marine Ecology

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
NE-BIO-1	"*Proposals that enhance the distribution of priority habitats and priority species will be supported. Proposals that may have significant adverse impacts on the distribution of priority habitats and priority* *species must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant;* *d) compensate for significant adverse impacts that cannot be mitigated*."	The Proposed Development may result in impacts to priority habitats and species. As such, a baseline review and assessment of likely effects has been conducted in this ES chapter.
NE-BIO-2	"*Proposals that enhance or facilitate native species or habitat adaptation or connectivity, or native species migration, will be supported. Proposals that may cause significant adverse impacts on native species or habitat adaptation or connectivity, or native species migration, must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant;* *d) compensate for significant adverse impacts that cannot be mitigated*."	The Proposed Development may result in impacts to native species. As such, a baseline review and assessment of likely effects has been conducted in this ES chapter.
NE-BIO-3	"*Proposals that conserve, restore or enhance coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, will be supported. Proposals must take account of the space required for coastal habitats, where*	This policy applies to intertidal habitats. The Proposed Development is not expected to result in adverse impacts to intertidal coastal habitats in the Study Area due to the

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
	important in their own right and/or for ecosystem functioning and provision of ecosystem services, and demonstrate that they will, in order of preference: *a) avoid;* *b) minimise;* *c) mitigate;* *d) compensate for net habitat loss*."	use of trenchless technologies such as Horizontal Directional Drilling (HDD).
NE-CC-1	"*Proposals that conserve, restore or enhance habitats that provide flood defence or carbon sequestration will be supported. Proposals that may have significant adverse impacts on habitats that provide a flood defence or carbon sequestration ecosystem service must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant;* *d) compensate for significant adverse impacts that cannot be mitigated*."	The proposed location for the Hydrogen Pipeline Corridor is within coastal saltmarsh habitat which typically sequesters large amounts of carbon. The saltmarsh, which is designated as part of the Teesmouth and Cleveland Coast SPA / SSSI, is above MHWS and considered in Chapter 12: Ecology and Nature Conservation (ES Volume I, EN070009/APP/6.2). However, it has been concluded that due to the use of trenchless technologies, such as HDD, there will be no adverse effects on saltmarsh and therefore this has not been considered further.
NE-DIST-1	"*Proposals that may have significant adverse impacts on highly mobile species through disturbance or displacement must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant*."	The construction of the Hydrogen Pipeline Corridor and associated activities in Greatham Creek may have adverse impacts on highly mobile species including fish and pinnipeds. Therefore, an assessment of likely effects is included in this ES chapter.

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
NE-FISH-3	"*Proposals that enhance essential fish habitat, including spawning, nursery and feeding grounds, and migratory routes, should be supported. Proposals that may have significant adverse impacts on essential fish habitat, including spawning, nursery and feeding grounds, and migratory routes, must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant*."	The Hydrogen Pipeline Corridor in Greatham Creek is not considered to be located within fish habitats but may be located within a fish migratory route. However, the use of trenchless technologies has been selected as the most appropriate construction method to avoid any adverse impacts to the marine environment. New water abstraction points are not part of the Proposed Development. Therefore, no potential impact pathway to fish and shellfish from underwater sound and vibration (due to the depth at which the trenchless technologies will be drilled) or entrapment and entrainment is likely to occur and this has not been considered further.
NE-INNS-1	"*Proposals that reduce the risk of introduction and/or spread of invasive non-native species should be supported. Proposals must put in place appropriate measures to avoid or minimise significant adverse impacts that would arise through the introduction and transport of invasive non-native species, particularly when:* *1) moving equipment, boats or livestock (for example fish or shellfish) from one water body to another;* *2) introducing structures suitable for settlement of invasive non-native species, or the spread of invasive non-native species known to exist in the area*."	The use of vessels for the Proposed Development is potentially required and there is, therefore, the potential for the introduction, transportation and / or spread of invasive non-native species (INNS) through use of ballast water or settlement on vessel hulls. Mitigation measures to avoid the introduction of INNS are detailed in Section 14.5. The impact of the introduction, transportation and / or spread of INNS has been considered in Section 14.6.
NE-INNS-2	"*Public authorities with functions to manage activities that could potentially introduce, transport or spread invasive non-native species should implement adequate biosecurity measures to avoid or*	The use of vessels for the Proposed Development is potentially required and therefore there is the potential for the introduction, transportation and / or spread of INNS through use of ballast water or settlement on vessel

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
	minimise the risk of introducing, transporting or spreading invasive non-native species."	hulls. Mitigation measures to avoid the introduction of INNS are detailed in Section 14.5. The impact of the introduction, transportation and / or spread of INNS has been considered in Section 14.6.

Local Planning Policy

14.2.19 The land considered for the Proposed Development is located within the administrative boundaries of Stockton on Tees Borough Council (STBC), the Redcar & Cleveland Borough Council (RCBC) and Hartlepool Borough Council (HBC).

14.2.20 Local planning policy relevant to the marine ecology assessment includes:

- Redcar and Cleveland Local Plan (adopted in May 2018) (RCBC, 2018);
- Stockton-on-Tees Local Plan (adopted in January 2019) (STBC, 2019); and
- Hartlepool Local Plan (HBC, 2018).

14.2.21 Policies N1 (Landscape) and N4 (Biodiversity and Geological Conservation) of the Redcar and Cleveland Local Plan also relate to the protection of the marine environment and important sites for biodiversity including Special Protection Areas (SPAs), Ramsar, Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSI) and local nature reserves (RCBC, 2018). Similar themes are covered by the Stockton on Tees Local Plan Policy ENV5 which aims to preserve, protect and enhance ecological networks, biodiversity and geodiversity (STBC, 2019), whilst the Hartlepool Local Plan policy NE1 aims to protect, manage and enhance Hartlepool's natural environment, including coastal environments (HBC, 2018).

14.2.22 The Stockton-on-Tees Local Plan also seeks to ensure, as part of policies SD5 and ENV7, that development proposals do not contribute to unacceptable levels of pollution, including noise pollution, and that any adverse effects are prevented or reduced by incorporating mitigation measures (STBC, 2019). This includes measures to prevent or reduce noise pollution in designated sites including Seal Sands SSSI where seals may be sensitive to any increases in noise pollution resulting from proposed developments.

14.2.23 All three local plans make specific mention of the then proposed (and now achieved) extension of the Teesmouth and Cleveland Coast SPA into the marine environment to protect breeding colonies of common tern (*Sterna hirundo*) and avocet (*Recurvirostra* spp.) as well as non-breeding waterbirds. The policies outlined above provide the necessary safeguards to protect both designated and proposed nature conservation sites.

14.2.24 Local Priority Species for the Tees Valley which are relevant to the assessment of marine ecology include salmon (*Salmo salar*), sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) (Tees Valley Nature Partnership, 2012).

14.2.25 Local Priority Habitats for the Tees Valley which are relevant to the assessment of marine ecology (with some overlap with terrestrial and aquatic ecology) include maritime cliffs and slopes, mudflats and saltmarsh, sand dunes and saline lagoons (Tees Valley Nature Partnership, 2012).

14.2.26 The River Tees is recognised as one of the main salmon rivers in England and Wales, and as such there is currently a Salmon Action Plan (SAP) enforced by the

Environment Agency (EA) (EA, 2009). The actions of high priority within the SAP include:

- improving water quality in the lower river and estuary;
- free fish passage past the Tees Barrage;
- improving evaluation of compliance against spawning targets;
- maintaining liaison with developers to ensure impacts of new developments are minimised; and
- promoting new regional byelaws relating to fishing near obstructions.

14.3 Assessment Methodology and Significance Criteria

Study Area

14.3.1 The Study Area is shown in Figure 14-1: Study Area (ES Volume II, EN070009/APP/6.3). For the assessment, the Study Area has been defined to include the predicted likely Zones of Influence (ZoI) where potential impacts and significant effects may arise from the Proposed Development. The largest predicted ZoI for marine ecology is considered to be 10 km (based on the ZoI for the deposition of airborne pollutants). The Rochdale Envelope has been applied to ensure that the baseline characterisation data is sufficient to underpin a reasonable worst-case assessment of impact pathways. Further details regarding the Rochdale Envelope approach are included in Section 14.3.

14.3.2 The Study Area is specific to each marine ecological receptor, recognising both the mobility of each receptor and the likely impact pathways to that receptor. The maximum ZoI of 10 km, encompasses the Study Areas of each marine ecological receptor, with the exception of marine mammals, which are highly mobile and transient. A summary of the Study Area for each receptor is defined below:

- Designated Sites: the Study Area for the search for relevant nature conservation sites for marine ecology includes a 10 km radius of the Proposed Development Site within the marine environment (except for marine mammals, as stated below). This spatial extent was chosen on the basis that, whilst it is an arbitrary distance, it provides geographical context and encompasses the relevant functional habitats and range of movement of most species found within the predicted ZoIs of the Proposed Development.
- Benthic ecology: the Study Area covers the tidally influenced limits of the River Tees and Tees Estuary, as well as Seal Sands, Seaton Channel and Greatham Creek. The Study Area also extends out of the estuary, from the south bank of the Tees Estuary to Redcar in Tees Bay, encompassing South Gare Breakwater and Coatham Sands.
- Fish and shellfish: the Study Area for these receptors is defined as the area comprising the tidally influenced limits of the River Tees and Tees Estuary, Seaton Channel, and Greatham Creek. The wider coastal area, which falls within the International Council for the Exploration of the Sea (ICES) statistical

rectangle 38E8 (ICES StatRecs), includeing Tees Bay, has also been considered; and

- Marine mammals: the Study Area for marine mammals includes the Greater North Sea Ecoregion (North Sea, English Channel, Skagerrak and Kattegat), which extends beyond the largest predicted ZoI of 10 km, recognising the highly mobile and transient nature of marine mammals. However, it is considered unlikely that most cetacean species will occur in the River Tees itself, although consideration has been given to the nearby coastal area. The particular focus within the Study Area for seals are Seal Sands and Greatham Creek.

Impact Assessment Methodology

14.3.3 A detailed assessment methodology is outlined in Chapter 2: Assessment Methodology (ES Volume I, EN070009/APP/6.2).

14.3.4 The impacts and likely significant effects on marine ecology outlined in this chapter as part of project specific ecological impact assessments (EcIAs), have been undertaken in accordance with the Chartered Institute of Ecology and Environmental Management's (CIEEM's) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019), tailored to consider the interconnectivity of marine ecology and the small number of impacts likely to occur.

14.3.5 In accordance with CIEEM (2019) guidance, not all habitats and species which have the potential to occur within the ZoI of the Proposed Development have been considered within this ES. Rather, focus has been placed on those features considered to be 'important' and most likely to occur – determining importance is discussed in further detail below. To ensure compliance with National and European policy, consideration is still given to biodiversity in its entirety and the need to achieve no net loss and enhancement of biodiversity.

14.3.6 In accordance with the appropriate guidance above, the importance of an ecological feature or receptor is defined according to the following factors:

- conservation or legal status;
- quality or health;
- extent; and
- rarity or endemism.

14.3.7 The aims of the EcIA are to:

- identify important ecological features (e.g., designated sites, habitats or species) which have the potential to be impacted by the Proposed Development;
- provide a robust assessment of the ecological impacts and resultant likely significant effects of the Proposed Development, which may be beneficial (i.e., positive) or adverse (i.e., negative);

- facilitate determination of the consequences of the Proposed Development in terms of national, regional and local policies relevant to nature conservation and biodiversity, where the level of detail provided is proportionate to the scale of the development and the complexity of its impact pathways;
- identify appropriate mitigation to reduce any likely significant effects; and
- set out the steps to be taken to adhere to legal requirements relating to the relevant ecological features concerned.

Value / Sensitivity of Receptors

14.3.8 The assessment has determined the worst-case scenario for impact pathways to marine ecology and has focused on those features considered to be 'important'. The importance criteria for marine ecological features are shown in Table 14-2. The importance of an ecological feature has been defined with reference to a specific geographical context and the scale of protection, ensuring consistency with CIEEM (2019) guidance.

14.3.9 Marine features are highly connected with few boundaries and therefore the levels of geographical importance must recognise this. The levels presented below are based on the level to which the marine ecological receptor may qualify as a legislative or policy designating feature. Therefore, the approach adopts the level of legislative designation as a proxy for the geographical importance of a marine species receptor:

- international (designated National Site Network sites in accordance with the Habitats Regulations– Special Areas of Conservation (SACs), Special Protected Areas (SPAs), as well as Ramsar Sites);
- national (UK protected areas – Sites of Special Scientific Interest (SSSI), Marine Protected Areas (MPAs), and Marine Conservation Zones (MCZs)); and
- regional or local (ecological features that do not meet criteria for valuation at an international or national level, but that have sufficient value to merit retention or mitigation e.g., for the purpose of ensuring no net loss of biodiversity).

14.3.10 The value of sites, habitats and potential for protected and notable species are evaluated with reference to both their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations) and their legal status.

Table 14-2: Importance Criteria for Marine Ecology Features

IMPORTANCE	DESCRIPTION*
Very High	Designated sites and qualifying / supporting features of international importance. Species which are legally protected and / or in significant decline (i.e., classified as 'endangered' or 'critically endangered' according to the

IMPORTANCE	DESCRIPTION*
	International Union for Conservation of Nature (IUCN) Red List (IUCN, 2023)). High quality examples of rare habitats which are threatened throughout their range.
High	Designated sites and qualifying / supporting features of national conservational importance. Priority habitats and species or those considered to be of principal importance for the conservation of biodiversity in England and those species considered vulnerable to decline (i.e. classified as 'vulnerable' or 'near threatened' according to the IUCN Red List). High quality examples of uncommon habitats which are vulnerable throughout their range.
Medium	Habitats and species of regional or local importance (i.e., Annex 1 habitats, in accordance with the Habitats Regulations, which are not a qualifying feature of a nearby designated site). Those species considered to be of 'least concern' (according to the IUCN Red List or listed in the OSPAR list of threatened and/or declining species for the North-East Atlantic). Poor quality examples of rare or uncommon habitats which are threatened or vulnerable throughout their range.
Low	Habitats and species of low conservation importance, such as those generally abundant and widespread around the UK with no specific local value.

*Should there be any overlap in the description of a particular feature/receptor, the worst-case importance criteria are adopted.

Magnitude of Impacts

14.3.11 The potential magnitude of change on marine ecological features arising from activities occurring as part of the Proposed Development is determined in consideration of their beneficial or adverse nature; extent; duration; timing; frequency; and reversibility of the impact.

14.3.12 Temporary, permanent, direct and indirect impacts have been considered during the construction, operation and decommissioning phases of the Proposed Development, and any mitigation measures necessary have been identified. To ensure compliance with National and European policy, consideration is still given to the need to maintain and enhance biodiversity.

Significance Criteria

14.3.13 To determine the likely significance of effect, the following parameters have been considered:

- impact type – direct or indirect, positive or negative, temporary or permanent;

- magnitude of impact – the 'amount' or intensity of an impact. This may sometimes be synonymous with 'extent' (see below) for certain receptors, such as habitats loss. For mortality it may be the number of individuals killed;
- spatial extent of impact – the area over which the impact will occur; and
- temporal nature of impact – timing, frequency and duration.

14.3.14 The assessment has also given regard to the sensitivity of an ecological feature to an impact which is determined by its:

- adaptability i.e., the capacity, or lack thereof, of a feature to avoid or adapt to a change; and
- tolerance / resilience i.e., capacity, or lack thereof, of a feature to accommodate temporary or permanent change or recover to pre-existing state following exposure to a change.

14.3.15 By combining the characteristics of an impact pathway with the importance and sensitivity of ecological features or receptors, a measure of the significance of effects on marine ecology can be derived.

14.3.16 For each marine ecological receptor, only those characteristics relevant to understanding the ecological effect and determining the effect significance are described. The determination of the significance of effects has been made based on the predicted impacts as outlined in Section 14.3 to designated sites, ecosystems, habitats, and species.

14.3.17 Conclusions on the significance of effects are assessed as being either:

- Not Significant – no effect to one or more of the features described above; or
- Significant – one or more features described above are affected.

14.3.18 CIEEM does not advocate a matrix approach for determining the significance of effects on ecological receptors (CIEEM, 2018). However, maintaining consistency with other disciplines / the wider ES, where a matrix approach is suitable, should be considered. As such, the assessment conclusions presented within this chapter have been translated into the significance terminology used within the wider ES (Chapter 2: Assessment Methodology (ES Volume I, EN070009/APP/6.2)), as outlined in Table 14-3.

Table 14-3: Description of Significance Terminology

CLASSIFICATION OF EFFECT BASED ON CIEEM GUIDANCE	TERMINOLOGY USED ELSEWHERE	DESCRIPTION IN ACCORDANCE WITH CIEEM GUIDANCE
Significant (Beneficial)	Major Beneficial	Beneficial effect on designated sites, ecosystems, habitat and species at the international level.

CLASSIFICATION OF EFFECT BASED ON CIEEM GUIDANCE	TERMINOLOGY USED ELSEWHERE	DESCRIPTION IN ACCORDANCE WITH CIEEM GUIDANCE
	Moderate Beneficial	Beneficial effect on designated sites, ecosystems, habitat and species at the national level.
Non-significant	Minor Beneficial	Beneficial effect on designated sites, ecosystems, habitat and species at a local level or regional level.
	Negligible	No effect on designated sites, ecosystems, habitat and species.
	Minor Adverse	Adverse effect on designated sites, ecosystems, habitat and species at the local level or regional level.
Significant (Adverse)	Moderate Adverse	Adverse effect on designated sites, ecosystems, habitat and species at the national level.
	Major Adverse	Adverse effect on designated sites, ecosystems, habitat and species at the international level.

Sources of Information / Data

14.3.19 Baseline conditions for marine ecology have been determined using findings from a desk-based study. The Study Areas shown in Figure 14-1: Study Area (ES Volume II, EN070009/APP/6.3) were used to define the area of search for the desk-based study.

14.3.20 The desk-based study identified several publicly available data sources relevant to the Study Area for each marine receptor. The review study determined the nature conservation designated sites and protected species and habitats to be considered within this assessment of impact pathways from the Proposed Development. Furthermore, the data sources were used to provide the relative importance, functionality and geographical context of each receptor. The following sources of information have been reviewed and have informed the assessment:

- The Marine Life Information Network (MarLIN, 2023);
- Habitat mapping undertaken by the Joint Nature Conservation Committee (JNCC) (2019a) – Marine Nature Conservation Review (MNCR) area summaries and the EA (2023b) – saltmarsh zonation and extent in England;
- European Marine Observation Data Network (EMODnet) (EMODnet, 2021) Seabed Habitats Project for broad-scale habitat maps of the Study Area;

- European University Information Systems organisation (EUNIS) (European Environment Agency (EEA), 2021) for classifying benthic habitats;
- EA TraC data 1987 – 2019 (EA, 2021a);
- EA River Tees Fish Counts for salmon and brown trout taken at the Tees Barrage 2011 – 2022 (EA, 2023a);
- EA ecology and fish data explorer (EA, 2021b);
- Spawning and nursery grounds for UK waters (Coull et al., 1998; Ellis et al., 2012);
- Salmon Stocks and Fisheries in England and Wales (Cefas, 2019 and 2022);
- Salmonid and fisheries statistics for England and Wales (EA, 2022e);
- UK fleet landings by rectangle stock and estimated EEZ 2016-2020 (updated) (MMO, 2021);
- ICES publications and data (ICES, 2022);
- SCANS (Small Cetacean Abundance in the European Atlantic and North Sea) data (Hammond et al., 2021);
- Inter-Agency Marine Mammal Working Group (IAMMWG) publications (IAMMWG, 2022);
- Sea Mammal Research Unit (SMRU) and Special Committee on Seals research reports (SCOS) (SMRU & SCOS, 2021 and 2022);
- Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management (Carter et al., 2022);
- INCA Tees Seals Research Programme publications (INCA, 2023);
- Academic papers and online reports as available for the Study Area;
- Designated sites condition assessments as available; and
- Existing reference baseline data (where available and relevant) from other developments in the area e.g., the Net Zero Teesside (NZT) Project.

14.3.21 Following a review of available data, with consideration of the potential impact pathways associated with the Proposed Development, no project specific marine ecology surveys have been proposed. This was agreed with regulators at the PEI Report stage.

14.3.22 The presence of harbour and grey seals in the Study Area is well known, including abundance, seasonality, and the known haul-out locations for these species. Therefore, no project specific effort-based surveys for marine mammals have been previously proposed. However, incidental sightings of seals at Seal Sands and Greatham Creek were recorded as part of the breeding and non-breeding bird surveys for the Proposed Development (see Section 14.4). This includes information on the species, their location, abundance, the presence of pups, and if seals were moulting.

14.3.23 Benthic ecology within the Study Area is well understood, through existing surveys undertaken by the JNCC (2019) and the EA (2022c), and the subtidal (bp, 2021a) and intertidal (bp, 2021b) benthic surveys completed for the NZT Project in the River Tees and Tees Bay. Trenchless technologies in the marine environment and existing pipeline bridges are to be used for the Hydrogen Pipeline Corridor at Greatham Creek and Tees River. The use of trenchless technologies will result in the avoidance of most impact pathways to benthic habitats and species which has negated the requirement for further surveys.

14.3.24 Fish and shellfish surveys are not considered necessary. The proposed Hydrogen Pipeline Corridor in the vicinity of Greatham Creek and in the River Tees are not considered to be located within fish habitats but may be located within a fish migratory route. However, the use of trenchless technologies has been selected as the most appropriate construction method to avoid any adverse impacts to this receptor. Furthermore, new water abstraction points are not part of the Proposed Development, meaning that there are no potential impact pathways to fish and shellfish from underwater sound or entrapment and entrainment.

Consultation

Scoping Opinion

14.3.25 An EIA Scoping Opinion was requested from the Inspectorate on 6 April 2023. A response was received on 17 May 2023. For the Scoping Opinion and the Applicant's responses to them, refer to Appendix 1E (ES Volume III, EN070009/APP/6.4).

Statutory Consultation

14.3.26 The PEI Report was published for statutory consultation on 14 September 2023 and the consultation period ended on 26 October 2023. A second statutory consultation was held between 13 December 2023 and 23 January 2024, and additional targeted consultation was held between 9 February 2024 and 10 March 2024. The matters raised have been reviewed and an explanation of how the Applicant has had regard to them is set out in the Consultation Report (EN070009/APP/5.1).

14.3.27 Refer to Table 14-4 for a detailed summary of the Statutory Consultation feedback relevant to this chapter from Statutory Environmental Bodies, and the Applicant's responses.

Table 14-4: Responses to the Statutory Consultation Feedback

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
Marine Management Organisation	21/09/23	Marine Licensing Works activities taking place below the mean high water mark may require a marine licence in accordance with the Marine and Coastal Access Act (MCAA) 2009. Such activities include the construction, alteration or improvement of any works, dredging, or a deposit or removal of a substance or object below the mean high water springs mark or in any tidal river to the extent of the tidal influence. Applicants should be directed to the MMO's online portal to register for an application for marine licence: https://www.gov.uk/guidance/make-a-marine-licence-application You can also apply to the MMO for consent under the Electricity Act 1989 (as amended) for offshore generating stations between 1 and 100 megawatts in English waters. The MMO is also the authority responsible for processing and determining Harbour Orders in England, together with granting consent under various local Acts and orders regarding harbours. A wildlife licence is also required for activities that that would affect a UK or European protected marine species. The MMO is a signatory to the coastal concordat and operates in accordance with its principles. Should the activities subject to planning permission meet the above criteria then the	Marine Licensing No marine licence applications are anticipated to be required. The Applicant engaged with the MMO regarding marine licensing during February-March 2024 and following discussion the Applicant has made a determination that any activities below the mean high water spring mark would be exempt of the requirements for a Deemed Marine Licence. Environmental Impact Assessment This comment is noted, the legislation and guidance highlighted here has been taken into account in the preparation of the Environmental Statement (ES Volume I, EN070009/APP/6.2) where applicable. Marine Planning The Applicant has undertaken a Marine Plan Policy Assessment and this is

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		applicant should be directed to the follow pages: check if you need a marine licence and asked to quote the following information on any resultant marine licence application: local planning authority name, planning officer name and contact details, planning application reference. Following submission of a marine licence application a case team will be in touch with the relevant planning officer to discuss next steps. Environmental Impact Assessment With respect to projects that require a marine licence the EIA Directive (codified in Directive 2011/92/EU) is transposed into UK law by the Marine Works (Environmental Impact Assessment) Regulations 2007 (the MWR), as amended. Before a marine licence can be granted for projects that require EIA, MMO must ensure that applications for a marine licence are compliant with the MWR. In cases where a project requires both a marine licence and terrestrial planning permission, both the MWR and The Town and Country Planning (Environmental Impact Assessment) Regulations http://www.legislation.gov.uk/uksi/2017/571/contents/made may be applicable.	included at Appendix 7A (ES Volume III, EN070009/APP/6.4).

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		If this consultation request relates to a project capable of falling within either set of EIA regulations, then it is advised that the applicant submit a request directly to the MMO to ensure any requirements under the MWR are considered adequately at the following link https://www.gov.uk/guidance/make-a-marine-licence-application Marine Planning Under the Marine and Coastal Access Act 2009 ch.4, 58, public authorities must make decisions in accordance with marine policy documents and if it takes a decision that is against these policies it must state its reasons. MMO as such are responsible for implementing the relevant Marine Plans for their area, through existing regulatory and decision-making processes. Marine plans will inform and guide decision makers on development in marine and coastal areas. Proposals should conform with all relevant policies, taking account of economic, environmental and social considerations. Marine plans are a statutory consideration for public authorities with decision making functions. At its landward extent, a marine plan will apply up to the mean high water springs mark, which includes the tidal extent of any rivers. As marine plan boundaries extend up to the level of the mean high water spring tides mark, there will be an overlap	

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		with terrestrial plans which generally extend to the mean low water springs mark. A map showing how England's waters have been split into 6 marine plan areas is available on our website. For further information on how to apply the marine plans please visit our Explore Marine Plans service. Planning documents for areas with a coastal influence may wish to make reference to the MMO's licensing requirements and any relevant marine plans to ensure that necessary regulations are adhered to. All public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area must do so in accordance with the Marine and Coastal Access Act and the UK Marine Policy Statement unless relevant considerations indicate otherwise. Local authorities may also wish to refer to our online guidance and the Planning Advisory Service soundness self-assessment checklist. If you wish to contact your local marine planning officer you can find their details on our gov.uk page.	
Natural England	20/10/23	Natural England's comments relating to the Public Consultation and the Preliminary Environmental Information Report (PEIR) are given below: Nationally and Internationally Designated Sites The proposal is likely to impact directly and indirectly upon the Teesmouth and Cleveland Coast Special Protection Area (SPA),	Nationally and Internationally Designated Sites The Applicant can confirm a Report to Inform Habitats Regulations Assessment (EN070009/APP/5.10) and a Cumulative and In-Combination Effects Assessment (Chapter 23: Cumulative and Combined

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		Ramsar Site and Site of Special Scientific Interest (SSSI) during construction and operation and has the potential to indirectly impact several other internationally designated sites during operation. Natural England notes that a 'Report to Inform Habitats Regulations Assessment Screening' has been submitted in line with the requirements of the Habitats Regulations, and that these assessments have been made taking account of the Rochdale Envelope approach (worst-case scenarios) in the absence of detailed design information. Natural England acknowledges the intention to carry out an assessment of cumulative and in combination effects as part of the forthcoming Environmental Statement and as option selection proceeds. We also note the Nutrient Neutrality Screening Assessment in recognition of the Tees catchment's current nutrient neutral status. With regard to the restoration of the SPA as distinct from nutrient neutrality the SPA's conservation objectives include the 'restore' objective. Natural England welcomes the statement regarding further consideration of the nutrient neutrality theme during the appropriate assessment stage of the project's Habitats Regulations Assessment. Based on the information available to date Natural England agrees with the conclusions of the assessments presented in the PEIR as a whole.	Effects (ES Volume I, EN070009/APP/6.2)) have been undertaken and submitted as part of the DCO Application. The Applicant can confirm a Nutrient Neutrality Assessment has been undertaken and is submitted as part of the DCO Application (EN070009/APP/5.13). Protected species The Applicant has reviewed the Natural England standing advice for protected species. The results of species-specific surveys are reported in the Environmental Statement (EN070009/APP/6.4). Habitat Enhancement The Applicant's biodiversity assessment is ongoing and includes assessment of priority habitat layers from the MAGIC database and the ecology surveys. The Applicant is happy to discuss opportunities with Natural England as the biodiversity assessment progresses.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		Protected Species Based on the information provided Natural England advises that the proposal has the potential to impact species protected by UK and EU legislation. We note that further species-specific surveys are being undertaken, and will be used to inform the Environmental Statement, as well as any required protected species licence applications. Natural England has published Standing Advice on protected species. Whilst this advice has been primarily designed to assist Local Planning Authorities better understand the information required when assessing the impacts of developments on protected species, it also contains a wealth of information to help applicants ensure their proposals comply with best practice guidelines and contribute to sustainable development. Notwithstanding our pre-application discussions on suitable ecological survey we would refer you to our standing advice for further guidance on information that may be required in terms of survey and mitigation requirements. The Standing Advice should not, however, be treated as giving any indication or providing any assurance that the proposed development will be unlikely to affect European Protected Species within the scheme's zone of influence, nor should it be interpreted as meaning that Natural England has reached any views as to whether a licence (or licences) will be required.	

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		Habitat Enhancement The development site includes and adjoins land supporting a range of priority habitats. We welcome the statement regarding consideration of these in the Environmental Statement, including open mosaic habitat on previously developed land. With regard to Biodiversity Net Gain (BNG) Natural England notes the statement within the PEIR regarding BNG being likely to achieve mandatory status for NSIPs in 2025. We welcome the commitment to a suitable BNG assessment at the relevant time in order to inform the stated objective of an overall net gain across the development site. We would be happy to work with the applicants to develop this.	
Environment Agency	26/10/23	Marine Ecology and Fisheries We are generally satisfied with the PEIR and its conclusions and have no further concerns to raise at this stage. We await further details on saltmarsh assessment and mitigation, which the PEIR states will be provided in the ES. Water Framework Directive We welcome that our previous comments regarding WFD have been acknowledged within this PEIR and that a WFD assessment will be presented in the ES. From a marine ecology and fisheries perspective, the forthcoming WFD Assessment should:	Marine Ecology and Fisheries Effects upon saltmarsh habitat will be avoided through the use of HDD. Water Framework Directive The WFD Assessment (EN070009/APP/5.16) has considered impacts to the Tees transitional water body and Tees Coastal water body, including all potential risks to the receptors listed. The WFD Assessment provides information on how adverse impacts will be avoided and/or mitigated, to achieve no deterioration to

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		• Consider the impact of the proposal on the WFD status of the Tees Transitional water body (GB510302509900), Tees Coastal water body (GB650301500005) and any linked water bodies • Identify all potential risks to the following receptors: hydromorphology, biology – habitats, biology – fish, water quality, WFD protected areas and invasive non-native species (INNS) • Ensure that there is no deterioration resulting from the proposed activities • Demonstrate how the development/activity will avoid adverse impacts • Describe how any identified impacts will be mitigated for or suggest compensation for loss. Guidance on how to assess the impact to WFD is available at: https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters The applicant should note that although the dissolved inorganic nitrogen (DIN) element for the estuary is reported as at Moderate status, monitoring has identified with 100% certainty that the DIN element falls into the Bad classification status. It is a rule of the WFD classification system that only biological elements can drive overall status below moderate. The WFD objective to prevent deterioration in the status of each body of water applies. Where an element is already at its lowest class, any further deterioration should be prevented, if	the two water bodies and receptors. River and groundwater WFD waterbodies have also been considered. The Proposed Development also ensures, in keeping with Natural England's nutrient neutrality requirements, that there would be no addition of nitrogen to the Tees Estuary. Full details are provided at Appendix 9C: Nutrient Neutrality Assessment (ES Volume III, EN070009/APP/6.4). Marine Licence No marine licence applications are anticipated to be required. The Applicant engaged with the MMO regarding marine licensing during February-March 2024. For details on the Other Consents and Licences being pursued for the Proposed Development, please refer to Other Consents and Licences Statement (EN070009/APP/5.7). The Applicant will engage with the EA on construction phase consents at the relevant time.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		necessary, through mitigation of all those effects and not limited to significant effects. Marine Management Organisation licence You may also need a Marine Management Organisation license depending on if any works will be undertaken below the mean high water springs (MHWS).	
Marine Management Organisation	03/01/24	Marine Licensing Works activities taking place below the mean high water mark may require a marine licence in accordance with the Marine and Coastal Access Act (MCAA) 2009. Such activities include the construction, alteration or improvement of any works, dredging, or a deposit or removal of a substance or object below the mean high water springs mark or in any tidal river to the extent of the tidal influence. Applicants should be directed to the MMO's online portal to register for an application for marine licence https://www.gov.uk/guidance/make-a-marine-licence-application You can also apply to the MMO for consent under the Electricity Act 1989 (as amended) for offshore generating stations between 1 and 100 megawatts in English waters. The MMO is also the authority responsible for processing and determining Harbour Orders in England, together with granting	Marine Licensing No licence applications are anticipated to be required for European protected marine species. Environmental Impact Assessment This comment is noted, the legislation and guidance highlighted here has been taken into account in the preparation of the Environmental Statement (ES Volume I, EN070009/APP/6.2), where applicable. Marine Planning The Applicant has undertaken a marine plan policy assessment and this is

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		consent under various local Acts and orders regarding harbours. A wildlife licence is also required for activities that that would affect a UK or European protected marine species. The MMO is a signatory to the coastal concordat and operates in accordance with its principles. Should the activities subject to planning permission meet the above criteria then the applicant should be directed to the follow pages: check if you need a marine licence and asked to quote the following information on any resultant marine licence application: * local planning authority name, * planning officer name and contact details, * planning application reference. Following submission of a marine licence application a case team will be in touch with the relevant planning officer to discuss next steps. Environmental Impact Assessment With respect to projects that require a marine licence the EIA Directive (codified in Directive 2011/92/EU) is transposed into UK law by the Marine Works (Environmental Impact Assessment) Regulations 2007 (the MWR), as amended. Before a marine licence can be granted for projects that require EIA, MMO must ensure that applications for a marine licence are compliant with the MWR.	included at Appendix 7A (ES Volume III, EN070009/APP/6.4).

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		In cases where a project requires both a marine licence and terrestrial planning permission, both the MWR and The Town and Country Planning (Environmental Impact Assessment) Regulations http://www.legislation.gov.uk/uksi/2017/571/contents/made may be applicable. If this consultation request relates to a project capable of falling within either set of EIA regulations, then it is advised that the applicant submit a request directly to the MMO to ensure any requirements under the MWR are considered adequately at the following link https://www.gov.uk/guidance/make-a-marine-licence-application Marine Planning Under the Marine and Coastal Access Act 2009 ch.4, 58, public authorities must make decisions in accordance with marine policy documents and if it takes a decision that is against these policies it must state its reasons. MMO as such are responsible for implementing the relevant Marine Plans for their area, through existing regulatory and decision-making processes. Marine plans will inform and guide decision makers on development in marine and coastal areas. Proposals should conform with all relevant policies, taking account of economic, environmental and social considerations. Marine plans are a	

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		statutory consideration for public authorities with decision making functions. At its landward extent, a marine plan will apply up to the mean high water springs mark, which includes the tidal extent of any rivers. As marine plan boundaries extend up to the level of the mean high water spring tides mark, there will be an overlap with terrestrial plans which generally extend to the mean low water springs mark. A map showing how England's waters have been split into 6 marine plan areas is available on our website. For further information on how to apply the marine plans please visit our Explore Marine Plans service. Planning documents for areas with a coastal influence may wish to make reference to the MMO's licensing requirements and any relevant marine plans to ensure that necessary regulations are adhered to. All public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area must do so in accordance with the Marine and Coastal Access Act and the UK Marine Policy Statement unless relevant considerations indicate otherwise. Local authorities may also wish to refer to our online guidance and the Planning Advisory Service soundness self-assessment checklist. If you wish to contact your local marine planning officer you can find their details on our gov.uk page.	

14.3.28 A high-level summary of responses to other consultation feedback relevant to this discipline is included in Table 14-5, below. A detailed consultation meeting was undertaken with the EA and the Applicant in November 2023. During this meeting, the approach to the assessment of nutrient neutrality and dispersion of treated effluent was discussed.

Table 14-5: Responses to Other Consultation Feedback

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
EA	Consultation meeting – November 2023	There are several chemical compounds present in the Tees Estuary and Tees Bay which exceed Environmental Quality Standards (EQS). Although these chemicals are not expected to be present in the effluent in high concentrations and are not being generated on site, different criteria are required to determine if these substances will significantly impact water quality during release of the effluent, given the already exceeded EQS values.	Therefore, for the purposes of the assessment, it has been agreed with the EA that the effect on water quality as a result of the release of the chemicals present within the effluent will be assessed against a 5% increase in ambient chemical concentrations (see Section 14.6 – Nutrient and Chemical Effects from the Dispersion and Discharge of Treated Effluent).

Use of the Rochdale Envelope

14.3.29 To ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the EIA is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate in line with the Planning Inspectorate's ('the Inspectorate's') Advice Note 9 (The Inspectorate, 2018). This involves assessing the maximum (or where relevant, minimum) / realistic worst-case parameters for the elements where flexibility needs to be retained (building dimensions or operational modes for example).

14.3.30 As outlined in Chapter 4: The Proposed Development (ES Volume I, EN070009/APP/6.2), the Proposed Development will include the installation of a Hydrogen Pipeline Corridor for the transportation of hydrogen (H_2) produced at the Production Facility, to off-takers in Teesside. The pipeline will be required to cross Greatham Creek to reach some of these off-takers.

14.3.31 As described in Chapter 5: Construction Programme and Management (ES Volume I, EN070009/APP/6.2), trenchless crossings will be used for the Hydrogen Pipeline Corridor which crosses the Greatham Creek area.

14.3.32 The current preferred route for the Hydrogen Pipeline Corridor at Greatham Creek is between the mouth of Greatham Creek and the A178 Seaton Carew / Tees Road, by creating a new trenchless crossing to the west of the existing bridge. The use of trenchless techniques is also proposed for the pipeline crossing under the River Tees.

14.3.33 Vessels will likely be required for transportation and delivery of materials and construction support (including abnormal indivisible loads) to Redcar Bulk Terminal (RBT) Quay.

14.3.34 For further detail regarding the proposed pipeline routings and construction methodologies, refer to Chapter 4: Proposed Development (ES Volume I, EN070009/APP/6.2) and Chapter 5: Construction Programme and Management (ES Volume I, EN070009/APP/6.2).

14.3.35 Due to the phasing of the construction, there may be a period following opening of Phase 1 where Phase 1 will be operational and Phase 2 in construction. Within the framework of this ES chapter, the worst-case scenario for construction and operation concurrently has been defined and assessed, resulting in Phase 1 being considered a more robust (worst-case) construction stage evaluation. This conclusion is drawn from the increased construction activity in Phase 1 compared to a combined assessment involving Phase 1 operational and Phase 2 construction, as construction activities during Phase 2 will be reduced. The operational stage worst case commences on completion of Phase 2.

Assumptions and Limitations

Assumptions

14.3.36 In line with the Inspectorate's guidance, the following assumptions have been made with regard to the construction phase of the Proposed Development:

- for the purposes of this assessment it is assumed that trenchless crossings will be conducted at a minimum depth of 10 m at the Greatham Creek crossing, however this will be further determined following ground investigations and the outcome of a frac-out risk assessment;
- geophysical and geotechnical surveys will be conducted as part of a separate marine licence application;
- no Proposed Development vessels will be required for the installation of the pipeline across Greatham Creek and the River Tees, however Proposed Development vessels will be present in the main channel of the Tees Estuary for delivery of plant and materials;
- there will be no impact piling in or next to the marine environment, including for the trenchless technologies pit setup and anchors, which will be installed by vibratory sheet piling;

- there will be specified construction hours: Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 16:00, thereby offering marine ecological receptors respite from any disturbance, except in specific circumstances where it is likely that some construction activities will require 24-hour working at certain times. See Chapter 5: Construction and Programme Management (ES Volume I, EN070009/APP/6.2) for further information.;
- within the final CEMP(s) prepared by the Engineering, Procurement and Construction (EPC) Contractor(s) there will be a Water Management Plan (WMP) that sets out the principles that shall be adhered to in order to manage the risk of water pollution;
- where sound production is above baseline ambient sound levels, as recorded in Section14.6, activities will have a very short duration in the event of standard operation, each lasting a maximum of 10 weeks (in Greatham Creek);
- equipment vendors and fabrication yard locations, from which material will be transported by vessel, have not been identified yet but will likely be a mix of overseas locations and from within the UK. This has informed the assessment of the risk of the introduction, transportation or spread of INNS;
- it is assumed that several vessels will be utilised for the Proposed Development, with a preliminary estimation of 15 vessels; although there is not enough engineering and procurement definition to know what vessels will be used, or their frequency of use. They are assumed as Lift on Lift off (geared vessels), barges, Roll on Roll off, and coastal vessels; and
- it is assumed that barges may be required for short transportation operations within the main channel of the Tees Estuary.

14.3.37 The following assumptions have been made for the operational phase of the Proposed Development:

- all effluent will be treated before discharged into water courses; and
- in line with the Indicative Lighting Strategy (Operation) (EN070009/APP/5.8), there will be controlled used of operational lighting.

14.3.38 Given the above, this assessment presents a reasonable 'worst-case' approach.

Limitations

14.3.39 A reasonable set of worst-case assumptions have been identified and assessed, using the Rochdale Envelope principle. There is considered to be sufficient information made available within this chapter to enable an informed view of the likely significant environmental effects of the Proposed Development.

14.3.40 However, some limitations to the assessment do persist, which are discussed in the relevant Sections below.

Construction

14.3.41 Information on airborne soundscape modelling during construction has been undertaken and the results in relation to marine mammals are presented in Section

14.6. There are some limitations with the modelling approach such as differences between thresholds for humans and thresholds for phocids. The modelling has applied A-weighting, which is typically used for human receptors, to predict sound levels for construction activities. However, due to the lack of high frequency in construction activities, predicted human A-weighted sound pressure levels (LA_{eq}) are considered to be equivalent to sound pressure levels for seals. Further information is provided in Section 14.6. The modelling undertaken also uses a highly precautionary approach which is likely to over-estimate effects.

Operation

14.3.42 Airborne sound modelling has also been undertaken for the operational phase of the Proposed Development at the Main Site based on a 24-hour working day. As with construction, there are some limitations to the approach to modelling due to differences between human and phocid thresholds. Therefore, a precautionary approach and a worst-case scenario has been adopted for the purposed of the assessment, which is likely to over-estimate the effects of airborne sound on seals. The worst-case scenario during the operational stage has been assessed as commencing on the completion of Phase 2 construction, as this is when combined Phase 1 and Phase 2 operations will begin, resulting in increased operational impacts.

Decommissioning

14.3.43 There are considered to be no limitations for the assessment of the Decommissioning Phase of the Proposed Development.

14.4 Baseline Conditions

Existing Baseline

Designated Sites

14.4.1 The Proposed Development Site is situated within the Teesmouth and Cleveland Coast SPA / Ramsar / SSSI and the Teesmouth National Nature Reserve (NNR). These sites, shown on Figure 14-2: Designated Sites with Marine Ecological Features (ES Volume II, EN070009/APP/6.3) and listed in Table 14-6, are in place for the protection of seals, and providing refuge at important haul-out sites. These sites are also designated for the protection of habitats and birds.

14.4.2 There are also several European designated sites within the Study Area and the wider North Sea which are designated for mobile marine mammals, listed in Table 14-6. These sites will be considered as part of the Report to Inform Habitats Regulations Assessment (EN070009/APP/5.10) which is also submitted as part of the DCO Application.

Table 14-6: National and European Designated Sites of Relevance to Marine Receptors

DESIGNATED/ PROTECTED SITE	APPROX. DISTANCE FROM STUDY AREA	DESIGNATED FEATURES RELEVANT TO THIS ASSESSMENT
EUROPEAN SITES		
Teesmouth and Cleveland Coast SPA/Ramsar	0 km	Breeding and non-breeding wetland birds and supporting habitats (intertidal sand and mudflats, rocky shore, saltmarsh, freshwater marsh and sand dunes)
Berwickshire and North Northumberland Coast SAC	85.6 km	Grey seal
Southern North Sea SAC	100.5 km	Harbour porpoise
NATIONAL SITES		
Teesmouth and Cleveland Coast SSSI	0 km	Breeding population of harbour seals
Teesmouth National Nature Reserve (NNR)	0 km	Protects habitats, birds and seals

14.4.3 The Southern North Sea SAC, which is designated for harbour porpoise, is located over 100 km away from the Proposed Development Site. This SAC has been scoped out from further assessment as confirmed with the Planning Inspectorate and Natural England, as there is considered to be no pathway for effect to this designated site.

14.4.4 There are no sites within the Study Area designated for the protection of fish species. However, the fish species present in the Teesmouth and Cleveland Coast SPA / Ramsar site and Teesmouth and Cleveland Coast SSSI provide an important food source to the protected features of these sites.

Benthic Habitats and Species

14.4.5 The information provided below on benthic habitats and species is derived from the following sources:

- Habitat mapping undertaken by the JNCC – Marine Nature Conservation Review (MNCR) area summaries (JNCC, 2019a);
- EA saltmarsh zonation and extent in England (EA, 2023b);
- Teesmouth and Cleveland Coast European Marine Site (EMS) Rocky Shore Survey 2010 (Natural England, 2015a);
- The intertidal mudflats GIS layer (Natural England, 2015b); and
- The UK Sea Map – Broad-scale Physical Habitat Map for UK Waters (JNCC, 2018a).

14.4.6 Data has also been provided from the phase I and II intertidal benthic survey undertaken in September 2019 as part of the NZT Project (bp, 2021c) to characterise the intertidal habitats and species present within the vicinity of the Proposed Development Site (AECOM, 2021a), as shown in Figure 14-3: Teesside Offshore Wind Farm and Net Zero Teesside EUNIS Subtidal Benthic EUNIS Biotope and Sediment Class (ES Volume II, EN070009/APP/6.3).

14.4.7 The data collected as part of the NZT Project, in combination with existing data sources such as JNCC (2019a), are considered to provide a good understanding of the existing benthic ecology and focus on the habitats at potential impact from the Proposed Development. Due to the use of trenchless technologies in the marine environment which will result in avoidance of most impact pathways to the benthic environment, the requirement for further surveys to be conducted was negated. This was proposed at the scoping stage and was agreed with regulators at the PEI Report stage.

Intertidal Benthic Ecology

Greatham Creek and Seal Sands

14.4.8 The marine habitats around Greatham Creek and Seal Sands consist of extensive areas of soft sediment including mud and sandflats. There is also coastal saltmarsh present above MHWS of both areas (a designating feature of the Teesmouth and Cleveland Coast SSSI) and on Seal Sands a small patchy area of boulders (as outlined in Figure 14-4: Important Intertidal and Subtidal Benthic Habitats (ES Volume II, EN070009/APP/6.3)).

14.4.9 Survey data is not available for Greatham Creek and Seals Sands specifically, but mapping data from magic.gov.uk indicates the EUNIS habitats present are as follows (as shown by Figure 14-4: Important Intertidal and Subtidal Benthic Habitats (ES Volume II, EN070009/APP/6.3)):

- Intertidal coarse sediment (EUNIS A2.1);
- Infralittoral / circalittoral soft sediments including sand and muddy sand (EUNIS A2.2), mud (EUNIS, A2.3) and mixed sediments (EUNIS, A2.4); and
- ‘Coastal saltmarsh and reed beds’ (EUNIS A2.5).

River Tees

14.4.10 The mouth of the River Tees is primarily comprised of estuarine soft sediment, with the muddy habitat becoming more dominant as mud content increases further into the estuary and river (JNCC, 2019a).

14.4.11 Intertidal rocky shore with areas of loose cobbles and boulders is also present along the eastern coastline of the river mouth to the left of the South Gare Breakwater, identified during the NZT Project Phase I and II intertidal benthic survey undertaken in September 2019 (bp, 2021a) (outlined in Figure 14-3: Teesside Offshore Wind Farm and Net Zero Teesside EUNIS Subtidal Benthic EUNIS Biotope and Sediment Class (ES Volume II, EN070009/APP/6.3)). These areas are highly exposed to wave action (JNCC, 2019a).

14.4.12 Bran Sands is located to the west of Coatham Sands on the other side of the dune system, within the mouth of the Tees Estuary. This is characterised as homogenous intertidal muddy sandflats (JNCC, 2019a). The location of Bran Sands means that it is comparatively sheltered from wave exposure, thereby allowing silt deposition and the formation of more muddy substrates. This muddy and sheltered habitat has allowed a more productive community of polychaetes and shellfish to develop compared to Coatham Sands. In particular, the NZT intertidal Phase I survey identified higher abundances of the common cockle (*Cerastoderma edule*) and the lugworm (*Arenicola marina*).

14.4.13 Further upstream in the river, the mud content of the sediments increases. Littoral mud is common along estuarine shorelines and is composed of fine particulate sediment, such as clay and silt (EEA, 2019). These habitats often form extensive mudflats. Little oxygen penetrates these sediments though they still support infaunal communities of bivalves, oligochaetes and polychaetes (EEA, 2019). This is part of the habitat which qualifies as an Annex I priority habitat 'Mudflats and Sandflats not covered by seawater at low tide' (1140).

14.4.14 Biotopes present in the intertidal zones of the River Tees are:

- 'Amphipods and *Scolelepis* spp. In littoral medium-fine sand' (EUNIS A2.223);
- '*Hediste diversicolor* and *Macoma balthica* in littoral sandy mud' (EUNIS A2.312);
- 'Pontic association with *Enteromorpha intestinalis'* (EUNIS A1.241);
- 'Barnacles and *Littorina* spp. On unstable eulittoral mixed substrata' (EUNIS A2.431)
- *'Fucus serratus* on full salinity sheltered lower eulittoral rock' (EUNIS A1.3151);
- *'Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock' (EUNIS A1.113);
- *'Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock' (EUNIS A1.313);
- *'Enteromorpha* spp. On freshwater-influenced and/or unstable upper eulittoral rock' (EUNIS A1.451);
- *'Ascophyllum nodosum* on very sheltered mid eulittoral rock' (EUNIS A1.314);
- '*Cerastoderma edule* and polychaetes in littoral muddy sand' (EUNIS A2.242) (represent of Annex I priority habitat and representative of UK habitats of principal importance (HPI) under Section 41 of the NERC Act 2006 (HM Government, 2006), although is not a qualifying feature of any nearby designated site);
- 'Littoral mud' (EUNIS A2.3); and
- *'Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock' (EUNIS A1.213).

Tees Bay

14.4.15 The intertidal zone of Tees Bay consists of Coatham Sands, which is an exposed intertidal sandflat running from Redcar to South Gare Breakwater, approximately 4 km in length (as outlined in Figure 14-3: Teesside Offshore Wind Farm and Net Zero Teesside EUNIS Subtidal Benthic EUNIS Biotope and Sediment Class (ES Volume II, EN070009/APP/6.3)).

14.4.16 During the NZT Project Phase I and II intertidal benthic survey undertaken in September 2019 (bp, 2021b), faunal communities exhibited low abundance, biomass, species richness and diversity, and with the exception of lugworm casts (*Arenicola* sp.) identified towards the northern end, very little evidence of benthic faunal activity was observed across Coatham Sands. The following biotopes were identified:

- Littoral sand and muddy sand (EUNIS A2.2) which included the following communities:
  - 'Talitrids on the upper shore and strandline' (EUNIS A2.211);
  - 'Polychaetes in littoral fine sand' (EUNIS A2.231), which also falls within the Annex I habitat 'mudflats and sandflats not covered by seawater at low tide';
  - 'Barren or amphipod-dominated mobile sand shores' (EUNIS A2.22), which qualifies as the Annex I habitat type 'mudflats and sandflats not covered by seawater at low tide';
  - Cerastoderma edule and polychaetes in littoral muddy sand (A2.242), which is present at Bran Sands; and
- '*Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata' (EUNIS A1.323) (around the eastern edge of South Gare breakwater).

Subtidal Benthic Ecology

Greatham Creek and Seal Sands

14.4.17 The subtidal extent of Seaton Channel, Greatham Creek, and Seal Sands is characterised by soft sediments, particularly mud (JNCC, 2019a). These habitats support several invertebrate species, including polychaetes ragworm (*Hediste diversicolor*) and the bristleworm (*Pygospio elegans*), as well as bivalves such as the common cockle (*Cerastoderma edule*).

14.4.18 Mapping data from magic.gov.uk indicates the dominant EUNIS habitats present, as shown by Figure 14-4: Important Intertidal and Subtidal Benthic Habitats (ES Volume II, EN070009/APP/6.3)) are:

- 'Sublittoral Soft Sediment' including sand, mud and mixed sediment (EUNIS A5.2, A5.3 and A5.4).

River Tees

14.4.19 Habitat mapping undertaken by the JNCC (JNCC, 2019) identified the habitat in the River Tees mouth to consist of extensive subtidal estuarine soft sediment (EUNIS A5.2, A5.3 and A5.4), with the mud content of the sediment quickly increasing with distance upstream.

14.4.20 Subtidal benthic surveys conducted in the Study Area by AECOM in 2019 as part of the NZT Project (bp, 2021c) identified the following biotope in the area of the river sampled:

- *Nephtys hombergii* and *Macoma baltica* in infralittoral sandy mud (A5.331) (as outlined at Figure 14-3: Teesside Offshore Wind Farm and Net Zero Teesside EUNIS Subtidal Benthic EUNIS Biotope and Sediment Class (ES Volume II, EN070009/APP/6.3)).

Tees Bay

14.4.21 The subtidal benthic habitat in Tees Bay is characterised by sandy sediments (JNCC, 2019a). A subtidal benthic survey conducted in Tees Bay in December 2019 as part of the NZT Project (bp, 2021c) recorded two biotopes in the bay:

- '*Nephtys cirrosa* and *Bathyporeia* spp. In infralittoral sand' (EUNIS A5.233); and
- '*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand' (EUNIS A5.242).

14.4.22 The former biotope was found in the shallow inshore area which is characterised by moderate to high exposure and sediments possessing a low clay / silt content, while the latter characterised stations which were located, in most cases, in slightly deeper, less exposed waters with a higher percentage of silt / clay (as outlined in Figure 14-3: Teesside Offshore Wind Farm and Net Zero Teesside EUNIS Subtidal Benthic EUNIS Biotope and Sediment Class (ES Volume II, EN070009/APP/6.3)). These two biotopes qualify as HPI as they are listed under Section 41 of the NERC Act (HM Government, 2006) and belong to the UK BAP priority habitat type, 'subtidal sands and gravels.'

Protected Habitats and Species

14.4.23 The saltmarsh habitat that exists in Greatham Creek and Seal Sands is a designating feature of the Teesmouth and Cleveland Coast SSSI. There are no benthic species that are specifically protected.

Invasive Non-Native Species

14.4.24 During intertidal and subtidal benthic surveys conducted in the Study Area by AECOM in 2019 (AECOM, 2021a), one INNS of seaweed was found, namely wakame (*Undaria pinnatifida*), which was observed in intertidal habitat around South Gare breakwater with a sporadic distribution. There were no INNS observed in the subtidal habitat.

Fish and Shellfish

Summary of Species

14.4.25 Fish communities in the Teesside Region (including the River Tees, Tees Estuary, and Greatham Creek) are characterised by a diverse range of pelagic and demersal fish species, with assemblages typically including herring (*Clupea harengus*), mackerel (*Scomber scombrus*), cod (*Gadus morhua*), whiting (*Merlangius merlangus*), haddock (*Melanogrammus aeglefinus*), plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*), (Teal, 2011; Callaway *et al*., 2002; EA, 2021a) (see Plate 14-1).

14.4.26 Within Greatham Creek, three-spined stickleback (*Gasterosteus aculeatus*), common goby (*Pomatoschistus microps*), European flounder (*Platichthys flesus*) and European eel (*Anguilla anguilla*) are present (Sun *et al*., 2021), and are therefore also likely to be present in the River Tees.

14.4.27 The river is an important waterbody for diadromous (i.e., migratory) fish species including salmon (*Salmo salar*), brown trout (*Salmo trutta*), European eel, river lamprey (*Lampetra fluvialis*) and sea lamprey (*Petromyzon marinus*). Shellfish species found in the Study Area include the Norway lobster, *Nephrops* sp., edible crab (*Cancer pagurus*) and European lobster (*Homarus gammurus*), although lobster is more common in coastal environments rather than riverine environments (Wilson, 2008).

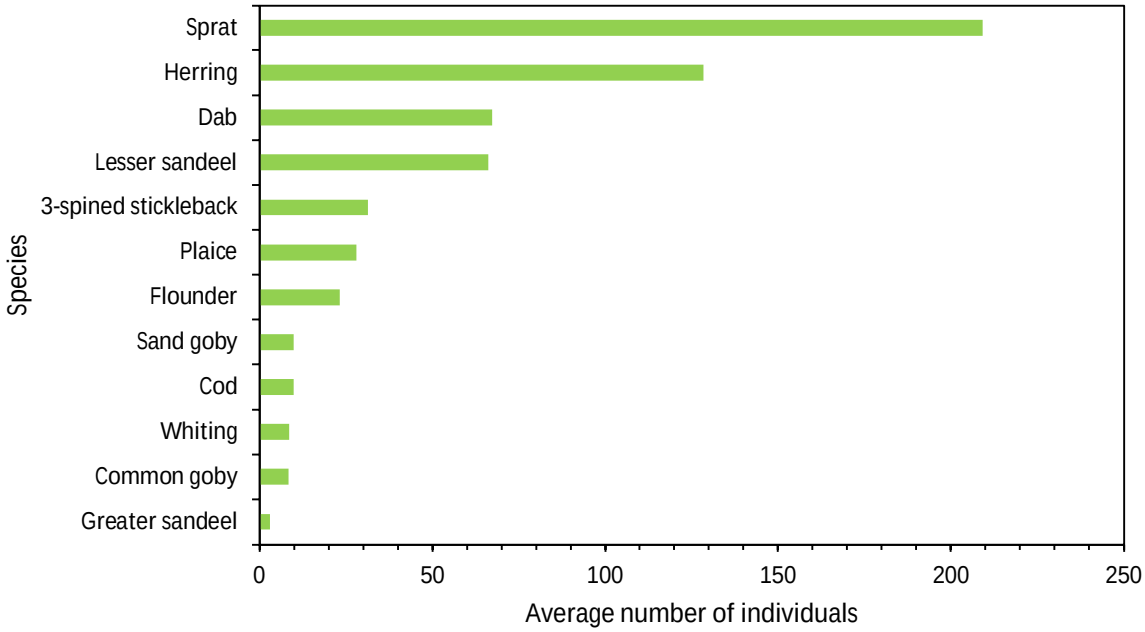

Plate 14-1: Average TraC Fish Counts for the top 10 Species Recorded in the Tees Estuary from 2010 to 2019 (EA TraC data, 2021a)

Spawning and Nursery Grounds

14.4.28 Broadscale fish sensitivity maps (Coull *et al*., 1998; Ellis *et al.,* 2012) indicate that spawning areas for lemon sole (*Microstomus kitt*) and Nephrops (Table 14-7) are found in Tees Bay. Haddock spawning grounds are also considered to occur in low

abundance (González-Irusta and Wright, 2016). Lemon sole prefer deep sandy and gravelly habitats (Hinz *et al*., 2006), whereas Nephrops are more commonly found in marine environments with muddy substrates (Johnson *et al*., 2013).

14.4.29 The Study Area falls within nursery grounds for the following species: herring, anglerfish (*Lophius piscatorius*), plaice, cod, whiting, spurdog (*Squalus acanthias*), sprat (*Sprattus sprattus*), Nephrops and lemon sole (Coull *et al*., 1998; Ellis *et al.,* 2012).

14.4.30 These spawning and nursery grounds are considered to be present mostly in the surrounding coastal areas, although some species may occur in the estuary. For example, plaice larvae enter estuarine nursery areas during the flood tide where they stay whilst metamorphosing into adults, at which point they start to prefer sandy sediments and move to coastal areas outside the estuary (Heessen *et al*., 2015).

14.4.31 The nursery grounds for herring located in Tees Bay (Coull *et al*., 1998) are of high intensity (Ellis *et al*., 2012). Spawning and nursery grounds for sandeel are not located in Tees Bay but cover much of the North Sea (Coull *et al*., 1998; Ellis *et al*., 2012). Adults of both species are found in the River Tees and estuary in small numbers. The highest concentrations of sandeel are found in the lower reaches of the River Tees, whereas herring are found throughout the river, including Greatham Creek (EA, 2021a).

14.4.32 Both salmon and brown trout are also known to spawn in the upper reaches of the River Tees (Table 14-7). Brown trout is also known to occur in small numbers within Greatham Creek (Sun *et al*., 2021).

Table 14-7: Peak Spawning Times of Species for which Spawning Grounds Occur in the Study Area (Coull *et al*., 1998; Ellis *et al*., 2012)

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Lemon Sole												
Nephrops				*	*	*						
Salmon												
Brown Trout												
Herring (Banks/Dogger stock)												
Sandeel *Ammodytes* spp.												
*peak spawning												

Migratory Fish

14.4.33 Diadromous fish species migrate between bodies of freshwater and seawater during different life phases. Major physiological changes associated with these movements occur to adapt to altered salinity and during such periods, sensitivity to environmental stressors increases (Shrimpton, 2012). Owing to their conservation importance, it is necessary to understand the migration patterns of the diadromous species known, or likely, to be present within the Study Area.

14.4.34 Several studies to observe migratory fish behaviour have occurred within the River Tees. Salmon and brown trout specifically have been heavily recorded migrating upstream. A three-year (2008, 2009 and 2013) tracking study of fish passage at the River Tees Barrage conducted by Moore and Potter (2014) observed a total of 237 fish species, 84% of which were salmon.

Salmon and Brown Trout

14.4.35 Salmon are an anadromous[1] migratory species, which during their lifetime use both marine and freshwater habitats. Spawning of salmon typically occurs in November or December, in the upper reaches of rivers where eggs are deposited into nests known as 'redds' cut into gravelly substrate (Heessen et al., 2015; NASCO, 2010).

14.4.36 In the River Tees, the greatest numbers of redds are located upstream of Eggleston, with a relatively high density between Stapleton and Whorlton (EA, 2009). Once hatched, the larvae remain within the interstitial gravels (Heessen et al., 2015), before developing into fry, and from then to a 'parr' and a 'smolt' stage (McCormick et al., 1998). The migration of smolt down-river to the ocean usually occurs from spring to early summer, generally occurring earlier in the season for larger smolt (Thorstad et al., 2012; Heessen et al., 2015).

14.4.37 Brown trout life history traits include individuals that complete their lifecycle in freshwater, and those that predominately inhabit estuarine waters (Harris et al., 2017). Sea trout are therefore anadromous brown trout. Brown trout exhibit a similar life cycle to Atlantic salmon. However, some immature smolt migrate back to freshwater environments after only a very short time feeding at sea (usually in the first winter in the ocean) (Gargan et al., 2006). Adult brown trout returning to freshwater to spawn are more likely to stray from natal rivers (Degerman et al., 2012; Gauld et al., 2013; King et al., 2016). Spawning usually takes place in autumn or winter, on stone and gravel bottoms (Heessen et al., 2015).

14.4.38 The results of the monthly upstream fish count from 2011 to 2022 show that salmon and brown trout were recorded to occur in the months of June to October (refer to Plate 14-2). Typically, peak numbers of fish were recorded in July and August though in 2015 the peak occurred in September. An average of the counts over this period shows the peak value occurred in August (mean = 180.2; std. = 219.5). Particularly high numbers of salmon and brown trout were reported in 2012 (1,661 individuals) and 2013 (1,161 individuals) however, in recent years numbers have declined, with

[1] Anadromous fish are fish that migrate from the sea into freshwater for spawning. This distinguishes them from catadromous fish, such as eels which migrate in the opposite direction, moving from freshwater to spawn in the sea.

only 266 individuals recorded in 2022. Counts only include the upstream migration of salmon and brown trout through the fish pass.

14.4.39 Brown trout were observed in the autumn breeding season downstream of Cloff Bridge Weir in Claxton Beck stream which flowed into Greatham Creek before the removal of the weir (Sun et al., 2021). Since the removal of the weir in 2018, the presence of brown trout has declined.

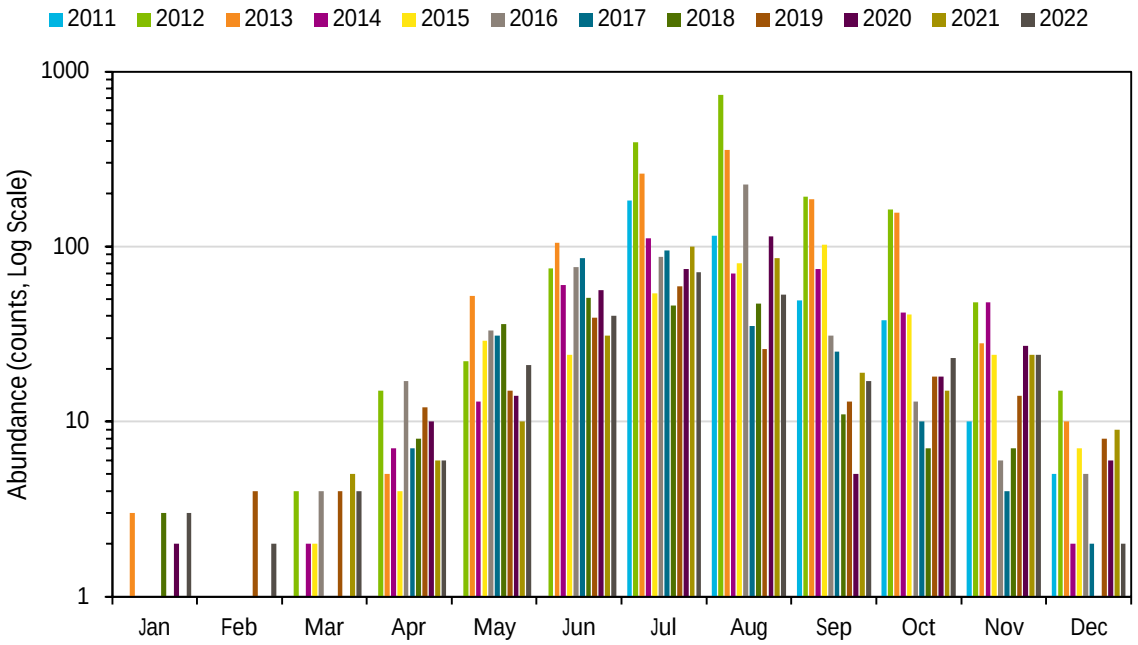

Plate 14-2: Monthly Combined Upstream Counts for Salmon and Brown Trout from 2011 to 2022 at the Tees Barrage on the Lower Tees, Reported by the EA (EA, 2023a).

Note: No data were reported for January to June 2011.

European Eel

14.4.40 European eel is a catadromous migratory species, whose spawning occurs in the Sargasso Sea where the adults subsequently die. Spawning occurs mainly in spring (Righton et al., 2016). Newly hatched larvae metamorphose into glass eels which then travel across shelf seas, using tidal stream transport. Glass eels migrate upstream into freshwater, predominately during spring but may continue to do so until early Autumn (Heessen et al., 2015; ICES, 2010). Once within freshwater habitats, eels remain for five to 15 years, transforming into yellow eels and then finally to silver eels when they begin their downstream migration through rivers and estuaries towards spawning grounds, predominately between August and December (Behrmann-Godel and Eckmann, 2003; Tesch, 2003; Chadwick et al., 2007).

14.4.41 Throughout England, European eels are present in almost all rivers, although their numbers have dramatically declined. This has resulted in European eels being listed as 'critically endangered' on the IUCN Red List since 2008. Reasons for the decline in numbers include barriers to migration, hydropower turbines, loss of wetland, and

the introduction of the parasitic nematode *Anguillicola crassus* (UK BAP, 2012). The River Tees Barrage has the potential to act as a barrier but has built opportunities for the migration of glass eels into its design, though the escapement of adult silver eels around the barrage is unknown.

14.4.42 The current population size and distribution of European eels in the River Tees is unknown. However, they have been reported in the EA TraC surveys in the River Tees (see Plate 14-3), with a total of 178 individuals found in total across all surveys over a 25-year period. TraC surveys included counts taken from Greatham Creek, though no European eels were recorded from this site. The majority of European eel were recorded in the upper reaches of the River Tees.

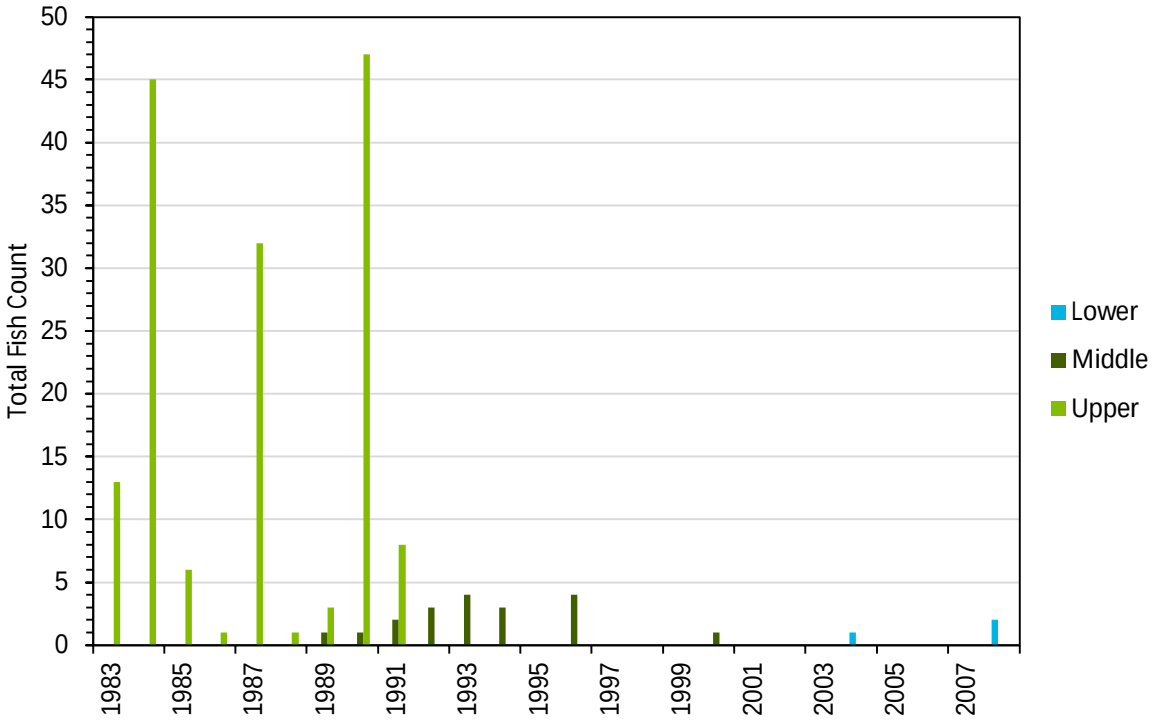

Plate 14-3: Total Fish Counts for European eel, in EA (2021a) TraC Surveys in the Three Reaches of the River Tees

14.4.43 However, European eel are known from other studies to be present in Greatham Creek, with recorded density increasing after the removal of Cloff Bridge Weir by the Tees Rivers Trust in 2018 (Sun *et al*., 2021). The colonisation of juvenile eels also occurred rapidly following the removal of the barrier.

River and Sea Lamprey

14.4.44 Sea lamprey and river lamprey are both anadromous migratory species, spawning in freshwater. Adults return to freshwater once they have spent several years in the marine environment (Laughton and Burns, 2003). Both species spawn in spring and early summer (Laughton and Burns, 2003).

14.4.45 Sea lamprey are widely dispersed in the open sea as they are solitary feeders, and are rarely found in coastal and estuarine waters (Moore et al., 2003; Heessen et al.,

2015). The distribution of sea lamprey is chiefly defined by their fish host which includes salmon (Waldman et al., 2008) and they are often found at considerable depths in deeper offshore waters (Moore et al., 2003). When returning to freshwater, sea lamprey generally choose larger rivers compared to river lamprey, although they can be found in tributaries of all sizes (Heessen et al., 2015).

14.4.46 River lamprey generally spend one to two years in estuaries and in the autumn, between October and December, stop feeding and move upstream (Natural England, 2010). Sea lamprey normally migrate into freshwater in April and May as adults, whilst the migration to sea can vary from river to river, although the metamorphosis of larvae into adults occurs in July and September (Maitland, 2003).

14.4.47 The UK distribution of river lamprey and sea lamprey, presented in Plate 14-4 (outlined by the red circles), suggests that neither species have been recorded in the River Tees. However, river lamprey were recorded in the EA TraC surveys of the River Tees, with three individuals observed in the middle reaches in 1992. Sea lamprey has not been recorded during the EA TraC surveys to date.

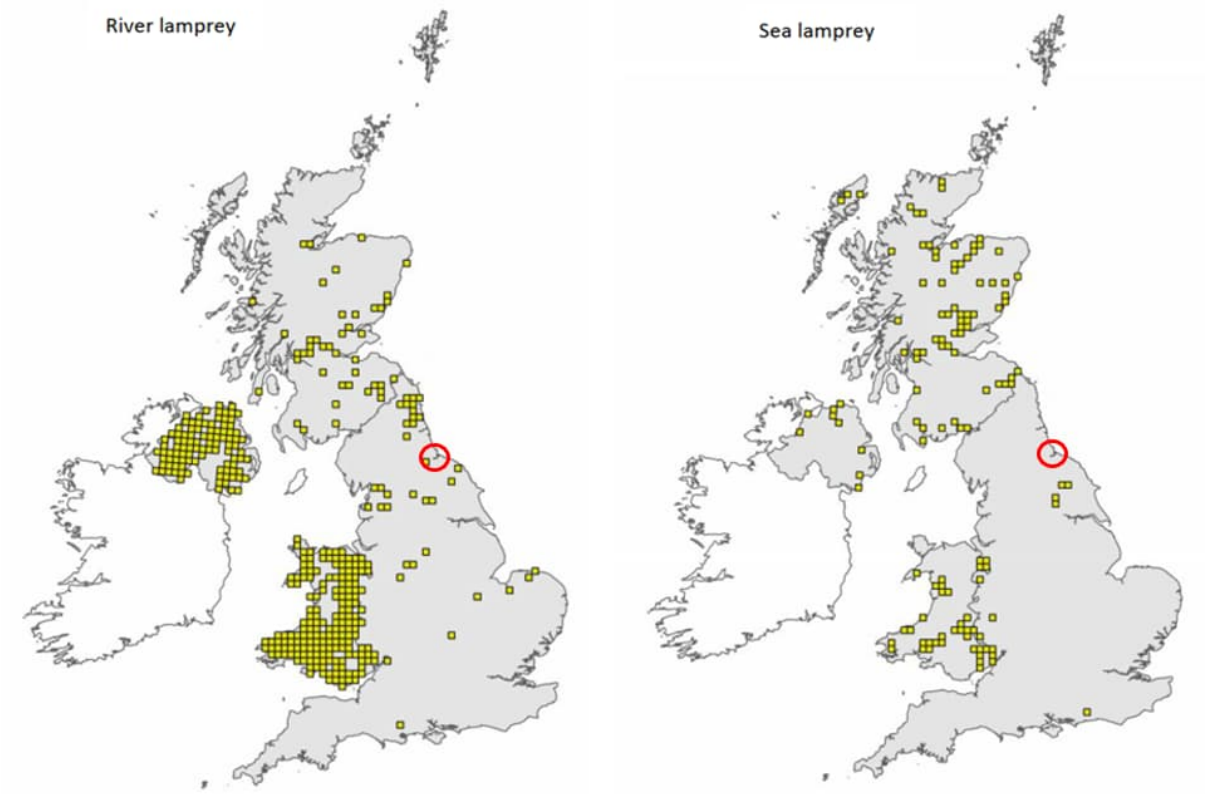

Plate 14-4: UK Distribution of River Lamprey (left) and Sea Lamprey (right) (JNCC, 2018b and 2018c)

Protected Fish Species

14.4.48 Table 14-8 lists all the fish species known to be present in the Study Area which are protected under national and international conservation legislation. With the exception of sandeel and the diadromous fish, all species listed are also considered to be of commercial importance within the Study Area.

14.4.49 There are no shellfish species which are afforded conservation protection known to be present in the Study Area.

Table 14-8: Summary of Relevant Fish Species Protected by National and International Legislation or Policy

COMMON NAMES	LATIN NAMES	HABITATS DIRECTIVE ANNEX II AND IV SPECIES	OSPAR LIST OF THREATENED AND/OR DECLINING SPECIES	BONN CONVENTION APPENDIX I AND II SPECIES	BERN CONVENTION APPENDIX II AND III SPECIES	NERC 2006 SPECIES OF PRINCIPAL IMPORTANCE	FEATURES OF CONSERVATION INTEREST (FOCI)	IUCN RED LIST*
Herring	*Clupea harengus*					✓	✓	LC (↑)
Mackerel	*Scomber scombrus*					✓	✓	LC (↓)
Cod	*Gadus morhua*		✓			✓	✓	VU (-)
Whiting	*Merlangius merlangus*					✓	✓	LC (?)
Haddock	*Melanogrammus aeglefinus*							VU (-)
Plaice	*Pleuronectes platessa*					✓	✓	LC (↑)
Dab	*Limanda limanda*							LC (↑)
Sandeel	*Ammodytidae*					✓	✓	LC (?)

COMMON NAMES	LATIN NAMES	HABITATS DIRECTIVE ANNEX II AND IV SPECIES	OSPAR LIST OF THREATENED AND/OR DECLINING SPECIES	BONN CONVENTION APPENDIX I AND II SPECIES	BERN CONVENTION APPENDIX II AND III SPECIES	NERC 2006 SPECIES OF PRINCIPAL IMPORTANCE	FEATURES OF CONSERVATION INTEREST (FOCI)	IUCN RED LIST*
Atlantic salmon	*Salmo salar*	✓	✓			✓	✓	LC (-)
Brown trout	*Salmo trutta*					✓		LC (?)
European eel	*Anguilla anguilla*		✓	✓		✓	✓	CR (↓)
Sea lamprey	*Petromyzon marinus*	✓	✓		✓	✓	✓	LC (↔)
River lamprey	*Lampetra fluviatilis*	✓				✓	✓	LC (?)

* IUCN Red List Status defined as 'CR' = Critically Endangered, 'EN' = Endangered, 'VU' = Vulnerable, 'NT' = Near Threatened, 'LC' = Least Concern and 'DD' = Data Deficient.

Population trends are also shown in brackets ('↑' = increasing, '↓' = decreasing, '↔' = stable, '?' = unknown and '-' = unspecified).

Marine Mammals

Cetaceans

14.4.50 The Proposed Development Site is located within the International Council for the Exploration of the Sea (ICES) Greater North Sea Ecoregion, which in part forms the boundaries for the Inter-Agency Marine Mammal Working Group (IAMMWG) marine mammal Management Units (Mus) for the North Sea (ICES, 2021; IAMMWG, 2022).

14.4.51 Within the Greater North Sea Ecoregion, there are four commonly occurring or resident cetacean species: harbour porpoise (*Phocoena phocoena)*, bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhynchus albirostris*) and minke whale (*Balaenoptera acutorostrata*) (ICES, 2023). There are a further six cetacean species which are considered to occur regularly, but are less common than those mentioned above, namely: common dolphin (*Delphinus delphis*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*), long-finned pilot whale *Globicephala mela*, killer whale (*Orcinus orca*) and humpback whale (*Megaptera novaeangliae*).

14.4.52 However, it is considered unlikely that these species will occur in the River Tees itself, due to their preference in open, offshore, deeper waterbodies (e.g. Barnes, 2008; Edwards, 2006). Harbour porpoise are more often found in nearshore waters (Russell, 2006) and therefore could occur in the surrounding coastal waters, such as Tees Bay. Harbour porpoise are present in the North Sea throughout the year, with numbers peaking from July – September (Hague, *et al*., 2020) coinciding with mating/calving periods (May – August) (Learmonth *et al*., 2014). No designated sites for harbour porpoise are located within the Study Area. The Southern North Sea SAC, for which harbour porpoise is a qualifying feature, is located approximately 100.5 km to the south.

14.4.53 All cetacean species are protected in the UK by the WCA (1981) and are European Protected Species (EPS) under the European Commission Habitats Directive (Annex II and IV). They are also protected internationally by the Bern Convention Appendix II (Council of Europe, 1979). Furthermore, all but the minke whale are also protected internationally by the Bonn Convention Appendix II (Conservation of Migratory Species (CMS), 2020) and the Agreement on the Conservation of Small Cetaceans of the Baltic, Northeast Atlantic, Irish and North Seas (ASCOBANS, 1992).

Pinnipeds

14.4.54 The immediate area around the Proposed Development Site is of local importance for harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) due to the presence of a breeding colony and haul-out sites at Seal Sands and along Greatham Creek. Of the two harbour seals are the most abundant (INCA, 2023).

Harbour Seal

14.4.55 Seal Sands is a known haul-out site for a breeding colony of harbour seal, which use the intertidal mudflat in this area. Greatham Creek is also known to be frequented by small numbers of individuals, which haul-out at multiple locations along the

creek, particularly at Bailey Bridge. Seal Sands is designated for harbour seal as part of the Teesmouth and Cleveland Coast SSSI and Teesmouth NNR.

14.4.56 The harbour seal population which uses habitat in the River Tees is the most significant population in the Northeast England MU, with Seal Sands (~ 1 km from the Project Site) being the only significant haul-out site within the MU (SCOS, 2022). This population also includes harbour seals found at Holy Island, situated off the north-east coast of England, south of Berwick-upon-Tweed.

14.4.57 Seals 'haul-out' at shore sites for breeding, nursing, moulting and resting (SCOS, 2022). Harbour seals haul-out patterns tend to be strongly influenced by tidal cycles and many seals haul-out on the falling tide in areas below the high tide mark. The highest numbers of seals hauled-out are usually during the breeding season and subsequent moult, although numbers may remain high year-round in areas with suitable foraging grounds available locally (Härkönen, 1987; Wilson, 2001). The maximum foraging distance for harbour seal is thought to be 273 km from haul-out sites (Carter et al., 2022). They typically consume 3-5 kg of food per day depending on the availability of prey species (SCOS, 2022).

14.4.58 Plate 14-5 shows the increasing maximum number of harbour seal recorded in Greatham Creek and Seal Sands, including the haul-out site at Bailey Bridge, between 1989 and 2023 (INCA, 2023). The annual estimate represents the maximum number of seals hauled-out at any one time over the entire survey period. Surveying was carried out on an annual basis between June and September over two different periods: the pupping period and a proportion of the moulting period. Counts were recorded every 30 minutes over low tide, every day during the pupping period and three to four days a week during the moulting period.

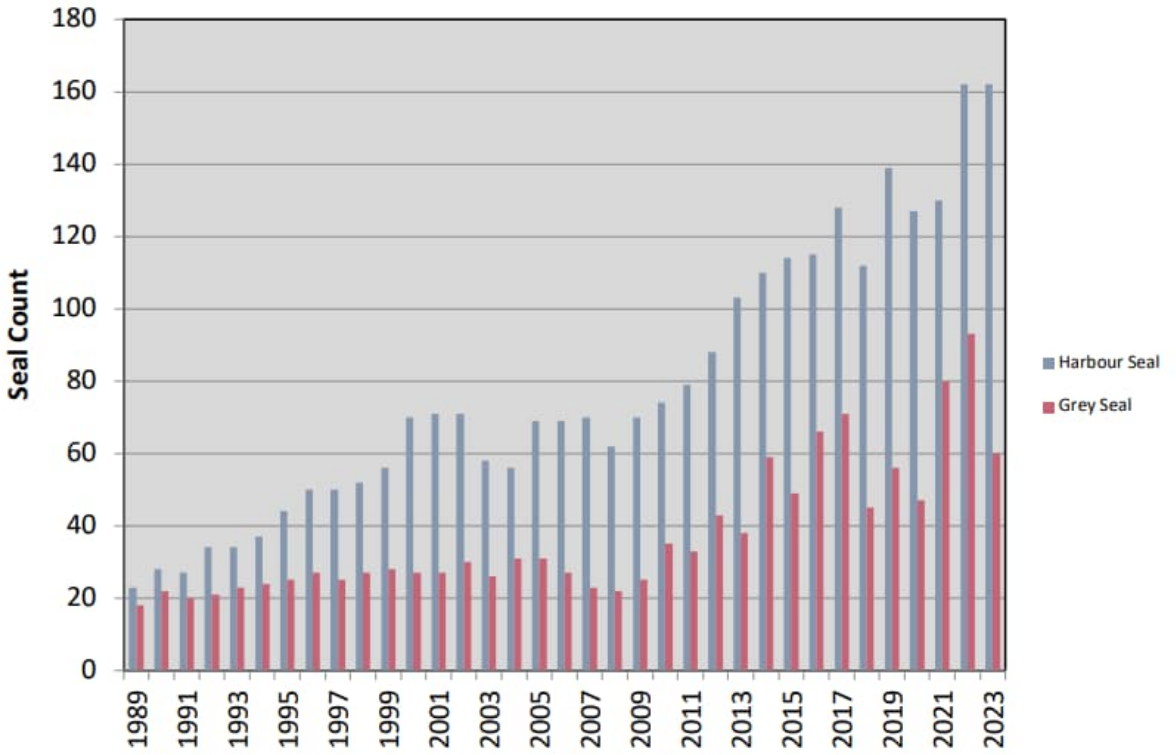

Plate 14-5: Maximum Number of Harbour Seals and Grey Seals Recorded at Greatham Creek and Seal Sands (INCA, 2023)

14.4.59 Incidental sightings of harbour seal were recorded on Seal Sands while undertaking other surveys for the Proposed Development on nine different days between October 2022 and March 2023. An average of 36.4 were recorded during each survey across this period (total of 144 individuals across the survey period), with only 13 pup sightings recorded. The seals were observed hauled-out at scattered locations on Seal Sands and in Greatham Creek.

14.4.60 The pupping season at the Tees typically occurs during late June and lasts for about three weeks into late July, typical of other populations in the north-east Atlantic (INCA, 2023). The moulting season follows, typically from mid-August until early September, when seals spend a considerable amount of time out of the water to rest and conserve heat.

14.4.61 The maximum number of harbour seal in the Tees Estuary has increased overall since 2010, with the highest estimates recorded to date observed in August 2022 August 2023 with 162 individuals both times (INCA, 2023). This included 36 pups in 2022, the highest number and increase recorded, and 26 pups in 2023. There were also no pup deaths reported during weaning in 2022, being the highest survivability rate recorded since 1989. Within the Tees Estuary, pupping is known to take place mostly at Seal Sands, with some also at Bailey Bridge.

14.4.62 Although harbour seals are present within the vicinity of the Proposed Development Site and are likely to use the adjacent sea area for foraging, in the context of wider populations in the North Sea, the immediate Study Area is not considered to be heavily used by this species compared to other areas around the

UK coast (as shown by Figure 14-5: Mean percentage of at-sea population of harbour seals from haulouts in the British Isles (Source: Carter et al., 2022) (ES Volume II, EN070009/APP/6.3)).

14.4.63 Populations along the eastern English coast, from Kent to the Scottish border, have generally increased in recent decades, including in the Tees. However, since 2019, there has been a decrease in the numbers of harbour seal in other parts of the UK, particularly in Scotland, attributed in part to outbreaks in phocine distemper virus (PDV) (SCOS, 2022). Whilst the range of this species is at a 'favourable' conservation status, its overall conservation status is considered to be 'unfavourable – inadequate'. However, this is a positive change from 'unfavourable – bad' since the last reporting in 2013, due to an overall increase in the abundance of harbour seal in the UK (JNCC, 2019b). The global conservation status of harbour seal is of 'least concern' (IUCN, 2023).

Grey Seal

14.4.64 The Proposed Development Site and the wider Tees area fall within the Northeast England Seal Management Unit. Within this management unit there are major colonies of grey seal, in both the north (Isle of May, Fast Castle, Farne Islands) and south (Donna Nook, Blakeney Point and Horsey / Winterton), either side of the Tees area (as shown by Plate 14-6). On Plate 14-6, blue ovals indicate groups of colonies within each region, whilst red stars denote less frequently surveyed colonies in England, Northern Ireland and the Isle of Man.

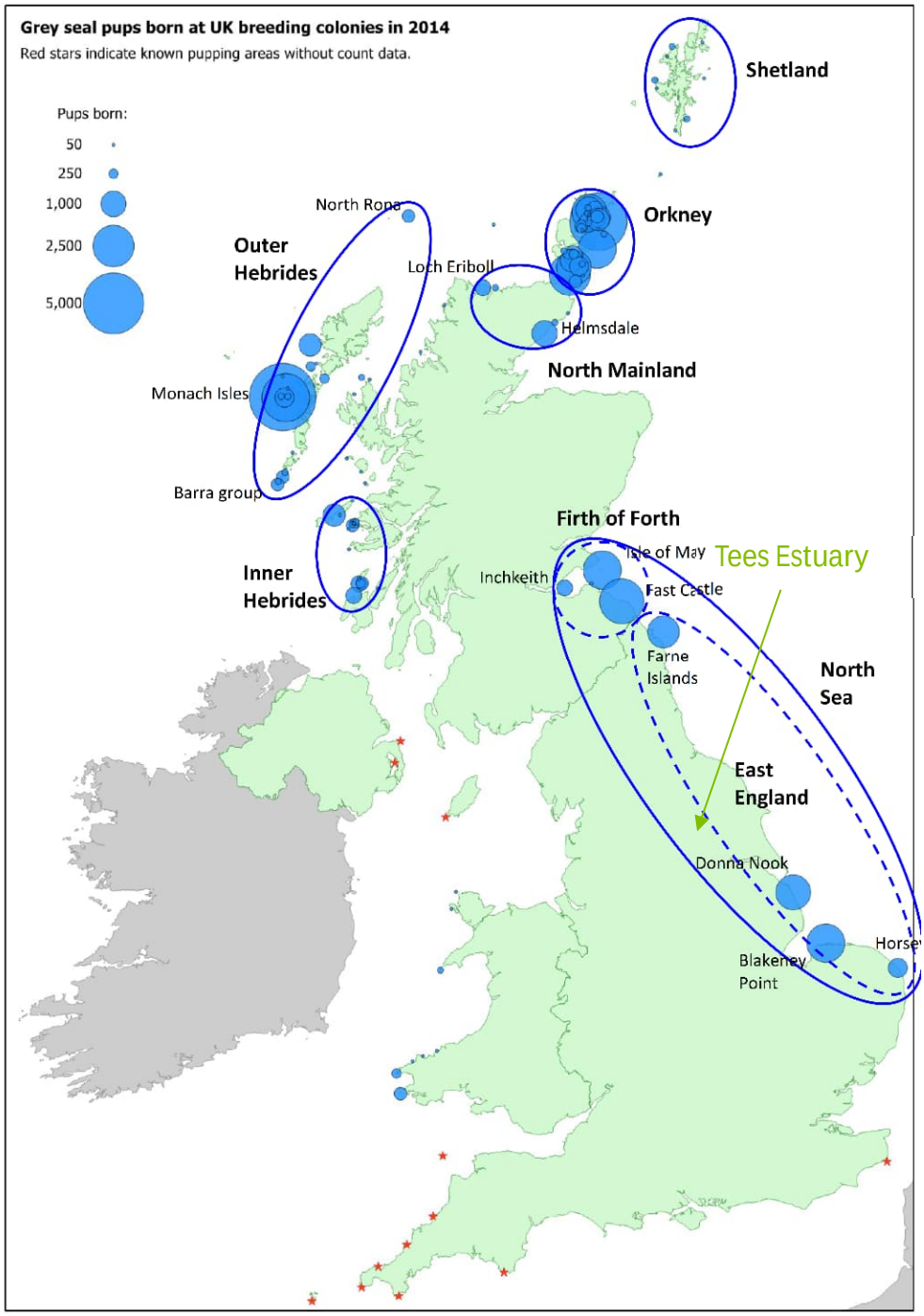

Plate 14-6: Distribution and Size of the Main Grey Seal Breeding Colonies in the UK (SCOS, 2021)

14.4.65 The latest count of grey seals in the North Sea, which included the Northeast England MU, as well as East Scotland and Southeast England MUs, took place in between 2016 to 2018 and was estimated at 19,160 individuals (SCOS, 2021). Pup production in Northeast England has continued to increase rapidly with a mean increase of 53% between 2014 and 2019. Most of the increase in the North Sea has been due to the continued rapid expansion of newer colonies on the mainland coasts in Berwickshire, Lincolnshire, Norfolk and Suffolk.

14.4.66 Grey seals forage in the open sea in depths up to 100 m and, like harbour seals, they return regularly to haul-out on land where they rest, moult and breed. They may range widely to forage, with foraging trips lasting between 1 to 30 days (SCOS, 2022). Modelling has shown that grey seals typically spend 43% of their foraging time within 10 km of a haul-out site (McConnell *et al*., 1999), with the maximum foraging range of grey seal observed up to 448 km (Carter *et al*., 2022).

14.4.67 Seal Sands on the River Tees is an important haul-out site for this species, although the grey seal population here is smaller than that of harbour seal (Plate 14-5; INCA, 2023). However, there has been an overall increase in the grey seal population since 2010. Maximum recordings of individuals on Seal Sands were down between 2018 and 2020 though a peak count of 96 individuals was recorded in August 2022, when all grey seals counted were hauled-out on Seal Sands, suggesting that population size is increasing. However, counts were considerably lower in 2023 with only 60 individuals recorded.

14.4.68 Incidental sightings recorded during other related surveys on nine different days between October 2022 and March 2023 observed an average of 35.6 grey seals each survey with a total of 28 pups recorded, all hauled-out on Seal Sands.

14.4.69 In December 2022, a grey seal pup at Seal Sands was recorded alongside an adult female, which is thought to be the first observation of a grey seal born in the Tees (INCA, 2023). There were no grey seal pup births recorded in the Tees in 2023. Grey seals are also known to use Greatham Creek but are only occasionally recorded here in small numbers.

14.4.70 Although grey seals are present within the Study Area and are likely to use the adjacent sea area for foraging, in the context of the populations in the wider North Sea, the Study Area is not considered to be heavily used by this species (Figure 14-6: Mean percentage of at-sea population of grey seals from haulouts in the British Isles (Source: Carter et al., 2022) (ES Volume II, EN070009/APP/6.3)). This is supported by historical boat-based surveys in the vicinity of the Dogger Bank Teesside A & B Wind Farm which recorded relatively few sightings of grey seal (<20 per sampling month) (January 2010 to June 2012) (Gardline Environmental, 2012). The average absolute density estimated for the survey period was 0.02131 (95% CI = 0.016 – 0.033) with a peak density of 0.5 seals per km^2.

14.4.71 The UK grey seal population is considered to be stable and increasing, particularly within the eastern England colonies which is supported by local observations in Teesmouth (SCOS, 2022; INCA, 2023). Overall, this species is at 'favourable' conservation status in the UK (JNCC, 2019b). Globally, populations are also considered to be increasing and therefore the conservation status of this species is of 'least concern' (IUCN, 2023).

Future Baseline

14.4.72 The River Tees and Estuary has had a long industrial and urbanised history during which time disturbance to the marine environment has been high. Historically, human activities have led to a range of impacts including increased water pollution and reduced access to upstream environments which have resulted in several well

documented ecological effects, including a decline in the abundance of migratory fish species and seals within the Tees Estuary (Cefas et al., 2019; INCA, 2019).

14.4.73 In recent years, conservation and management efforts have seen an improvement in environmental conditions and a recovery in some species' populations. Trends for several species, such as harbour seal, are generally increasing (INCA, 2019), whilst for others such as Atlantic salmon, populations remain at risk (Cefas *et al*., 2019). Future management measures (e.g., continued improvements in water quality, removal of instream barriers and the installation of fish passes and screening at intakes) can be expected to facilitate improvements in species populations, although it is not possible to quantify the future benefits of such measures.

14.4.74 However, starting in October 2021 and continuing periodically through 2022, large numbers of dead and dying crustaceans were washed up on the north-east England coastline, including Teesside (Defra, 2023). Some crustaceans were observed displaying unusual twitching behaviour. The exact cause of death has been highly disputed. However, several explanations have been proposed, including disease, harmful algal blooms, chemical toxicity resulting from historical industrial activity in Teesside, and dredging in the Tees area, including Tees Estuary. The most likely cause of death is considered to be a novel pathogen. However, the mortality event is still largely unexplained, suggesting similar events could continue to occur into the future without an identifiable cause and therefore focused mitigation.

14.4.75 Other factors which pose a risk to marine ecological receptors include the prevalence of disease and climate change. Outbreaks of PDV can lead to mass mortality of seals. In 2019, unprecedented levels of seal pup mortality were observed in the Study Area and although no specific cause was identified, individuals displayed symptoms which indicated some type of infection (INCA, 2019).

14.4.76 Climate change is not expected to have an impact on the future baseline of the Study Area within the relatively short timeframe of the Proposed Development. Changes in sea temperature may have a small effect on the abundance and distribution of certain species. However, these changes are unlikely to be detectable in the short term of the construction phase of the Proposed Development. Changes due to sea temperature increase are more likely to occur during the operational or decommissioning phases. Impacts during decommissioning are thought to be similar to those during construction and changes in the baseline are not likely to be significant.

14.5 Proposed Development Design and Impact Avoidance

14.5.1 The EIA process aims to avoid, prevent, reduce or offset potential environmental effects through design and/or management measures. These are measures that are inherent in the design and construction of the Proposed Development (also known as 'embedded measures').

14.5.2 The following impact avoidance measures have either been incorporated into the design or are standard construction or operational practices. These measures have,

therefore, been taken into account during the impact assessment and will be secured through the draft DCO.

14.5.3 The following design and impact avoidance measures are those that are inherent to the design of the Proposed Development. The measures proposed have considered the reasonable worst-case scenarios.

Construction

14.5.4 A Framework CEMP (EN070009/APP/5.12) sets out the key measures to be employed during the construction of the Proposed Development, to control and minimise the impacts on the environment. The Framework CEMP will set out how impacts upon marine ecology receptors will be managed during construction, such as the use of trenchless technologies for pipeline crossings. A Final CEMP(s) will be prepared by the EPC Contractor(s) in substantial accordance with the Framework CEMP prior to construction. The submission, approval, and implementation of the Final CEMP(s) will be secured by a Requirement of the draft DCO.

Management of Construction Surface Water Runoff and Marine Water Quality

14.5.5 The Framework CEMP includes the requirement for a Water Management Plan (WMP). This document will outline the mitigation measures necessary to avoid, prevent and reduce adverse effects where possible upon the local surface water (and groundwater) environment during construction. An Outline Water Management Plan is included as Appendix B to the Framework CEMP (EN070009/APP/5.12). The Framework CEMP and Outline Water Management Plan include detail on the measures to manage:

- fine sediment in surface water runoff;
- the risk of accidental spillages on the Proposed Development site; and
- the management of construction dewatering.

14.5.6 The Outline Water Management Plan will also outline drainage and runoff strategies during construction phases, a pollution prevention plan, and an emergency response plan.

14.5.7 Furthermore, during construction of the Proposed Development, it is proposed that a water quality monitoring programme is undertaken to ensure that mitigation measures are operating as planned and preventing pollution. This is standard practice for construction works of this type, and full details will be outlined in the WMP accompanying the Final CEMP(s).

Management of Construction Vessel and Accidental Spillages

14.5.8 Vessels including barges and geared vessels will be required for transportation and delivery of construction materials and for construction support. All vessels associated with the Proposed Development will adhere to the following:

- Harbour Authority approvals;

- International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of marine INNS (IMO, 2017);
- International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011);
- International Regulations for Preventing Collisions at Sea (IMO, 1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (IMO, 2021) with the aim of preventing and minimising pollution from ships; and
- The Shipboard Oil Pollution Emergency Plan (SOPEP) (IMO, 2019); all vessels shall have a contingency plan for marine oil pollution.

Construction of Hydrogen Pipeline Corridor – Trenchless Crossings

14.5.9 A gaseous phase Hydrogen Pipeline is required to connect various potential industrial off-takers across the Tees Valley to the Hydrogen Production Facility at the Main Site. This will require crossings of numerous watercourses.

14.5.10 The Hydrogen Pipeline is expected to range from 6 to 24 inches (15.24 cm to 60.96 cm) in diameter and while being primarily above ground, it would cross the River Tees and Greatham Creek (and adjacent water features at Seal Sands) using trenchless technologies. The Hydrogen Pipeline Corridor is shown in Figure 4-4: Hydrogen Pipeline Corridor (ES Volume II, EN070009/APP/6.3).

14.5.11 The use of trenchless technologies avoids any direct impact to the estuary or creek bed, associated sediment mobilisation and scour. For the purposes of this assessment the worst-case minimum depth below the bed of Greatham Creek is assumed to be 10 m. For the Tees Crossing this is expected to be in the range of a minimum of 25 m depth (at the deepest point of the crossing) to prevent impacts on river channel integrity, habitats and infrastructure (including other bores and tunnels); and a maximum depth of 60 m. However, this will be determined following the ground investigation at the detailed design phase and the outcome of a frac-out risk assessment. This will ensure that there is no risk of exposure of the pipeline.

14.5.12 The methodology of the drilling, or other trenchless techniques, will include measures to minimise the risk to the environment, as set out in the Framework CEMP (EN070009/APP/5.12). For HDD methods, there are risks associated with the use of drilling muds and plant close to the channel. For example, although rare, without due care there is a risk that drilling muds can 'break out' into watercourses leading to pollution (known as 'hydraulic fracture' or 'frac-out' event) or that the HDD bore may collapse.

14.5.13 It is noted the potential also exists for habitat loss to occur as a result of HDD collapse or leakage of drilling fluid to the surface, known as breakout. There are standard measures which are included in the design and performance of the HDD which are considered sufficient to avoid the risk of habitat loss.

14.5.14 Risk of hydraulic fracture / breakout and the potential for habitat loss will be minimised by:

- performing appropriate geotechnical investigations along the trenchless crossing alignments;
- designing the trenchless crossings profile to pass at an appropriate depth below the watercourse (>10 m for Greatham Creek and >25 m for the Tees River). The depth should be sufficient to minimise the risk of failure or collapse based on the expected ground conditions (>25 m);
- designing the trenchless crossing to pass through competent soil layers identified in geotechnical investigations;
- detailed design of the launch and exit points of the trenchless crossing, taking account of geological layers and the intended drill path;
- performing drilling fluid hydrofracture analyses for each drilling operation and maintaining downhole pressures within recommended limits;
- using appropriate downhole annular pressure monitoring equipment (set by fracture calculations) in real time to warn of over pressurising by drilling fluid;
- designing a drilling fluid appropriate for the anticipated ground conditions;
- appropriate monitoring of drilling fluid parameters during drilling; and
- performing regular monitoring of the ground above the trenchless crossing alignment for drilling fluid leaks to the surface.

14.5.15 In addition, for HDD casing pipe to contain drilling fluid may be installed through less competent shallow ground layers at entry or exit points when considered necessary. Similarly, MBT shafts will be lined with concrete rings for stability.

14.5.16 A site-specific Hydraulic Fracture Risk Assessment will be developed prior to construction following further investigation of specific ground conditions at the crossing locations, and appropriate mitigation developed in line with best construction practice. The drilling fluid that returns to the drilling rig is recycled within that drilling rig. Any wastewater/drilling products that are not recycled will be stored and removed by a suitable waste management contractor and disposed of at a licensed wastewater facility. The drill fluids used within the drilling machine will be water based, such as naturally occurring bentonite clay.

14.5.17 These mitigation measures are secured within the Framework CEMP (EN070009/APP/5.12).

Management of Construction Lighting and Working Hours

14.5.18 An Indicative Lighting Strategy (Framework Construction Environmental Management Plan Appendix C EN070009/APP/5.12) has been developed to minimise and control the impacts of artificial lighting on the marine environment. Construction lighting will be arranged so that glare and light spill outside the

construction site is minimised to avoid impacts to sensitive ecological features – the strategy for this lighting will be included in the Final CEMP(s).

14.5.19 Construction working hours will generally be Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 16:00 plus, up to one hour before and/or after for mobilisation (start-up and close down) procedures, thereby offering marine ecological receptors respite from any disturbance. However, some construction activities that cannot be interrupted, such as certain specialist crossing activities such as trenchless pipeline installation (which produce continuous sound sources only), are likely to continue outside the general core working hours and may operate 24 hours a day at certain times. See Chapter 5: Construction and Programme Management (ES Volume I, EN070009/APP/6.2) for further information.

Operation

Management of Construction Surface Water Runoff and Marine Water Quality

14.5.20 A Detailed Surface Water Drainage Strategy will be in place during the operation of the Proposed Development, which will be defined through consultation with the Environment Agency, the LLFA (RCBC and STBC) and other statutory agencies. This will be a Requirement of the DCO.

14.5.21 In addition, it is envisaged that a Surface Water Maintenance and Management Plan will be developed by the future site operator, detailing information relating to access, and maintenance of the different Sustainable Drainage Systems (SuDS) and surface water features proposed on the Proposed Development Site. An Emergency Response Plan will also be produced to deal with emergency situations.

14.5.22 The use of the chemical products at the Proposed Development Site will follow the product-specific environmental guidelines, as well as the legislative requirements set out in the Control of Substances Hazardous to Health Regulations (COSHH) (2002) and Control of Major Accident Hazards (COMAH) Regulations (2015). A site Emergency Response Plan will be produced for the operational phase to deal with emergency situations involving loss of containment of any hazardous substances. Key actions which will be included within this plan are outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

14.5.23 Further information of the design controls for process and foul wastewater, generated by the Proposed Development, is outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2).

Management of Operational Lighting

14.5.24 A Lighting Strategy will be implemented to reduce the effects of artificial light on site during the operational phase of the Proposed Development, with several mitigation measures incorporated including careful placement of lighting columns, using lamps with a limited UV spectrum in locations which might affect ecological receptors, and directing luminaires away from ecologically sensitive receptors. This will be in substantial accordance with the Indicative Lighting Strategy (Operation) (EN070009/APP/5.8).

Management of Nitrogen Depositions

14.5.25 The Proposed Development will be designed so that all process emissions to the air comply with the Emissions Limit Value agreed in the environmental permit. The Environment Agency will also regulate the operation of the Proposed Development. The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024.

14.5.26 An Environmental or Ecological Clerk of Works (ECoW) will be present during Proposed Development construction as appropriate to supervise and instruct implementation of impact avoidance commitments as detailed in the Outline Landscape and Biodiversity Management Plan (EN070009/APP/5.9).

14.5.27 Further information can be found in Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2).

Decommissioning

14.5.28 A Decommissioning Environmental Management Plan (DEMP) would be produced pursuant to a DCO Requirement. The DEMP would consider in detail all potential environmental risks on the Proposed Development Site and contain guidance on how risks can be removed or mitigated. This will include details of how surface water drainage should be managed during decommissioning and demolition. The DEMP would be secured by a Requirement on the draft DCO, if granted. A DEMP would also include an outline programme of works.

14.6 Impacts and Likely Significant Effects

14.6.1 This Section presents an assessment of impacts and likely significant effects associated with construction, operation (including maintenance) and decommissioning of the Proposed Development on marine ecological receptors in the absence of any mitigation, over and above that which is inherent to the design and good practice as detailed in Section 14.5.

14.6.2 Construction and operational lighting will be arranged so that glare and light spill outside the construction site is minimised to avoid impacts to sensitive ecological features. An Indicative Lighting Strategy (Operation) (EN070009/APP/5.8) has been prepared to demonstrate how lighting impacts on sensitive ecological features. The Proposed Development is located within an area characterised by a high level of industrial activity, including the Venator Greatham Works, located approximately 0.4 km northwest of Seal Sands and 0.6 km north of Greatham Creek and therefore the level of artificial lighting is already expected to be high. The implementation of the Final Lighting Strategy is expected to minimise the spill of artificial lighting onto haul-out locations due to the protection measures included. However, due to the proximity of the Proposed Development to sensitive seal habitats, this impact pathway has been assessed further below.

14.6.3 The impact pathway for underwater sound associated with the Proposed Development has been scoped out as described below.

14.6.4 Although the use of vessels is proposed, underwater sound has been scoped out from further assessment and is not considered further. A preliminary estimate indicates that up to 15 vessels may be required during construction of the Proposed Development, subject to finalisation at the design stage. The underwater sound produced by the small number of vessels[2] associated with the Proposed Development, are not expected to be greater than the background vessel noise expected to already be occurring in the Study Area due to the location of Tees Port and the high number of vessels using the port, as shown by AIS Marine Vessel Traffic Data (ABPmer, 2017). Furthermore, it is assumed that vessels are not required in Greatham Creek, due to its narrowness and tidal nature, making it a risky area to work within.

14.6.5 There is no drilling or piling required in the marine environment, and therefore planned UXO clearance is considered unlikely. Trenchless technologies such as HDD will be at a minimum depth of 10 m below the bed at Greatham Creek and a minimum 25 m depth for the Tees Crossing (this will be determined following the ground investigation at the detailed design phase and the outcome of a frac-out risk assessment), such that there is no pathway for planned activities for underwater sound and vibration effects to marine ecological receptors, as the works will be through bedrock below marine sediment. This is assumed to occur at a sufficient depth where underwater sound and vibration effects to migratory fish are unlikely.

14.6.6 On the basis of design and impact avoidance measures provided, the risk of frac-out events occurring is minimised. Furthermore, site-specific hydraulic fracture risk assessment will be developed prior to construction of the Proposed Development, taking into account ground investigations. Therefore, the risk for 'frac-out' during HDD is considered negligible and has not been considered further. Thus, this impact pathway has been scoped out.

14.6.7 The release of air pollutants produced by land-based construction machinery and vehicles during the construction is predicted to have negligible effect (Not Significant) upon air quality (see Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2)). As such, there is considered to be no pathway of effect to marine ecological receptors from airborne pollutant deposition from construction machinery in the marine environment and this pathway has been scoped out. Air pollutants produced by marine vessels used during the construction phase of the Proposed Development are also not expected to be greater that the background vessel air pollution expected to already be occurring in the Study Area due to the high number of vessels using Tees Port, as shown by the AIS Marine Vessel Traffic Data (ABPmer, 2017). However, the effects to marine ecological receptors from airborne pollutants deposited from the production facility during operation have been assessed below.

[2] The total number of vessels is not yet defined. However, these will likely consist of lift on/lift off (geared vessels), barges, Roll on Roll off, and coastal vessels. These vessels will be used for the delivery of prefabricated production modules, which would be berthed at RBT's Terminal Quay for unloading using a crane on the quayside or geared vessel.

14.6.8 On this basis, the likely impacts and effects of the Proposed Development on marine ecological features, that have been scoped in for consideration within this ES chapter, are summarised in Table 14-9.

Table 14-9: Likely Impacts Considered Further in the Assessment and Marine Ecological Features Most Likely to be Affected by the Proposed Development

LIKELY IMPACTS	DESIGNATED SITES	INTERTIDAL HABITATS AND SPECIES	SUBTIDAL HABITATS AND SPECIES	FISH AND SHELLFISH	MARINE MAMMALS
Construction					
Changes in Marine Water Quality During Construction Activities including Surface Water Runoff	✓	✓	✓	✓	✓
Changes in Water Quality from Accidental Spills and Vessel Fuels and Oils	✓	✓	✓	✓	✓
Collision Risk between Proposed Development Vessels and Marine Mammals	✓				✓
Changes in Airborne Soundscape During Construction	✓				✓
Changes in Visual Stimuli, including from Artificial Lighting	✓			✓	✓
Introduction, Transportation and Spread of INNS		✓	✓	✓	
Operation					
Changes in the Airborne Soundscape during Operation	✓				✓
Deposition of Airborne Pollutions including Nitrogen	✓	✓	✓	✓	✓
Nutrient and Chemical Effects from the Dispersion and Discharge of Treated Effluent	✓	✓	✓	✓	✓
Thermal Effects from Treated Effluent Discharge	✓	✓	✓	✓	✓
Decommissioning					
No likely effects to marine ecology features have been identified for the decommissioning of the Proposed Development.					

Construction

14.6.9 The following Sections present an assessment of likely significant effects on marine ecological features during construction of the Proposed Development.

Changes in Marine Water Quality During Construction Activities Including Surface Water Runoff

14.6.10 During land-based construction activities for the Proposed Development, there is the potential for impacts on marine water quality from chemical and fine sediment discharges into the marine environment. These discharges have the potential to alter water quality in terms of physico-chemical, biological, and chemical parameters in Greatham Creek, Tees Estuary and Tees Bay. Indirect marine water quality impacts may also occur to downstream receptors, as spills or contaminated water and suspended sediments can propagate along the initial receiving watercourse, and all non-marine waterbodies that could be impacted ultimately discharge into Tees Bay. The downstream receptors for all tributaries within the Study Area are the Tees transitional and Tees Coastal WFD waterbodies.

14.6.11 Several design and good practice mitigation measures have been proposed (outlined in Section 14.5 and included in the Framework CEMP) which are intended to reduce and avoid the risk of pollutants entering the marine environment. This includes locating trenchless crossing launch, reception and jointing pits at least 10 m away from a watercourse and the use of water-based drill fluids, and monitoring of water quality during construction .

14.6.12 The direct effects to marine water quality are considered in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2). With the implementation of appropriate design and good practise measures as detailed in the chapter, the assessment in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) concludes that effects to the Tees Estuary and Greatham Creek from changes in surface water quality during the construction phase will be negligible. Both water features feed into the Tees Transitional WFD Waterbody resulting in a Slight Adverse impact (Not Significant) in Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2), but no long-term effect is expected.

14.6.13 Given the highly dynamic nature of Greatham Creek, the Tees River, and Tees Bay, in the unlikely event that pollutants or contaminants were accidently released, these would be rapidly dispersed and diluted. This would mean that any indirect effects to benthic ecology and other marine receptors would be highly localised to the discharge point, temporary, and short-term. Furthermore, mobile receptors such as fish and marine mammals (including seals) are expected to move away from any affected area, and thus effects to these receptors would be limited.

14.6.14 Considering the nature of the impact, any significant effect to the abundance, distribution or functioning of habitats and species populations beyond the local level is considered unlikely. Therefore, the magnitude of indirect effects to marine ecology receptors from changes in marine water quality during the construction of

the Proposed Development is assessed as very low and the effects are predicted to be Negligible (Not Significant).

Changes in Water Quality from Accidental Spills of Vessel Fuels and Oils

14.6.15 The use of vessels for the delivery and transport of construction materials and construction support, presents a risk for the accidental release of fuels and oils. An accidental release of fuels and oils has the potential to negatively affect water quality in the Study Area, with subsequent impacts to marine habitats and species. Leaked fuels and oils can directly impact benthic habitats and species, fish and shellfish and marine mammals through smothering which can cause toxicity or inhibition of normal behaviours (e.g., feeding and egg laying) and ultimately lead to mortality.

14.6.16 Minor spills could occur through several activities including leaking hydraulic hoses or during refuelling. However, such spills are expected to be small, consisting of only a few litres. If released into the marine environment these minor spills are expected to undergo rapid dispersion and evaporation when subjected to wave action, wind, currents and light, as well as degradation via bacterial action. Consequently, any small releases are likely to break up and disperse in a short space of time, resulting in little impact to the marine environment.

14.6.17 Larger spills, such as during collisions between vessels, have the potential to impact flora and fauna particularly if the spill is in shallow water. As part of proposed design and good practise measures in place to reduce the risk of collisions, vessels will be required to comply with the International Regulations for Preventing Collisions at Sea (IMO, 1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (MARPOL Convention 73/78) specifically including compliance with Annex IV on pollution by sewage and prevention of air pollution by ships; and Annex V on pollution by garbage from ships with the aim of preventing and minimising pollution from ships.

14.6.18 The sensitivity of benthic, fish and shellfish and marine mammal receptors to accidental spills is considered to be high. However, given the design measures in place, and the high baseline presence of vessels in the Tees Estuary, any significant effect to marine ecology receptors is considered unlikely and the magnitude is assessed as very low. Therefore, effects to marine ecology receptors due to changes in water quality from accidental spills are predicted to be Negligible (Not Significant).

Collision Risk Between Proposed Development Vessels and Marine Mammals

14.6.19 The construction of the Proposed Development will require the deployment of several vessels for delivery of materials and construction support. The vessels required are expected to include lift-on/lift-off (geared - LOLO) vessels, barges, roll-on / roll-off (ROLO) vessels and coastal vessels. It is expected that the majority of vessels will travel through the Tees Estuary to access the Redcar Bulk Terminal Quay for deliveries.

14.6.20 Marine mammals, particularly cetaceans, are considered to be fast swimming, agile species, with rapid reflexes and good sensory capabilities (Hoelzel, 2002). However,

individuals can become distracted during important activities such as foraging and social interactions, and therefore may not perceive the threat of an approaching vessel (Wilson *et al*., 2007). Cetaceans including harbour porpoise and minke whale have exhibited avoidance behaviour to vessel presence (Palka & Hammond, 2001; Wisniewska, *et al*., 2018; Roberts *et al*., 2019).

14.6.21 Cetaceans and seals are reasonably resilient to minor strikes and collisions (Wilson et al., 2007). However, a direct strike from a sharp object such as rotating propeller blades has potential to cause lethal injury.

14.6.22 The risk of collision for seals is considered to be lower than that for cetaceans, although they are still at risk of injury or death (Jones *et al*., 2017). Cases of seal injuries thought to be caused by propellers and thrusters (for dynamic positioning of vessels) have been recorded in the UK (Bexton *et al*., 2012). However, evidence suggests that a large proportion of these injuries can be attributed to alternative, natural mechanism for injury such as grey seal infanticide and cannibalism, which may also cause 'spiral / corkscrew' lacerations comparable to those produced by ship propellors (Thompson *et al*., 2015; Brownlow *et al*., 2016).

14.6.23 Locally resident species such as harbour seal and grey seal, which haul out at Seal Sands (~ 1 km from the Project Site), are likely to be habituated to marine vessel movements due to regular marine traffic using the River Tees navigational channel. However, juvenile seal pups which are inexperienced in the water may be more vulnerable. It is considered unlikely that other marine mammals species, such as harbour porpoise, will occur in the River Tees itself due to the regular marine vessel movements.

14.6.24 The two biggest factors concerning collision risk and severity are vessel speed and draft depth (Rockwood *et al*., 2017; Schoeman *et al.,* 2020; Winkler *et al*., 2020). Higher speeds produce a greater force of impact and larger drafts have been associated with increased risk of mortality. Species-specific relationships of collision risk require further research. However, previous research has identified several behavioural factors that may play an important role, including amount of time spent at the surface and avoidance behaviours (Schoeman *et al*., 2020).

14.6.25 The vessels used for the Proposed Development are likely to be large and therefore will be traveling at slow speeds (estimated to be less than 10 knots), particularly through the estuary. At such speeds, vessels are unlikely to pose a significant risk of collision to marine mammals; most serious injuries are considered to occur at speeds >14 knots (Winkler *et al*., 2020). Furthermore, due to the large volume of vessels regularly using the Tees estuary and surrounding waters of the North Sea (ABPmer, 2017), the small number of vessels associated with the Proposed Development (preliminary estimates suggest 15 vessels will be used during construction) is not expected to cause a substantive change from baseline vessel activity. Marine mammals are highly mobile species and are expected to move away from oncoming vessels. In addition, any marine mammals present in the busy estuary and North Sea are also expected to have habituated to vessel presence.

14.6.26 Therefore, although collisions with vessels could result in injury or mortality, the likelihood of vessel collision with marine mammals is considered low due to the highly mobile nature of marine mammals, their ability to exhibit avoidance behaviour, and the likely slow vessel operation speeds. In addition, the Tees estuary is already characterised by a high-level of shipping traffic (ABPmer, 2017). Therefore, although marine mammals have a high sensitivity to vessel collision, the magnitude is assessed as very low, and therefore the overall impact is assessed as Negligible (Not Significant).

Changes in the Airborne Soundscape During Construction

14.6.27 Marine and land-based construction activities associated with the Proposed Development will create airborne sound which has the potential to disturb seals that are hauled-out nearby or have surfaced whilst in the water. The effects of disturbance could include a cessation of feeding, travelling, resting, breeding and / or socialising. Long-term effects of repeated disturbance could include a permanent displacement and / or a decline in fitness and productivity (such as moulting and breeding success).

14.6.28 A haul-out site for breeding grey and harbour seals is located at Seal Sands. Seals are also known to haul-out along Greatham Creek and at Bailey Bridge, travelling between these locations. These sites are in close proximity to the Proposed Development Site boundary. Seal Sands supports the greatest number of seals followed by Greatham Creek and Bailey Bridge. On Seal Sands, the majority of harbour seals and grey seals are known to haul-out at haul-out sites A and D, respectively, as shown on Plate 14-7. Haul-out sites located in Greatham Creek and Seal Sands are within close proximity to several industrial sites which produce airborne sound, with the closest site known as the Venator Greatham Works on Tees Road, approximately 0.4 km northwest from Seal Sands.

Plate 14-7: Location of Haul-Out Sites on Seal Sands (INCA, 2023)

14.6.29 To inform the assessment of changes in the airborne soundscape, baseline ambient sound measurements have been taken from the industrial area surrounding Seal Sands, including on the Seal Sands emergency access road, next to the Venator Greatham Works on Tees Road, and the Seal Sands Office (located northwest of Site B on Plate 14-7).

14.6.30 Indicative predictions of construction sound levels have been made to determine the impacts of construction activities on sensitive ecological receptors, including

seals, for both the Main Site (location 1) and the location of HDD[3] near Greatham Creek (location 2), using measurement location EB6 for noise modelling location 1 and EB3 for location 2 (see Figure 14-7: Airborne Noise Modelling Locations for Seals (ES Volume II, EN070009/APP/6.3)). The free-field (A-weighted) sound level for a particular receptor for each construction activity has been predicted. A-weighting is an adjustment that is typically applied to measurements of sound to reflect how a human ear responds to an environmental noise (Parmanen, 2007). The predicted A-weighted sound levels for construction activities have assumed a 12-hour working day for most construction activities, except for the directional drilling as part of the HDD, where working hours are 24-hours. Construction activities likely to result in the highest airborne sound levels include vibratory sheet piling (for the HDD pit setup and anchors) and directional drilling. The construction activities and estimated sound pressure levels are outlined in Table 14-10.

Table 14-10: Sound Pressures Levels for Activities Occurring in the Vicinity of Greatham Creek (Decibels at 10 m)

ACTIVITY	EQUIPMENT	A-WEIGHTED SOUND PRESSURE LEVEL (dB AT 10 m)
HDD pit setup/anchors	Vibratory sheet piling rig	88
	Tracked excavator	77
Drilling and pullback	Directional drill (generator)	77
	Tracked drilling rig	86
	Water pump	78

14.6.31 Sound exposure level (SEL) weighted thresholds have been equated to the onset of the auditory impacts of Permanent Threshold Shifts (PTS)[4] and Temporary Threshold Shifts (TTS)[5] in phocids (harbour and grey seals). These weightings are specific to the phocid seal group, which are 134 and 154 decibels (dB) re (20 µPa) in air, respectively (Southall et al., 2019). These differ from the A-weighting which will be applied in the model, and which is typically used for human receptors. The weightings will reflect variations in peak sensitivity of the receptor groups, which occurs at around 10 kilohertz (kHz) for seals.

14.6.32 Construction activities, including HDD, are expected to be dominated by low or mid-frequency sound, as shown in Table 14-10. It is also expected that there will be less propagation of high frequency sound (compared to mid- or low-frequency sound) due to ground absorption and dispersion. Thus, in the absence of high frequency sound it is considered reasonable to assume that the LA_{eq} is equivalent (and a likely

[3] Although MBT is also considered as a potential trenchless technology for the Proposed Development, the airborne sound construction estimates are based on the use of HDD as a worst-case.
[4] Permanent Threshold Shift (PTS) - is a permanent elevation in hearing threshold (i.e., an unrecoverable reduction in hearing sensitivity). PTS can occur from a variety of causes, but it is most often the result of intense and / or repeated noise exposures.
[5] Temporary Threshold Shift (TTS) - is a recoverable elevation in hearing threshold (i.e., a non-permanent reduction in hearing sensitivity) most commonly resulting from long-term noise exposure not high enough to cause PTS.

worst-case) to phocid-weighted sound pressure level. However, to permit a comparison between the LA_{eq} value and the TTS and PTS thresholds for seals in air provided by Southall *et al*. (2019) (which are expressed in different units), the predicted LA_{eq} levels have been reported as 12-hour and 24-hour (for activities where the working day assumption might be extended to 24-hours such as HDD) unweighted SEL. The predicted and threshold values can then be compared for determination of likely impact for phocid seals. To allow further comparison of disturbance effects, compared to background levels, the predicted ambient unweighted SEL levels and total combined unweighted SEL are also shown in Table 14-11 and Table 14-12.

Table 14-11: Frequency Spectrum for Construction Activities Associated with Pipeline Construction and HDD next to Greatham Creek

CONSTRUCTION ACTIVITY		OCTAVE BAND FREQUENCIES (Hz)								
		63	125	250	500	1000	2000	4000	8000	TOTAL
Drilling and pullback	Unweighted L_{eq}	63	60	53	51	51	48	44	38	65
	Unweighted SEL	112	109	102	101	101	97	94	88	115
All pipeline construction	Unweighted L_{eq}	72	66	61	60	60	58	56	54	74
	Unweighted SEL	121	115	110	109	109	108	106	103	123

Table 14-12: Predictions of Airborne Sound Levels Associated with the Main Site and HDD Site During Construction

LOCATION	ACTIVITY	PREDICTED FREE-FIELD SOUND LEVEL (UNWEIGHTED) L_{EQ} 12H AND 24HR	SEL (UNWEIGHTED) PROPOSED DEVELOPMENT ONLY	AMBIENT DAYTIME SOUND LEVEL (UNWEIGHTED) L_{EQ},12H AND 24 H (MEASUREMENT LOCATION EB6 FOR NOISE MODELLING LOCATION 1 AND EB3 FOR LOCATION 2)	SEL (UNWEIGHTED) DUE TO AMBIENT ONLY	SEL (UNWEIGHTED) TOTAL
12 HOUR DAY						
1 (Nearest to Main Site)	Main Site construction and compounds	51	97	80	127	127
1(Nearest to Main Site	Pipelines Construction	67	113	80	127	127
24 HOUR DAY						
2 (Nearest to HDD)	Pipelines Construction	74	120	77	123	125

14.6.33 For activities at the main site which are expected to occur within a 12-hour period, the total unweighted SEL is not expected to exceed the ambient SEL, resulting in no significant overall change in the total SEL.

14.6.34 For HDD activities located close to Seal Sands at the Venator Site, there is expected to be an increase in total SEL of 2 dB above ambient (from 123 dB to 125 dB; Table 14-12). An increase of 2 dB may result in some perceptible change for seals, particularly considering that the HDD will be located next to Greatham Creek and therefore may affect seal movement through the creek.

14.6.35 However, the HDD is only predicted to occur for a duration of up to 10 weeks (in Greatham Creek) and will operate continuously over that period (rather than stopping and starting which would be more disturbing). An SEL value of 125 dB is also well below the TTS and PTS values for seals of 134 and 154 dB re (20 µPa) in air respectively, as discussed by Southall *et al.* (2019). Therefore, although an increase of 2 dB may be detectable to seals at Seal Sands and in Greatham Creek, particularly at Site A as shown on Plate 14-7, it is not likely to result in significant changes at a population level. Where disturbance does occur, seals are expected to move away and make use of alternative haul-out sites in Seal Sands. There will be only one start-up event and seals can return once the short HDD operation is complete.

14.6.36 Furthermore, the Tees Estuary is highly industrialised, with lots of activity resulting in airborne noise, as shown by the ambient SEL unweighted values in Table 14-12. In addition, the main A178 Seaton Carew Road which crosses Greatham Creek via a bridge to the west of the proposed Hydrogen Pipeline Corridor is expected to produce a large amount of background noise. Thus, seals are expected to be habituated to some level of airborne noise in the local area.

14.6.37 In addition, activities will be a temporary, therefore, considering the nature of the impact, any airborne sound production and visual disturbance is not likely to affect the abundance, distribution or functioning of seals, and their habitats, or the condition of surrounding designated sites in place for the protection of seals (e.g., harbour seal – Teesmouth and Cleveland Coast SSSI).

14.6.38 However, due to the proximity of the HDD activities to Greatham Creek and Seal Sands, some disturbance effects may occur as a result of the 2 dB increase in SEL above ambient. Disturbance is expected during the important moulting and breeding period for grey and harbour seals, where greater numbers are expected. Given the high importance of seals at Seal Sands and the potential for minor disturbance to these individuals, the magnitude is assessed as moderate and the effect to this receptor is predicted to be Moderate Adverse (Significant).

Changes in Visual Stimuli, Including from Artificial Lighting

14.6.39 Construction activities on both the land and in the marine environment (i.e. from the use of vessels) could result in changes in visual stimuli (including artificial light). This can result in avoidance behaviour in marine organisms, affecting breeding or foraging activities, with potential for wider implications for populations.

14.6.40 It can often be very difficult to separate out the relative contribution of different stimuli causing disturbance to marine organisms. However, for larger taxa which

occur in shallow or surface waters (e.g. fish and marine mammals) and those that migrate onto land (e.g. seals hauled out at Seal Sands), changes in visual cues (particularly light) are known to strongly influence behaviour.

14.6.41 An Indicative Lighting Strategy (Construction) is Appendix C to the Framework CEMP (EN070009/APP/5.12) has been developed as part of design measures to reduce glare and light spill into the marine environment, to inform the construction lighting strategy that will form part of the Final CEMP(s). Measures include using warm white, LED bulbs, using a suitable mounting height for lights to reduce light spill, and ensuring the correct angle and orientation is used to reduce the contribution of light to spill, sky glow, and glare. Lighting is also likely to be present on vessels. The Venator Site is the closest construction area as part of the Proposed Development to Greatham Creek and therefore, this location is where most light spill is expected. Therefore, this site is one of the focusses within the Indicative Lighting Strategy (Construction) (EN070009/APP/5.12).

Fish and Shellfish (Migratory Fish)

14.6.42 Fish species are photoreceptive, with key activity rhythms and behavioural patterns (e.g. feeding) stimulated by light. Daytime feeders are generally attracted to light whilst nocturnal species (e.g. salmon and trout) exhibit strong avoidance of light (Marchesan *et al.,* 2005). Shellfish typically exhibit higher activity levels in the hours of darkness (Robson *et al*., 2010).

14.6.43 Previous studies have also shown that the introduction of artificial lighting associated with anthropogenic structures into an estuary can influence behaviour, with aggregations of both larger-bodied predator fish and smaller shoaling fish observed in artificially lit areas (e.g. Becker *et al*., 2013; McConnell *et al*., 2010). In some cases, fish work against the current to maintain their position in the lit areas, resulting in negative implications to energy budgets (Becker *et al*., 2013).

14.6.44 Migrating salmonids such as Atlantic salmon and trout can be particularly sensitive to changes in lighting which can interfere with diel migratory patterns. The introduction of streetlights next to an estuary, for example, has been shown to result in random timings of smolt salmon migrations (Riley *et al*., 2012). In comparison, without the introduction of artificial lighting, migration of smolt was significantly correlated with sunset.

14.6.45 Standard working hours will be implemented as much as possible to reduce working in hours of darkness and therefore reduce the requirement for artificial lighting. When extended working hours are required, the design measures included within the Indicative Lighting Strategy (Construction) (EN070009/APP/5.12) are to be implemented, reducing light glare or spill into the marine environment, including directing light away from the estuary (particularly at the Venator Site, close to Greatham Creek). A warm white light colour will also be used, which is considered less intrusive for ecological receptors. For example, some salmonids such as post-smolt Atlantic salmon are known to be particularly sensitive to light at the blue-green end of the visible spectrum (Becker *et al*., 2013).

14.6.46 Furthermore, the River Tees and Tees estuary is characterised by high levels of industrial land use, including on the banks of the estuary. Therefore, the baseline conditions of artificial lighting in close proximity to the estuary are considered to be high.

14.6.47 Any changes in artificial lighting which result in visual disturbance are expected to be localised, temporary and intermittent for the duration of the construction period. Due to the design measures proposed, there is not considered to be light spill into the marine environment, which could result in behavioural disturbance, such as changes in migratory patterns. Therefore, the magnitude is assessed as very low and any effects to fish and shellfish are predicted to be Negligible (Not Significant).

Marine Mammals (Seals)

14.6.48 Seals which have surfaced or hauled out at Seal Sands could be affected by changes to visual stimuli (e.g. from moving vessels and artificial lighting used as part of the construction phase) causing individuals to stop resting, breeding, feeding, travelling and / or socialising, with possible long-term effects of repeated disturbance resulting in permanent displacement and / or a decline in fitness and productivity.

14.6.49 In general, shipping traffic more than 1,500 m away from a haul out site is not thought to evoke any reaction. However, between 900 m and 1,500 m, grey seals could be expected to detect the presence of vessels; and at closer than 900 m, a flight reaction may occur (Scottish Executive, 2007). Vessels will not be present in Greatham Creek due to its narrowness and tidal nature, making it a high-risk area in which to work. Therefore, vessels are unlikely to pass through the Seaton on Tees Channel, in close proximity to Seal Sands.

14.6.50 The Tees Estuary is characterised by a high volume of industrial and vessel activity, and therefore, seals are likely to be habituated in part to changes in visual stimuli, such as from moving vessels and artificial light. Therefore, taking this into consideration, and accounting for the design measures which will be implemented as part of the Indicative Lighting Strategy (Construction) (EN070009/APP/5.12), which will prevent spill of light into the marine environment, the Proposed Development is not expected to result in a large deviation from baseline conditions for seals and evoke behavioural disturbance.

14.6.51 Considering these factors, alongside the temporary, localised and intermittent nature of any changes in visual stimuli arising as a consequence of construction of the Proposed Development, the magnitude is assessed as low. Effects to marine mammals, including harbour seals, which are a feature of the Teesmouth and Cleveland Coast SSSI, are predicted to be Negligible (Not Significant).

Introduction, Transportation and Spread of Invasive Non-Native Species

14.6.52 Due to the use of vessels as part of the Proposed Development, there is the potential for the introduction, transportation and spread of INNS, either from biofouling or from the discharge of ballast water and bilge water. INNS can out-compete native species which could result in habitat loss, increased competition for space and food, ecosystem modifications, and the introduction of disease and

pathogens. Many of these effects can result in mortality of native species. The vessels used for the Proposed Development will include lift-on / lift-off (geared) vessels, barges, ROLO vessels and coastal vessels. The exact number and vessel specifications are yet to be determined, but they are expected to be travelling from a mix of overseas and UK locations.

14.6.53 During intertidal and subtidal benthic surveys conducted in the Study Area by AECOM in 2019 (AECOM, 2021a), only one species of INNS was identified, wakame (*Undaria pinnatifida*) in the intertidal zone of South Gare Breakwater. Therefore, the presence of INNS within the site is limited.

14.6.54 Several good practice mitigation measures will be implemented throughout all phases of the Proposed Development where vessels are required, as discussed in section 14.5. All Proposed Development vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of marine INNS (IMO, 2017). All Proposed Development vessels shall also adhere to the International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011). With these measures, the risk of introduction and spread of INNS through ballast water and biofouling will be considerably reduced, making the risk of transmission low.

14.6.55 Therefore, given the limited use of vessels and the implementation of good practice mitigation measures, the risk of existing or new INNS becoming established or proliferating to an extent that would cause ecological harm is considered to be very low. Due to this, native species are considered to have low sensitivity to the introduction of INNS, and the magnitude is assessed as very low. As a result, the overall impact is considered Negligible (Not Significant).

Construction Summary

14.6.56 Table 14-13 provides a summary of the effects described above on marine ecological features during the construction of the Proposed Development.

Table 14-13: Summary of Effects on Marine Ecological Features During Construction of the Proposed Development

ECOLOGICAL FEATURES	IMPACT PATHWAY	VALUE/ IMPORTANCE	SIGNIFICANCE OF LIKELY EFFECTS (WITH EMBEDDED MITIGATION)
All marine features	Changes in Marine Water Quality During Construction Activities including surface water runoff	Low to very high	Negligible Not Significant
All marine features	Changes in Water Quality from Accidental Spills of Vessel Fuels and Oils	Low to very high	Negligible Not Significant
Marine mammals	Collision Risk between Proposed Development Vessels and Marine Mammals	Very high	Negligible Not Significant
Marine mammals	Changes in the Airborne Soundscape during construction	Very high	Moderate adverse Significant
Marine mammals and migratory fish	Changes in Visual Stimuli, including from Artificial Lighting	Medium to very high	Negligible Not Significant
All marine features	Introduction, Transportation and Spread of INNS	Low to very high	Negligible Not Significant

Operation

14.6.57 The following Sections present a preliminary assessment of likely significant effects during operation of the Proposed Development on marine ecological features.

Changes in the Airborne Soundscape During Operation

14.6.58 There is the potential for airborne noise to occur during the operation of the Proposed Development.

14.6.59 Indicative predictions of operation sound levels have been made to determine the impacts of operation activities on sensitive ecological receptors. The free-field (A-weighted) sound level for a particular receptor for operation activity has been predicted assuming a 24-hour working day.

14.6.60 In line with the modelling undertaken and discussed in the construction phase, to permit a comparison between the L_{Aeq} value and the TTS and PTS thresholds for seals in air provided by Southall et al. (2019), the predicted LA_{eq} levels have been reported as 24-hour unweighted SEL. The predicted and threshold values can then be compared for determination of likely impact for phocid seals. The frequency spectrum for operational sound levels are shown in Table 14-14 and predicted ambient unweighted SEL levels and total unweighted SEL are shown in Table 14-15. During operation, airborne noise is only expected to be produced by the Main Site. The closest airborne modelling location to the Main Site is shown as location 1 on Figure 14-7: Airborne Noise Modelling Locations for Seals (ES Volume II, EN070009/APP/6.3).

Table 14-14: Frequency Spectrum for Operation Sound Level Associated with the Operational Phase of the Proposed Development

CONSTRUCTION ACTIVITY		OCTAVE BAND FREQUENCIES (Hz)									
		31.5	63	125	250	500	1000	2000	4000*	8000*	TOTAL
Operational Sound Level	Unweighted $L_{eq\ 24h}$	60	50	44	38	30	23	5	-	-	61
	Unweighted SEL	110	100	94	87	79	72	55	-	-	110

*Values are not provided for 4000 Hz or 8000 Hz as atmospheric attenuation is too high for a significant value to be predicted in these octave bands

Table 14-15: Predictions of Airborne Sound Levels Associated with the Main Site During Operation

LOCATION	ACTIVITY	PREDICTED FREE-FIELD SOUND LEVEL (UNWEIGHTED) L_{EQ}, 24H	SEL (UNWEIGHTED) PROPOSED DEVELOPMENT ONLY	AMBIENT DAYTIME SOUND LEVEL (UNWEIGHTED) L_{EQ},24H (MEASUREMENT LOCATION EB6 FOR LOCATION 1)	SEL (UNWEIGHTED) DUE TO AMBIENT ONLY (OVER 24H FOR OPERATION)	SEL (UNWEIGHTED) TOTAL (OVER 24H)
24 HOUR DAY						
1 (Nearest to Main Site)	Operation	61	110	80	130	130

14.6.61 During operation at the main site, the total SEL is not expected to exceed the ambient sound levels, assuming a 24-hour working day is followed. Therefore, operation activities of the Proposed Development are not expected to result in any detectable changes in the airborne soundscape to seals that could cause disturbance to individuals hauled out at Seal Sands and along Greatham Creek, above what is already caused by background noise levels.

14.6.62 Therefore, the magnitude is assessed as very low and the effect of increases in airborne sound associated with the operation of the Proposed Development on seals is assessed as Negligible (Not Significant).

Deposition of Airborne Pollutants Including Nitrogen

14.6.63 Deposition of air pollutants released from point source emissions can be deposited into the marine environment either by wet or dry deposition processes. Deposition of air pollutants, particularly nitrogen (and sulphur) compounds can cause direct disturbance to marine habitats and species through acidification and eutrophication (Pacyna, 2008), as well as fish species which may depend on these habitats for specific functions (e.g. spawning grounds).

14.6.64 Airborne pollutants are expected to be emitted by the production facility during operations, with the potential for nitrogen oxides (NOx), nitrogen (N) and sulphur dioxide (SO_2 – acid) deposition to occur in the marine environment.

14.6.65 An assessment of atmospheric deposition has been undertaken in Chapter 8: Air Quality (ES Volume I, EN070009/APP/6.2). Emissions from the Proposed Development have been assessed using the Environment Agency's Risk Assessment for air emissions (Defra and Environment Agency, 2016). In line with this, detailed dispersion modelling using the atmospheric dispersion model ADMS (currently ADMS 5.2.2) has been used to calculate the concentrations of pollutants at identified receptors. Dispersion modelling, takes into consideration recent meteorological data and any buildings, structures, and local topography which may affect dispersion, assessing the worst-affected ecological receptor.

14.6.66 An assessment of nutrient nitrogen enrichment has been undertaken by applying published emission/deposition velocities to the predicted annual average nitrogen dioxide (NO_2) and ammonia (NH_3) concentration thresholds for the Teesmouth and Cleveland Coast SSSI, Ramsar and Teesmouth NNR. Emission/deposition rates of acid (sulphur dioxide, SO_2) have also been considered. Modelled nitrogen and acid rates have been calculated at a range of locations within these designated sites, representative of different protected habitats, including those in the intertidal. These rates have then been compared to the Critical Loads (or Air Quality Assessment Level, AQAL) for nitrogen and acid, published by UK Air Pollution Information System (APIS) (Centre for Ecology and Hydrology and APIS, 2016), taking into consideration the baseline deposition within the Study Area.

14.6.67 During the operational phase of the Proposed Development, the worst-case concentration of nitrogen oxides (NOx) emitted by the Proposed Development or Process Contribution (PC) are predicted to be below 10% of the Critical Load for both the annual mean NOx (30 µG M^{-3}) and 24-hour maximum NOx (75 µG M^{-3}) for

marine ecological receptors within the Teesmouth and Cleveland Coast SSSI, Ramsar and Teesmouth NNR. The daily maximum PC of NOx is predicted to be 4.2% of the Critical Load. A PC of 10% of the Critical Load threshold (over 24-hours) is considered by Natural England and the Environment Agency air quality specialists to be an indicator of potential significant atmospheric pollution impacts which require further analysis. This is a precautionary level below which is an indicator of negligible effect.

14.6.68 The highest, worst-case concentration of annual nitrogen deposition during the operational phase of the Proposed Development within the Teesmouth and Cleveland Coast SSSI, Ramsar and Teesmouth NNR, was calculated at 0.06 µG M^{-3} which is 0.6% of the Critical Load.

14.6.69 The annual mean PC emissions of SO_2 from the Proposed Development were calculated as less than 0.01% of the Critical Load (20 µG M^{-3}) at all locations modelled. The calculated annual rates of SO_2 deposition during the operational phase was calculated as 0.004 µG M^{-3}, which is also below the Critical Load for this pollutant (<0.01%).

14.6.70 Any impacts to air quality and subsequent depositions of nitrogen and acid within the marine environment are predicted to be negligible in the context of the Critical Loads for these habitats assessed. Furthermore, the hydrodynamic conditions and the open nature of the coastline mean that this area is subject to frequent tidal washing. Therefore, any deposits that do occur will be rapidly dispersed, particularly within intertidal habitats, and therefore the potential for adverse effects to these habitats is considered to be low.

14.6.71 Given that tidal washing will remove any deposited nitrogen and acid from the Proposed Development within the intertidal zone, the impacts on intertidal habitats and species, and the wider marine environment, from air pollution during the operational phase are considered to be Negligible (Not Significant).

Nutrient and Chemical Effects from the Dispersion and Discharge of Treated Effluent

14.6.72 During operation, it is expected that treated effluent may be taken offsite by tanker for disposal or discharged into Tees Bay by a purpose-built outfall which is part of the NZT project. Stormwater/surface water run-off will be discharged either through the NZT outfall, through the existing South Tees Development Corporation's (STDC) infrastructure or alternatively to a new outfall via the South Tees Development Corporation's drainage system. It is not currently known which option will be chosen but all discharges will comply with the WFD and Natural England's policy on Nutrient Neutrality[6], the requirements for which are applicable to the Teesmouth and Cleveland Coast SPA / Ramsar Site.

[6] A Nutrient Neutrality Assessment has been undertaken for the Proposed Development (EN070009/APP/5.13). This has screened in further assessment of the nitrogen discharged into Tees Bay, as there is potential for this nitrogen to be dispersed into the Tees estuary due to tidal movements (and thus reach the sensitive areas of the Teesmouth and Cleveland Coast SPA/Ramsar site). The consequential assessment undertaken in that document has been taken into account in this chapter.

14.6.73 Water quality modelling (Appendix 9D: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.4)) has been undertaken to determine the degree of dispersion from the outfall for constituents of the wastewater, including total dissolved inorganic nitrogen (DIN) (given nutrient neutrality requirements applicable to the Teesmouth and Cleveland Coast SPA/Ramsar sites) and benzo(ghi)-perylene. This is based on a Delft3D model, which provides inputs describing hydrodynamic conditions to a near field model which shows the area over which pollutants are diluted during the initial rapid phase of turbulent mixing following discharge of the buoyant effluent plume into the higher density water of Tees Bay. The Cornell Mixing Model software (CORMIX), developed and maintained by MixZon Inc., has also been used to simulate this stage of mixing.

14.6.74 Substances in the Tees Bay coastal water body can be compared to environmental quality standards (EQS) (provided under UK Legislation for the Tees Bay coastal water) for monitoring purposes to determine the level of contamination. However, several chemicals including benzo(g,h,i)-perylene and perfluorooctance sulfonate (PFOS) already exceed the EQS in Tees Bay. Therefore, for these substances, modelling has been carried out to determine the area over which the discharge may increase local concentrations by more than 5% above ambient.

14.6.75 The water quality modelling shows that the mixing zones for all substances are small and EQS values are met within the near field plume rising stage for high tide and maximum current conditions (Plate 9D-17: CORMIX Near Field Mixing Zones – DIN (Main Site Process Effluent Only) (Appendix 9D: Water Quality Modelling Report (ES Volume III, EN070009/APP/6.)). The plume only reaches the water surface at concentrations above the EQS for DIN and polyaromatic hydrocarbons under low tide and minimum current conditions (in summer).

14.6.76 Under winter discharge conditions, the elevated temperature of the Proposed Development's effluent in comparison to the ambient water results in a greater volume of effluent reaching the water surface prior to concentrations of DIN, polyaromatic hydrocarbons, benzo(g,h,i)-perylene and PFOS being diluted to below the EQS.

14.6.77 Far field modelling showed that DIN is expected to reach 0.017 mg/l under minimum current conditions but only over an extremely small area close to the outfall, which is not sufficient to exceed the EQS. Polyaromatic hydrocarbons are expected to reach 0.022 ng/l under minimum current conditions which is also not sufficient to exceed the EQS. Any plumes would be over an extremely small area (i.e. tens of metres) and diluted rapidly, andrapidly andxpected to significantly affect the chemical environment overall, with any potential changes to habitats and species therefore also expected to occur within these tens of metres.

14.6.78 Outside of the vicinity of the outfall, DIN will become even more diluted within the mixing zone, resulting in an undetectable concentration.

14.6.79 In winter conditions, the maximum increase in any model layer in benzo(g,h,i)-perylene concentration is 0.018 ng/l above ambient concentrations and the maximum increase in PFOS concentration is 0.003ng/l above ambient

concentrations. Both these values are less than 5% above the ambient background and therefore are not considered to result in a significant change in water quality above EQS.

14.6.80 When the main site effluent is mixed with surface water runoff, far-field modelling indicates that effluent is rapidly diluted with average DIN concentrations only expected to increase by less than 0.001 mg/l, and polyaromatic hydrocarbons expected to increase by less than 0.0001 ng/l.

14.6.81 Near-field modelling indicated that, due to a higher discharge velocity, the plume (containing effluent and surface water run-off) reaches the water surface at concentrations above EQS for both DIN and polyaromatic hydrocarbons under low tide and minimum current conditions, but the mixing zones are extremely small and are expected to have no effects on the environment. Therefore, no impacts to water quality in Tees Bay are expected from the discharge of process effluent and surface water discharge.

14.6.82 All substances found in the discharged effluent are expected to undergo immediate dilution and rapid dispersion due to the hydrodynamic conditions and therefore are not expected to result in a reduction in water quality in Tees Bay. Therefore, the potential for adverse effects to marine water quality is considered to be low. Although small-scale change may be observed at the outfall, localised deterioration in marine water quality within the vicinity of the outfall is not predicted to result in any detectable effects to marine species or habitats, nor to biodiversity or the conservation objectives for any marine species or designated site. As such, the magnitude is assessed as very low and the effects to marine ecological receptors from wastewater discharge are predicted to be Negligible (Not Significant).

14.6.83 The alternative design scenario where stormwater / surface water runoff is released into the Tees Estuary has not been modelled. A new surface water drainage system will be provided to the Main Site which will include stormwater from sources including roadways, carparks and landscape areas.

14.6.84 A Surface Water Drainage Plan (SuDS) will be implemented with a treatment train. The treatment train is considered to provide a suitable protection to water quality from surface water runoff from industrial and commercial land uses. The surface water drainage strategy will be required to meet standards of the environmental permit, with measures in place for responses to spillages and disposal of fire-water when necessary (which may contain chemicals harmful to the marine environment). The Applicant has also begun engagement with the Environment Agency under the enhanced pre-application scheme and is finalising an application for an Environmental Permit anticipated to be submitted in 2024.

14.6.85 Water quality monitoring will also be regularly undertaken (see Chapter 9: Surface Water, Flood Risk and Water Resources (ES Volume I, EN070009/APP/6.2) for further information).

14.6.86 With these measures in place, the release of stormwater / surface water run-off into the Tees Estuary (either via existing or new South Tees Development Corporation (STDC) infrastructure) is not expected to result in nutrient or chemical

effects to marine receptors and is assessed as low magnitude. Therefore, effect is considered Negligible (Not Significant).

Thermal Effects from Treated Effluent Discharge

14.6.87 The discharge of treated effluent, at a higher temperature than ambient, can influence a variety of marine organisms including plankton, benthic habitats and species as well as fish, shellfish and INNS. Long term effects can include changes in biological processes (e.g. growth, spawning, etc.), mortality, displacement and changes in species' community composition and distribution.

14.6.88 Marine mammals can be indirectly affected by shifts in the distribution of food resources if, for example, prey species are attracted or deterred by the warmer waters around the outfall. The elevated temperatures which may be found at the release point from the outfall – or the 'thermal plume' - may also act as barrier to fish migration.

14.6.89 Near-field modelling has been undertaken for thermal plumes based on the approximate location for the discharge of treated effluent at the NZT outfall.

14.6.90 The modelling has shown that the effluent discharged from the Proposed Development is cooled to less than 3°C of the ambient water temperature within a very short distance of the outfall (within tens of metres). As a result, surface water temperatures are also not expected to be increased by more than 3°C of the ambient temperature during any combination of effluent discharge.

14.6.91 The marine environment experiences small natural fluctuations in water temperature due to mixing processes and tidal cycles, seasonal changes and anthropogenic impacts such as climate change. Therefore, marine organisms are expected to have some habituation to small increases in water temperature. Given the small-scale increase in water temperature expected as part of the discharge of effluent from the Proposed Development, and the location of the outfall outside the estuary, it is not expected to affect migration of fish out of the estuary or result in perceptible changes to benthic ecology in Tees Bay.

14.6.92 Therefore, any thermal effect is expected to be Negligible (Not Significant).

Operation Summary

14.6.93 Table 14-16 provides a summary of the effects described above on marine ecological features during the operation of the Proposed Development.

Table 14-16: Summary of Effects on Marine Ecological Features During Operation of the Proposed Development

ECOLOGICAL FEATURES	IMPACT PATHWAY	VALUE/ IMPORTANCE	SIGNIFICANCE OF LIKELY EFFECTS (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS
Marine Mammals (Seals)	Changes in the Airborne Soundscape during operation	Very high	Negligible (Not Significant)	N/A	Negligible (Not Significant)
All marine features	Deposition of Airborne Pollutants including Nitrogen	Low to very high	Negligible	N/A	Negligible (Not Significant)
All marine features	Nutrient and Chemical Effects from the Dispersion and Discharge of Treated Effluent	Low to very high	Negligible (Not Significant)	N/A	Negligible (Not Significant)
All marine features	Thermal effects from treated effluent discharge	Low to very high	Negligible (Not Significant)	N/A	Negligible (Not Significant)

Decommissioning

14.6.94 During decommissioning, all above ground structures on the Main Site removed, and the ground remediated as required by the Environmental Permit to facilitate future re-use. There will be no change to the trenchless crossings and therefore activities such as HDD will not occur. Therefore, no likely effects to marine ecology features have been identified for the decommissioning of the Proposed Development. The effects during decommissioning are generally considered to be less than or equal to those during construction where no likely significant effects have been identified. In addition, a DEMP will be in place which contains guidance on removing or mitigating risks, including managing surface water drainage. Therefore, effects are considered to be negligible to Minor Adverse (Not Significant).

14.7 Essential Mitigation and Enhancement Measures

14.7.1 The only significant adverse impact to marine ecology predicted for the construction phase relates to effects of airborne sound on seals, particularly those hauled-out at Seal Sands, during HDD. Therefore, additional mitigation has been proposed.

14.7.2 No significant adverse impacts to marine ecology during the operational or decommissioning phases are predicted to occur.

Construction

Essential Mitigation

14.7.3 To minimise the effects of airborne sound on seals hauled-out at Seal Sands and using habitat within Greatham Creek during the use of trenchless technologies for the Proposed Development at the Venator site, it is recommended that noise abatement barriers (such as close-board acoustic fencing or other barriers) are installed around the Venator Site to reduce the amount of perceptible change in airborne sound to any seals using habitat at Seal Sands or within Greatham Creek.

Enhancement Measures

14.7.4 There have been no enhancement measures identified for the Construction Phase.

Operation

Essential Mitigation

14.7.5 There have been no additional mitigation measures identified for the operational phase.

Enhancement Measures

14.7.6 There have been no enhancement measures identified for the operational phase.

Decommissioning

Essential Mitigation

14.7.7 There have been no additional mitigation measures identified for the decommissioning phase.

Enhancement Measures

14.7.8 There have been no enhancement measures identified for the Decommissioning Phase.

14.8 Residual Effects and Conclusions

14.8.1 This assessment has taken into account the design and good practice measures as detailed in Section 14.5.

14.8.2 Due to the potential effects of the generation of airborne sound on seals during the construction of the hydrogen pipeline under Greatham Creek using trenchless technologies, it is recommended that mitigation measures are implemented to reduce the current predicted 2 dB increase in SEL above ambient.

14.8.3 As stated in the Framework CEMP (EN070009/APP/5.12), it is proposed that noise abatement barriers (such as close-board acoustic fencing or other barriers) are placed around the area of HDD at the Venator Site to reduce the amount of perceptible change in airborne sound. The residual effect following the implementation of this mitigation, which would achieve the aforementioned reduction, is predicted to be Minor Adverse (Not Significant).

14.8.4 In conclusion, with these measures in place, this assessment has determined that there will be no significant residual effects to marine ecology associated with the construction, operation and decommissioning of the Proposed Development.

14.9 Summary of Significant Effects

14.9.1 No significant effects have been identified from effects associated with the construction, operation and decommissioning of the Proposed Development (see Table 14-17, Table 14-18 and Table 14-19).

Table 14-: Summary of Significant Effects During Construction

RECEPTOR/ RECOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	PROPOSED MITIGATION / ENHANCEMENT	RESIDUAL EFFECTS
Designated Sites	Very High	N/A	Nutrient and Chemical Effects from the Dispersion and Discharge of Treated Effluent	N/A	Minor Adverse (Not Significant) – Cumulative with NZT CCUS
Benthic Habitats and Species	Medium	N/A	Nutrient and Chemical Effects from the Dispersion and Discharge of Treated Effluent	N/A	Minor Adverse (Not Significant) – Cumulative with NZT CCUS
Fish and Shellfish	Medium to Very High	N/A	N/A	N/A	Negligible (Not Significant)
Marine Mammals	Very high	N/A	Changes in the Airborne Soundscape During Construction	Placement of Noise Abatement Barriers Around Venator Site (HDD Location)	Minor Adverse (Not Significant)

Table 14-17: Summary of Significant Effects During Operation

RECEPTOR/ RECOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	PROPOSED MITIGATION / ENHANCEMENT	RESIDUAL EFFECTS
Designated Sites	Very High	N/A	Changes in the Airborne Soundscape During Operation	Placement Of Noise Abatement Barriers Around Venator Site (HDD Location)	Minor Adverse (Not Significant)
Benthic Habitats and Species	Medium	N/A	N/A	N/A	Minor Adverse (Not Significant)
Fish and Shellfish	Medium To Very High	N/A	N/A	N/A	Negligible (Not Significant)
Marine Mammals	Very High	N/A	N/A	N/A	Negligible (Not Significant)

Table 14-18: Summary of Significant Effects During Decommissioning

RECEPTOR/ RECOURCE	IMPORTANCE AND VALUE/ SENSITIVITY	MAGNITUDE OF IMPACTS	LIKELY SIGNIFICANT EFFECTS	PROPOSED MITIGATION / ENHANCEMENT	RESIDUAL EFFECTS
All Marine Features	Low to Very High	N/A	N/A	N/A	Negligible to Minor Adverse (Not Significant)

14.10 References

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