9 MARINE ECOLOGY

9.1 Introduction

This section of the EIA Report considers the following potential environmental impacts for the construction and operation phase of the proposed scheme:

- Removal of marine habitat due to removal of existing structures, quay construction and capital dredging.
- Impacts on marine ecology from increased suspended sediment during capital dredging and smothering as a result of dredging.
- Impacts on marine communities due to the creation of new subtidal habitat.
- Impacts on marine communities due to changes in flow regime.
- Impacts associated with decreased exposure of intertidal areas at North Tees mudflat.
- Impacts on marine communities due to changes in the maintenance dredge regime.

It is recognised that the proposed scheme may introduce an increased risk to marine ecological receptors from invasive species, through activities such as maintenance dredging, shipping ballast water exchange, and biofouling of hulls. Generic project-level mitigation has been put in place to minimise this risk, set out in **Section 3.12**. As such, this risk has not been covered any further in this section.

9.2 Policy and consultation

9.2.1 Policy

National Policy Statement for Ports

The assessment of potential impacts to marine ecology has been made with reference to the policy guidance for this topic area contained within the NPS for Ports (Department for Transport, 2012). The particular assessment requirements relevant to marine ecology, as presented within the NPS for Ports, are summarised in **Table 9.1**.

Table 9.1 ***Summary of NPS for Ports requirements with specific regard to marine ecology and cross reference to section of this EIA Report where the requirement has been addressed***

NPS requirement	NPS reference	EIA Report reference
Where the development is subject to EIA, the application should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological interests.	Section 5.1.4	Impacts to designated sites are addressed in **Section 29**.
The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity conservation interests.	Section 5.1.5.	**Section 9.5** and **9.6**.
The ES should include an assessment of the effects on the coast. In particular, the applicant should assess the effects of the proposed project on marine ecology, biodiversity and protected sites.	Section 5.3.5.	**Section 9.5** and **9.6**. Impacts to designated sites are addressed in **Section 29**.
The applicant should be particularly careful to identify any effects on the integrity and special features of Marine Conservation Zones (MCZ), Special Areas of Conservation (SAC) and candidate SACs, Special Protection Areas (SPA) and potential SPAs, Ramsar sites,	Section 5.3.7	Impacts to designated sites (including SPAs and Ramsar sites) are addressed in **Section 29**. The proposed scheme footprint is not located within or adjacent to an MCZ. The closest MCZ is located approximately 20km to the south at Runswick Bay; given the

NPS requirement	NPS reference	EIA Report reference
actual and potential Sites of Community Importance and Sites of Special Scientific Interest (SSSI).		separation distance between the scheme location and this MCZ, it is considered that there is no pathway for effect and MCZs have not been considered further.

9.2.2 Consultation

As mentioned in **Section 5.1**, consultation was carried out with the MMO and RCBC in August 2020 to confirm that the Scoping Opinion issued by the MMO and RCBC in 2019 can be relied upon to inform this EIA. The MMO confirmed that this was the case in September 2020 and RCBC issued a formal Scoping Opinion in September 2020 (**Appendix 3**).

Site-specific comments relevant to marine ecology that were received during the scoping process are detailed in **Table 9.2**. This table also signposts to the relevant section of this EIA Report where the comment has been addressed.

Table 9.2 Relevant site-specific comments received from stakeholders during the scoping process

Scoping comment	Response / section of the EIA Report where comment has been addressed
It is recognised that a number of Habitats of Principal Importance may be present on or near to site. These habitats, which are listed under Section 41 (S41) of the Natural Environment and Rural Communities Act 2006, are considered in decision making with regards to the conservation of biodiversity in England. Therefore, impacts to these habitats will need to be considered, and the mitigation hierarchy used to protect these features. We have noted records for species including, but limited to common seal, grey seal, common lizard, brown hare, toad, hedgehog and invertebrates.	Any intertidal or marine Habitats of Principal Importance, and species of ecological importance have been considered within this section. Consideration of terrestrial Habitats of Principle Importance and species of ecological importance has been included in **Section 11.**
The site is in close proximity to a number of internationally protected sites, such as SSSI, SPAs and Ramsar sites. Any change of land use or construction work in the vicinity or at these sites has the potential to have a detrimental impact on designated features of those sites. Any detrimental impacts on these sites or their designated features, or loss of these habitats will require a habitat regulations assessment and suitable mitigation and compensation.	Impacts on designated sites as a whole have been assessed within **Section 29**. Impacts on species as individuals, that have been recorded within the development boundary or within close proximity, have been assessed within this section (**Section 9.5** and **9.6**). Impacts on relevant designated features of the Teesmouth and Cleveland Coast SSSI are included within this section.
These requirements are supported by paragraphs 170 and 175 of the National Planning Policy Framework (NPPF) which recognise that the planning system should conserve and enhance the environment by minimising impacts on and providing net gains for biodiversity. If significant harm resulting from a development cannot be avoided, adequately mitigated, or as a last resort compensated for, planning permission should be refused.	STDC is in the process of developing a South Tees Regeneration Masterplan Environment and Biodiversity Strategy, which will define the works required to offset the loss of habitat arising as a result of works being proposed by STDC (including the proposed scheme). The extent and location of habitat creation and enhancements will be agreed with Natural England, the Environment Agency and RCBC.
It would be beneficial for the EA to review benthic invertebrate survey design, as stated within the scoping document.	Liaison with Natural England has been undertaken to confirm the scope of benthic ecological survey required to inform the marine licence application. Liaison with the Environment Agency has also been undertaken to discuss comments received within its scoping response to RCBC with regard to ecological survey requirements. Although this survey design has been agreed upon, the survey has not yet been carried out at the time of writing, therefore the impact assessment presented within this section is based on data collected for the NGCT scheme, which is considered accurate and

Scoping comment	Response / section of the EIA Report where comment has been addressed
	relevant for the purposes of this impact assessment.
Full ecological survey of current fauna and flora associated with structure will be required, including a full Invasive Non-Native Species INNS survey. The structure itself will likely be used by numerous species as a shelter, including for juvenile fish. EA survey data will not cover this location due to its inaccessibility, so we advise that this is included into any monitoring survey design being carried out. It is important we understand the habitat lost and its associated impacts (in respect to birds and fish) so that appropriate mitigation/compensation can be quantified.	Liaison with the Environment Agency was undertaken in September 2020 to discuss the scope of required survey below the existing wharf. The Environment Agency confirmed that if the structure is inaccessible, it may not be possible to survey as requested. Staff within the Environment Agency could not identify a solution to survey it, and advised that the assumption should be that the structures would have a habitat / species value, or provide justification why this is not the case.
In addition, depending what ecology is found living upon the structure, an understanding of how the structure will be removed, and the impacts associated with this (what will happen to the ecology living upon the current structure), needs to be considered. It is illegal to spread INNS between sites, and a river allows a perfect vector for spread so needs inclusion within the methods statement.	The methodology of how the structure is to be decommissioned and removed is provided within **Section 3.3**. An assessment of impacts on the ecology living on the structures to be removed is included within **Section 9.5.** .
Methods statements need to ensure consideration for the sensitives during the build process, this should include surface run-off management during the build, and afterwards, as to ensure no impact to the water quality occurs.	This has been addressed within **Section 7**. Further information will be detailed within Method Statements to be produced prior to construction works commencing.
This development will result in a loss of intertidal habitat, in already heavily modified estuary and we are supportive of the applicant's strategy to compensate for biodiversity net losses. We would like to state that in accordance with paragraph 175 of the National Planning Policy Framework, if significant harm to biodiversity cannot be avoided the initial step is to fully consider options for mitigation on site prior to compensation off-site. This could be included within the design of the development, using bio-engineered designs such as estuary edges techniques. Opportunities to soften and enhance estuary edges to provide habitat for a range of fish species and life stages, should be sought. Also methods to reconnect and improve connectivity to any watercourses discharging into the Tees estuary should be fully explored. These watercourses may provide valuable habitat for certain fish species most notably the critically endangered European Eel. This will provide an opportunity for some on-site mitigation.	Refer to response above with regard to the South Tees Regeneration Masterplan Environment and Biodiversity Strategy.
Where on site design cannot adequately mitigate impacts, which would be determined through a sufficient justification, and achieve a biodiversity net gain, compensation would be suitable.	
We are aware of the emerging biodiversity strategy for the STDC area to support the STDC masterplan, which would be a material consideration in any planning application however this plan is not yet approved. Should this EIA development be submitted, and determined, prior to this document being approved we would seek to ensure that any appropriate like-for-like compensation is adequately secured through a condition.	Noted.
The Tees Estuary Partnership (TEP) has developed a Tees Estuary Habitat Vision that aims to deliver WFD mitigation measure objectives. The Tees Rivers Trust are already leading an IMMERSE project that sets out to enhance the biodiversity of the intertidal zone of the Tees estuary. This project forms a contribution to achieving the TEP habitat vision of establishing coherent ecological networks that are more resilient to current and future pressures at a landscape scale across local authority boundaries.	The work of Tees Estuary Partnership has been considered within the South Tees Regeneration Masterplan Environment & Biodiversity Strategy.

Scoping comment	Response / section of the EIA Report where comment has been addressed
The techniques employed have been drawn from successful Estuary Edges pilots on the Thames estuary where biodiversity benefits have also been shown to enhance the visual and aesthetic value afforded to new developments. Such measures have the potential to also enhance the impact of the adjacent Teesdale Way / England Coast Path for the benefit of the wider community. Such a scheme would complement the landscaping strategy for the proposal. There are other opportunities to implement WFD mitigation measures and the applicant should explore these with the TEP to compensate for impacts which cannot be mitigated through best practice design onsite.	
Special consideration needs to be taken to understand the knock on impacts to other intertidal habitats and created habitat enhancement projects within the Tees (e.g. Seal Sands, and Greatham managed realignment). A relatively small change in tidal elevation associated with dredging, can have a large effect upon habitats such as intertidal muds and saltmarsh. Plant species which survive within a saltmarsh community are adapted to a specific amount of tidal inundation, so any changes upon this can alter the zonation of the entire marsh.	Impacts relating to changes in the tidal prism and intertidal habitats (including mudflats and saltmarsh) are assessed within **Section 9.6.** Cumulative impacts on marine ecological receptors are included within **Section 27.**.
Strict biosecurity measures should be implemented to avoid the importing of non-native invasive species. Equipment, plant and PPE brought to site should be clean and free of material and vegetation. To ensure measures are implemented, it is recommended biosecurity toolbox talks are given to all site staff and rigorous inspections are undertaken of all equipment delivered to site, following the Check Clean and Dry campaign.	Any proposed biosecurity measures in relation to marine non-native invasive species has been considered in **Section 9.5** and **9.6**.

9.3 Methodology

9.3.1 Study area

For this section of the EIA Report, the study area comprises the likely maximum extent over which potentially significant environmental impacts of the proposed scheme may occur. This has been informed by the hydrodynamic and sedimentary plume modelling undertaken. This section excludes consideration of potential impacts to the ecology of the Tees Bay C offshore disposal site; such impacts are considered in **Section 26**.

9.3.2 Methodology used to describe the existing environment

This section of the EIA Report has been informed through a desk-based assessment. The desk-based assessment has included a review of the following:

- Readily available internet resources, specifically broad scale habitat maps (which have been developed using modelling technology (UKSeaMap)) and habitat maps which have been informed by research (Marine Environmental Mapping Programme (MAREMAP)). EUSeaMap 2019 is an online mapping resource that is hosted by the European Marine Observation and Data Network (EMODnet). This provides broadscale habitat maps as well as more specific habitat maps on a broad, medium and fine scale, obtained from surveys.
- Benthic surveys undertaken elsewhere within the Tees estuary in support of marine licence applications for other developments.

9.3.3 Methodology for assessment of potential impacts

The methodology used to assess potential environmental impacts is provided in **Section 5**.

The Marine Evidence based Sensitivity Assessment (MarESA), presented on the Marine Life Information Network's (MarLIN) website was used to determine sensitivity of relevant species and habitats, where information was available. Professional judgement has been used to determine potential environmental impacts which could arise during the construction and operational phases of the proposed scheme based on our existing knowledge of the sensitivity of the Tees estuary.

Cross reference to the findings of the hydrodynamic and sedimentary regime assessment (**Section 6**) and the marine sediment and water quality assessment (**Section 7**) has been made when assessing potential impacts to marine ecological receptors.

9.4 Existing environment

9.4.1 Existing habitats

Overview of proposed scheme footprint

The majority of the proposed dredge footprint is located within the subtidal zone. However, given the proposals to locate the quay in the riverbank (i.e. on existing land), dredging and excavation in front of the quay wall to create the berth pocket will remove both intertidal sediments and landside materials / soils.

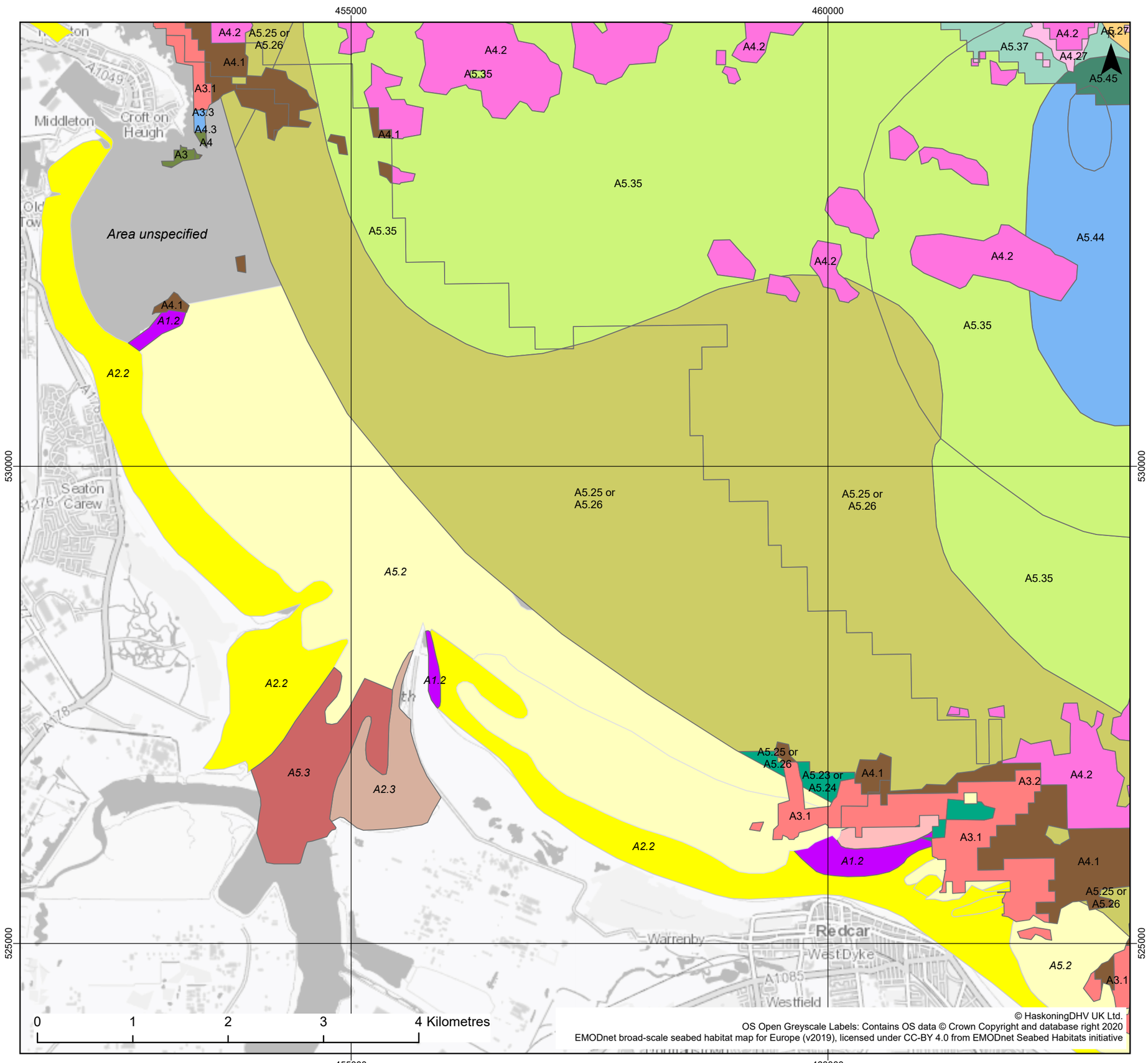
A review of the Priority Habitats Inventory (available on the MAGIC maps website) has determined that localised areas of intertidal mudflat are present within the proposed berth pocket, as well as a much larger area of intertidal mudflat on the opposite side of the river (North Tees Mudflat) (**Figure 11.2**). Further information regarding these areas of habitat is provided below. No other priority habitats are reported to be present within the immediate vicinity of the proposed scheme.

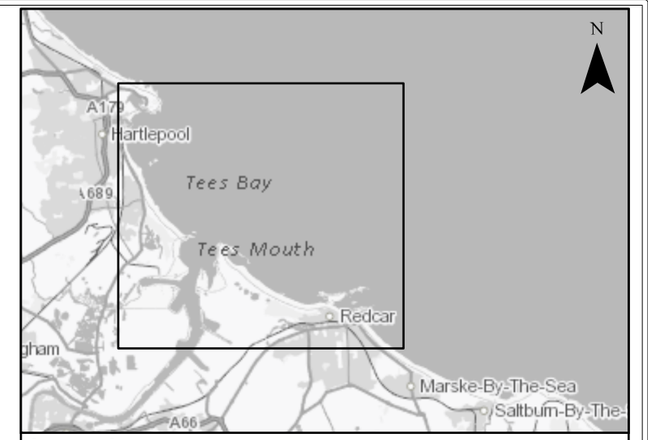
Within the Tees estuary, the extent of intertidal habitat has been significantly reduced as the banks of the estuary have been developed. Existing areas of intertidal habitat, especially intertidal mudflat, within the Tees estuary are fragmented and, in this context, intertidal areas are a sensitive resource. Intertidal mudflat is a UK Biodiversity Action Plan (BAP) priority habitat. In 2012, the UK BAP was succeeded by the UK Post-2010 Biodiversity Framework, but the UK list of priority BAP habitats remains an important reference source.

Description of habitat from online mapping sources

Figure 9.1 shows information relating to the broadscale and medium scale habitats that were obtained from EMODnet. It is evident that only detailed habitat classification information is available for the downstream part of the Tees as well as the nearshore areas, with very limited habitat information available for the proposed scheme footprint (only information on the priority habitats). Some information is available for the upstream section of the river from Defra's Magic mapping, which appears to be comprised of one habitat type; the priority habitat of mudflat (**Figure 11.2**). The mapping illustrates that the downstream part of the proposed berth pocket is occupied by high energy circalittoral sandy mud or circalittoral fine mud (EUNIS code A5.35 or A5.36), and high energy infralittoral sand (EUNIS code A5.33 or A5.34).

As can be seen in **Figure 11.2** (which was developed using information from MAGIC maps), there are individual, non-extensive areas of priority habitat 'mudflats' within the proposed scheme footprint, totalling 0.74ha. There are also areas of the priority habitat 'saltmarsh' located lower down the Tees, near Seal Sands (as can be seen in **Figure 11.2**).





Legend

Broad-scale Seabed Habitat Map

- A3.1: Atlantic and Mediterranean high energy infralittoral rock
- A3.2: Atlantic and Mediterranean moderate energy infralittoral rock
- A3.3: Atlantic and Mediterranean low energy infralittoral rock
- A3: Infralittoral rock and other hard substrata
- A4.1: Atlantic and Mediterranean high energy circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.2: Atlantic and Mediterranean moderate energy circalittoral rock
- A4.3: Atlantic and Mediterranean low energy circalittoral rock
- A4: Circalittoral rock and other hard substrata
- A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.35: Circalittoral sandy mud
- A5.37: Deep circalittoral mud
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments

Medium-scale Seabed Habitat Map

- A1.2: Moderate energy littoral rock
- A2.2: Littoral sand and muddy sand
- A2.3: Littoral mud
- A3.2: Atlantic and Mediterranean moderate energy infralittoral rock
- A5.2: Sublittoral sand
- A5.3: Sublittoral mud

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Marine Ecology - Broad- and Medium-scale Seabed Habitat Map for Europe (2019)

Figure: 9.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/10/2020	TC	MV	A3	1:40,000

Co-ordinate system: British National Grid

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9.4.2 Designated sites for nature conservation

The proposed scheme is located within and immediately adjacent to the Teesmouth and Cleveland Coast SPA and is adjacent to the Teesmouth and Cleveland Coast Ramsar site. These sites are, however, designated for waterbird and seabird interest, and are described and assessed in **Section 12**.

The proposed scheme is also located within and adjacent to the Teesmouth and Cleveland Coast SSSI. **Table 9.3** presents the reasons for notification of the SSSI. It should be noted that a number of reasons for notification are not of relevance to this section of the EIA Report (shown in italics), however have been included for completeness.

As noted in **Table 9.2**, the proposed scheme footprint is not located within or adjacent to an MCZ and impacts to MCZs are therefore not considered further in this report.

Table 9.3 Reasons for notification of the Teesmouth and Cleveland Coast SSSI (features in italics are not of relevance to this section of the EIA Report, but are addressed elsewhere as necessary. The other sections relevant to the italicised features are included within the 'relevant section' column)

Feature	Description	Relevant section where impacts on feature considered
Jurassic geology	*The foreshore between Redcar Rocks and Coatham Rocks (both located to the south of the Tees estuary) provides exposures of parts of the Lower Jurassic succession that are otherwise unexposed in the Cleveland Basin. These complement the younger Lower Jurassic successions exposed further south in Robin Hood's Bay and are sedimentologically distinct from rocks of the same age to the south of the Markey Wighton Axis.*	**Section 6** **Section 8**
Quaternary geology	*Tees Bay includes a feature known as the 'submerged forest' which has been well studied on the foreshore at Hartlepool between Carr House Sands and north of Newburn Bridge. On the Hartlepool foreshore, there is a complex of peats, estuarine and marine sediments deposited during the Holocene, which overlie the glacial deposits from the last Ice Age. Within the peats there are tree stumps and branches. This sequence is also rich in fossils and contains archaeological evidence from the Mesolithic to the Romano-British periods. The location of Hartlepool between areas of crustal uplift to the north and subsidence to south makes these sediments crucial in interpreting Holocene sea level changes.*	**Section 6** **Section 8**
Saltmarsh	The Tees estuary supports the largest areas of saltmarsh between Lindisfarne and the Humber estuary. Its saltmarshes show a succession of vegetation types, from pioneer marshes of glassworts and annual sea-blite, through common saltmarsh-grass communities to stands dominated by common couch at the limit of tidal influence.	**Section 9** (this section)
Sand dunes	*The site supports an extensive complex of dunes flanking both sides of the Tees estuary. It is the largest dune system complex between Druridge Bay and Spurn Point. The dunes support a large area of semi-natural vegetation. There are a number of damp depressions in the dunes which support a range of wetter vegetation types.*	**Section 11**
Harbour seal	*Harbour seals (also known as common seals) have lived at the mouth of the Tees for hundreds of years but were lost from the estuary for much of the 20th Century, principally due to pollution. They recolonised in the estuary in the 1980s and have established a regular breeding colony which is the only pupping site in the north-east of England. Harbour seals are present in the estuary and the tidal Tees throughout the year, with regular haul outs at Greatham Creek and Seal Sands. Pupping tends to occur in June and July on the intertidal mud of Seal Sands.*	**Section 10**
Breeding birds	*The site supports nationally important numbers of three breeding species, namely avocet, little tern and common tern. Avocets and common terns both nest within the SSSI. Little terns from a large nearby colony at Crimdon (in the adjacent Durham Coast SSSI), use*	**Section 12**

Feature	Description	Relevant section where impacts on feature considered
	the SSSI for foraging and pre- and post-breeding gatherings, with only occasional recent nesting attempts. *The extensive sand dunes, saltmarshes and wetlands across the site support a diverse assemblage of breeding birds. This includes a number of scarce and declining species, such as shoveler, pochard, ringed plover and little ringed plover.*	
Non-breeding birds	*The extensive areas of open water, grazing marsh and intertidal habitats within the site provide safe feeding and roosting opportunities for large numbers of waterbirds throughout the year. The site is of special interest for its non-breeding populations of ten species, namely shelduck, shoveler, gadwall, ringed plover, knot, ruff, sanderling, purple sandpiper, redshank and Sandwich tern, and an assemblage of over 20,000 non-breeding waterbirds. Shoveler, gadwall and ruff are predominantly associated with the extensive freshwater wetlands of the site, while ringed plover, knot, sanderling, purple sandpiper and sandwich tern mostly use the open coast. Redshank are widespread across the site, but the greatest foraging concentrations occur, along with the largest numbers of shelduck, on the intertidal mud of Seal Sands and Greatham Creek. Seal Sands and Bran Sands are also regularly used by ringed plover and knot.*	**Section 12**
Invertebrate assemblage	The extensive complex of sand dunes within the site supports a nationally important invertebrate assemblage, including at least 14 threatened species. The assemblage is diverse and makes use of a wide range of niches, with a strong dependency on open but consolidated sand exposures within which to nest and hunt.	**Section 9** (this section)

9.4.3 Results from previous benthic surveys in the Tees estuary

2006 NGCT benthic survey (Royal Haskoning, 2006)

The 2006 benthic survey undertaken for the NGCT HRO application confirmed that none of the species present in sediments from the survey area are rare and therefore, in this respect, the species present were considered typical of the estuarine environment. The proposed reclamation area for NGCT, as well as the turning circle, were found to contain low abundance and diversity.

The most abundant species recorded during the 2006 trawl survey was shrimp *Crangon* sp., which was recorded throughout the estuary, followed by shore crab *Carcinus maenas* which was more abundant in the middle section of the estuary adjacent to the proposed NGCT quay. Lower abundances of epifauna was recorded at the mouth of the estuary. Infaunal species were also recorded, the most abundant being *Abra alba*.

2014 Anglo American Harbour Facilities benthic survey (Fugro, 2014)

The survey undertaken in 2014 for the Anglo American Harbour Facilities identified the dominant biotope complex recorded in the Tees navigation channel was SS.SMU.ISaMu (Infralittoral sandy mud). This biotope is typically dominated by a rich variety of polychaetes, and a common characterising species of this biotope is *A. alba*.

The outer channel adjacent to the proposed NGCT scheme was found to contain two biotopes, namely SS.SMu.ISaMU.Cap (*Capitella capitata* in enriched sublittoral muddy sediments) and SS.SMU.SMuVS.CapTubi (*Capitella capitata* and *Tubificoides* spp. in reduced salinity infralittoral muddy sediment), where *C. capitata* dominated and was accompanied by large numbers of *Ophryotrocha* sp. These species are characteristic of fine sediments, usually with some level of organic pollution and associated depleted oxygen levels. The epifaunal survey identified that the most abundant species recorded was shrimp *Crangon crangon*. *C. maenas* and *A. alba* were also abundant, and the species were three of the ten most abundant species present in 2014.

2019 NGCT benthic survey (Ocean Ecology, 2019)
PDT commissioned a benthic ecological survey in 2019 to inform the marine licence application for the NGCT marine licence application. The survey comprised:

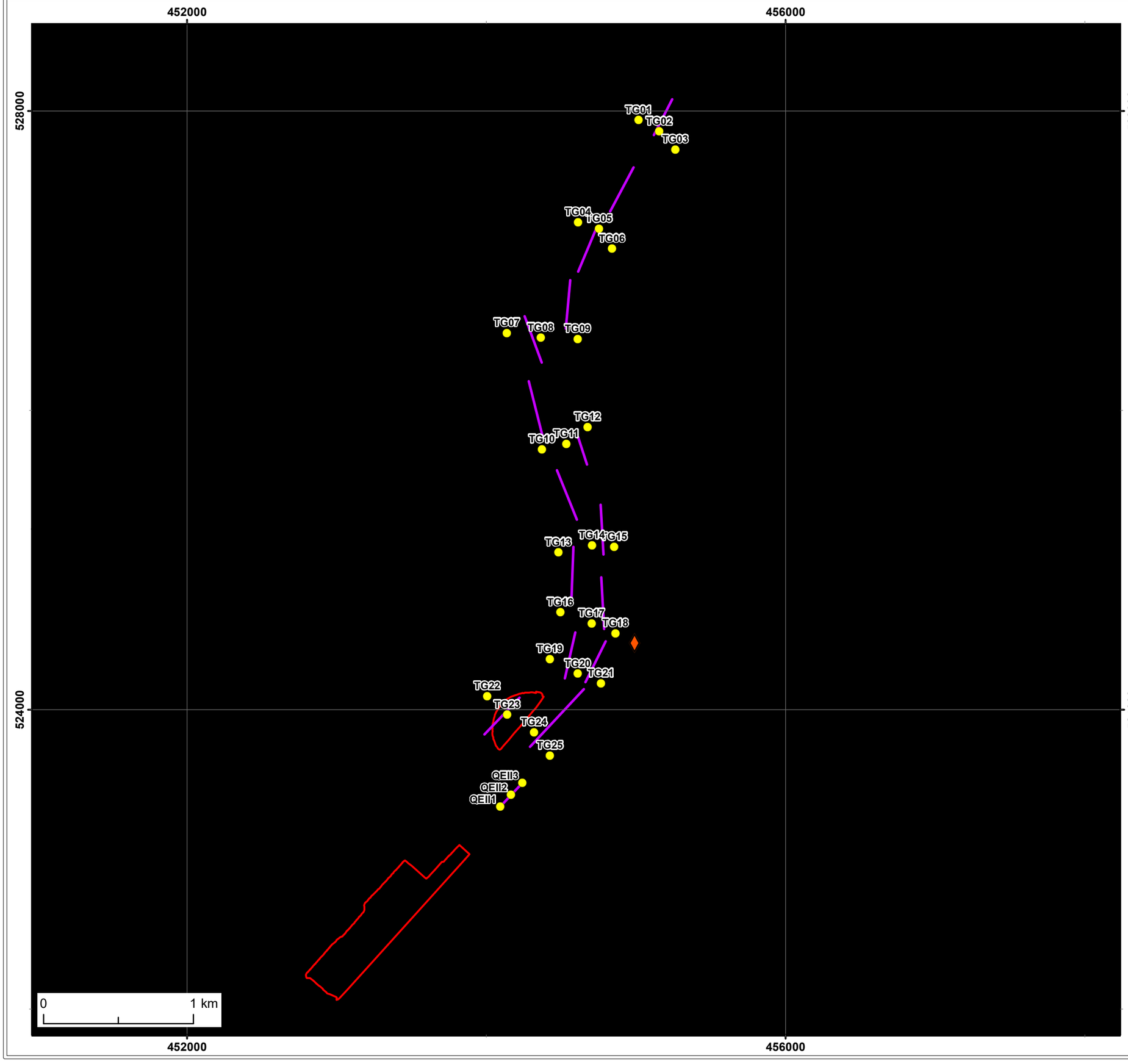
- 44 subtidal 0.1m^2 Day grab samples from the proposed NGCT footprint and from within the offshore disposal sites in Tees Bay. A number of the sampling locations covered the area that would be directly affected by the marine works for NGCT and the adjacent areas that potentially would be indirectly affected (e.g. through sediment deposition during capital dredging).
- Deployment of 16 scientific benthic trawls within the lower Tees estuary, using a 20mm mesh with a 5mm cod end, with the trawls evenly distributed across the dredge area. Fish, shrimp and other commercial invertebrates were counted and measured and all other epifauna were identified and recovered using a modified SACFOR scale based on trawl area, length and efficiency.
- A targeted intertidal biotope survey at mean low water springs on 20th March 2019 within the NGCT footprint to determine the nature and ecological value of the intertidal. The survey was undertaken in line with guidance in the Marine Monitoring Handbook (Davies *et al*., 2001) and the CCW Handbook for Marine Intertidal Phase I Survey and Mapping (Wyn *et al*., 2006), facilitated by the collection of high-resolution aerial imagery using an Unmanned Aerial Vehicle (UAV).

As shown on **Figure 9.2**, the footprint of the NGCT scheme is located approximately 1km downstream of the proposed scheme footprint which is the subject of this report. There is however a degree of overlap between the dredge footprint for the two schemes, specifically at Tees Dock turning circle. Results from the NGCT benthic ecology survey are detailed below.

Sediment type
Sediment types, as classified using the Folk triangle (Folk, 1954) for each of the sample stations across the 2019 survey area are provided in **Figure 9.3**. A variety of sediment types were present across the survey area and most samples ranged from poorly sorted to extremely poorly sorted. The samples in the Tees estuary were generally mud and sandy mud in the most upstream locations, becoming sandier with distance downstream.

Sediment biotopes
Biotopes were determined based on the 2019 Particle Size Distribution (PSD) and macrobenthic data; the distribution of these biotopes is shown in **Figure 9.4**. The biotopes that occurred most frequently in the estuarine locations was EUNIS biotope A5.323 '*Nephtys hombergii* and *Tubificoides* spp. in variable salinity infralittoral soft mud'. One station, TG15 (see **Figure 9.2**), was classified as EUNIS biotope A5.325 '*Capitella capitata* and *Tubificoides* spp. in reduced salinity infralittoral muddy sediment'. Several stations were unable to be classified further than the EUNIS level 4 biotopes A5.32 'Sublittoral mud in variable salinity' and A5.22 'Sublittoral sand in variable salinity', based on the fauna present.

Benthic grabs – microbenthic composition
The majority of species recorded during the 2019 benthic survey are typical of sublittoral microbenthic communities. As has been observed in previous surveys within the Tees (summarised above), annelid taxa, particularly polychaetes, dominated the assemblages in terms of abundance and diversity across all stations. Mollusc taxa generally contributed most to biomass. Crustaceans, echinoderms and other taxa all generally contributed little to abundance, diversity and biomass, except for 'other taxa' in the intertidal (discussed below). Unlike the findings from the 2006 and 2014 surveys in the Tees (**Section 9.4.3**), the opportunistic species *Capitella capitata* was only recorded in high numbers at one station (TG-15) (this species was widespread in the 2006 and 2014 surveys).



N

Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Benthic grab sample locations
- Intertidal core
- Benthic trawls

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: 2019 benthic grabs and trawls and intertidal core

Figure: 9.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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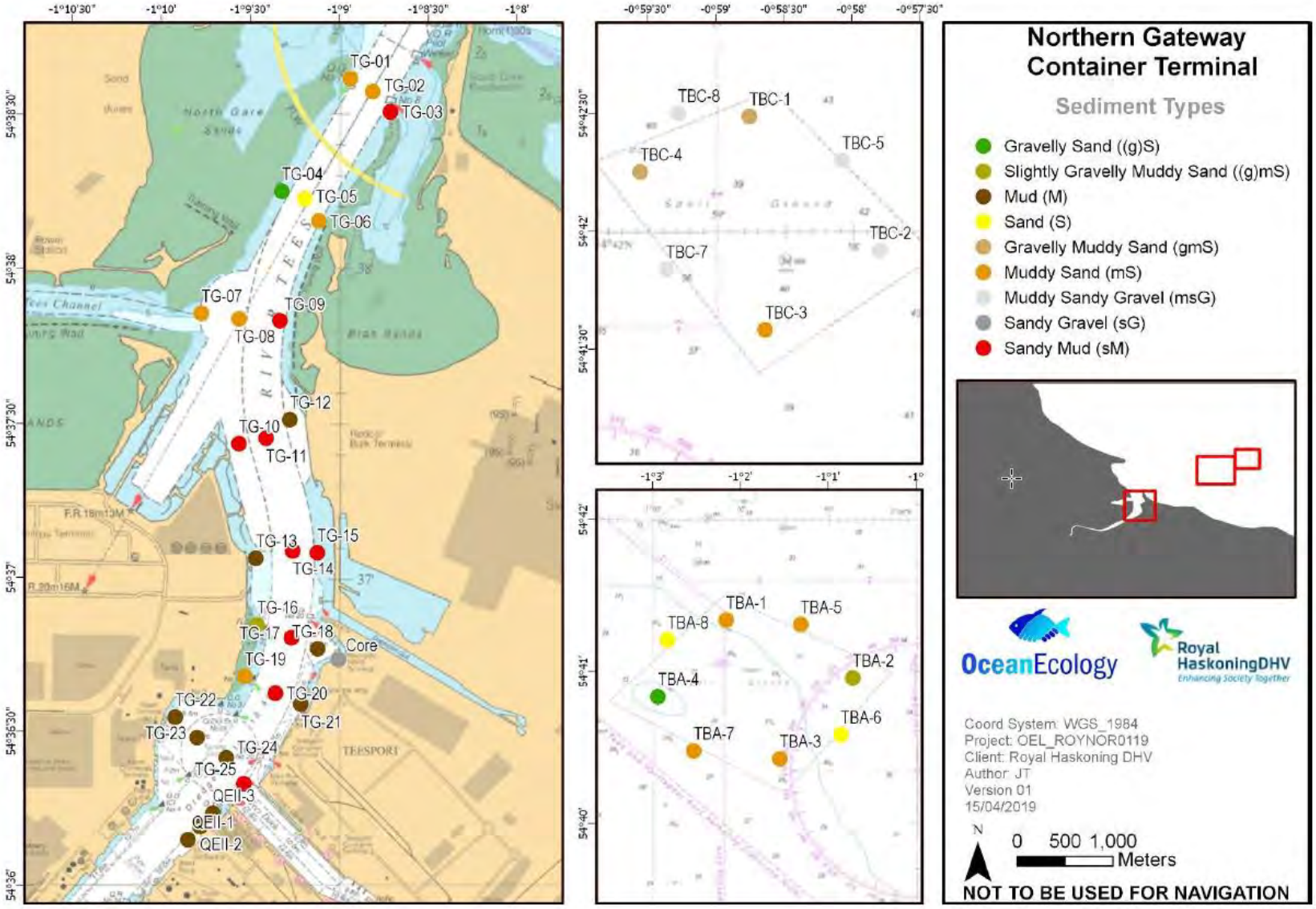

Figure9.3 *Comparison of Folk (Folk, 1954) sediment types as determined from PSD analysis of samples acquired during the NGCT sediment and marine ecology survey, 2019*

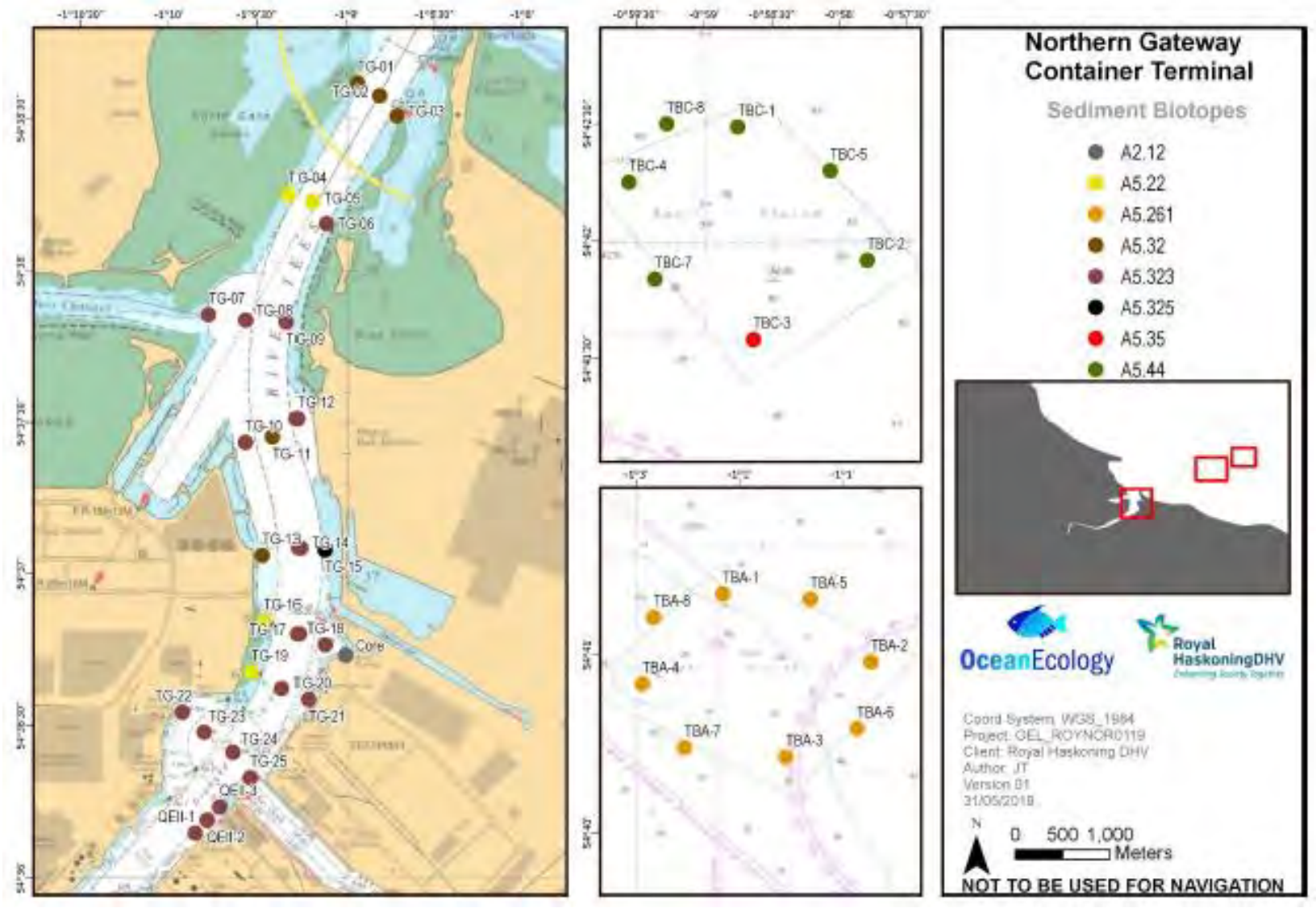

Figure 9.4 *Distribution of biotopes determined from PSD and macrobenthic analysis of samples recovered during the NGCT sediment and marine ecology survey, 2019*

There was no obvious dominance of a single taxon in the macrobenthic community during the 2019 survey. The polychaete worm *Dialychone* was the most abundant taxon sampled and accounted for 8% of all individuals recorded. Nematode worms occurred most frequently in samples (31%) (Ocean Ecology, 2019, cited within Royal HaskoningDHV, 2020).

Benthic grabs – macrobenthic faunal groups

Multivariate analyses were carried out on the benthic grab data to identify characteristic faunal groups. Faunal Group A was identified at 25 of the 2019 trawl stations (representing 56% of macrobenthic samples) and all grab sampling stations within the Tees estuary. These communities were comprised of a range of taxa with no dominance of a single taxa. The polychaetes *Chaetozone gibber* and Dialychone contributed most to within group similarity (11% and 9% respectively). However, *Tubificoides swirencoides, Abra alba*, and Nematode worms also contributed 8%, 6% and 6% to the within group similarity respectively.

Faunal Group B and C occurred at the offshore disposal sites (namely Tees Bay C and Tees Bay A respectively). Further detail regarding these faunal groups is provided in **Section 26**.

Benthic grabs - species of conservation interest and non-natives

Most species present in the Tees estuary are typical of sublittoral macrobenthic and epibenthic communities (Ocean Ecology, 2019). However, two non-native species and two species that receive designation under nature conservation legislation were recorded.

With regard to the species of conservation interest, juvenile specimens of the ocean quahog, *Arctica islandica* and the Ross worm *Sabellaria spinulosa* were identified. *A. islandica* is on the OSPAR List of threatened and/or declining species and habitats and is also a Feature of Conservation Importance (FOCI) in England and Wales. *A. islandica* was found in very low numbers (maximum of two individuals) within only three of the 25 grab samples from the Tees estuary. *S. spinulosa* is also on OSPAR List of Threatened and/or Declining Species and Habitats and is listed in Annex 1 of the Habitats Directive. *S. spinulosa* was identified in very low numbers (maximum of eight individuals in one sample) within only seven of the 25 grab samples recovered from the Tees estuary (TG01, TG03, TG04, TG09, TG13, TG24, TG25). Larger populations of both species were found within samples recovered from the offshore disposal sites in Tees Bay; *S. spinulosa* was confined to Tees Bay C only, whilst *A. islandica* was found at both offshore disposal sites. The benthic ecology of the offshore disposal sites is considered separately in **Section 26**.

Visual inspection of the grab samples containing *S. spinulosa* determined that the individuals recorded were not deemed to meet the Annex I reef qualifying criteria as described by Gubbay (2007) ((Ocean Ecology, 2019, cited within Royal HaskoningDHV, 2020). It was therefore concluded that the *S. spinulosa* tube aggregations sampled within the Tees estuary were not deemed to be representative of biogenic reef habitat.

Two individuals of the invasive species *Theora lubrica* were found at station TG-23, located within the northern half of the turning circle at the entrance to Tees Dock. *T. lubrica* is a small bivalve that belongs to the family Semelidae. Multiple specimens of *Yoldiella* species were collected at seven stations. Following discussions with expert bivalve taxonomists at the National Museum of Wales, they were assigned to *Yoldiella c.f hyperborea*.

Taxa within the Tees estuary were similar to previous surveys including nematode worms, *Chaetozone gibber*, and *Tubificoides swirencoides* (Royal Haskoning 2009, Fugro 2014). One macrobenthic faunal group was identified within the Tees estuary (Group A), occurring at all stations within the estuary. These communities were comprised of a range of taxa with no dominance of a single taxa. The polychaetes *Chaetozone gibber* and *Dialychone* contributed most to within group similarity (11% and 9% respectively).

However, *Tubificoides swirencoides*, *Abra alba*, and Nematode worms also contributed 9%, 7% and 7% to the within group similarity respectively.

Epibenthic trawls

A total of 40 epibenthic species were identified from the 2019 trawls, including 18 fish species. This is comparable to previous surveys in 2006 (47 species in total and 10 fish species, (Royal Haskoning 2006)) and 2013 (58 species in total and 19 fish species, (Fugro 2014)). Further information regarding the fish species encountered within the epibenthic trawls is provided in **Section 13** of this report.

The discrepancy in the number of species present between the various surveys appears to be related to the number of annelids recorded (Ocean Ecology, 2019). Annelids contributed to 5% of species in 2019 as opposed to 21% in 2013. Several annelids were removed prior to analysis of the epifaunal data in 2019 due to them having infaunal traits during (Ocean Ecology, 2019, cited within Royal HaskoningDHV, 2020). This is the most likely cause of the reduction in species from previous surveys (Ocean Ecology, 2019, cited within Royal HaskoningDHV, 2020).

A large increase in the numbers of brittlestars (*Ophiura* sp.) was observed in the 2019 survey when compared to previous survey data. Echinodermata only accounted for 1% of total numbers of individuals in 2013 (Fugro 2014) compared to 85% in 2019, with *Ophiura* sp. alone accounting for 80% of individuals recorded. *Ophiura* sp. was reported to be abundant at station BT08 in 2006 (Royal Haskoning, 2006) however the highest numbers were observed at stations BT06, BT05, BT10, and BT12 in 2006 where its occurrence across the survey area has also increased. Brittlestars can occur in very dense beds on sediments and in estuarine environments (Wolff 1968, Hughes 1998). The beds can play an important role in improving water quality due to their filter-feeding nature contributing to wider ecosystem function (Hughes 1998).

Overall, the epibenthic communities in the Tees appear to be stable with similar taxa observed over multiple surveys. Brown shrimp (*Crangon* sp.) and plaice (*Pleuronectes platessa*) have remained abundant across all surveys since 2006 and occurred at all or most (81%) of stations in 2019 and in 2013. Additionally, the shore crab (*Carcinus maenas*) was also abundant in 2006 which suggests that the main characterising species of the epibenthic communities remain largely unchanged.

Site-specific intertidal observations

A number of site walkovers have been undertaken by Royal HaskoningDHV during 2020 which have been used to understand the nature of the intertidal at the proposed scheme footprint. Photographs from walkovers have confirmed that the intertidal comprises intertidal mud and gravelly sediment with rocks and high levels of debris (similar to other areas of the Tees estuary). The habitat at the base of the existing structures to be demolished as part of the proposed scheme was observed to be dominated by brown algae (likely fucoids, such as *Fucus ceranoides*), and the pillars of the South Bank Wharf appear to only support areas of green, mat-like algae (possibly *Rhizoclonium riparium* or *Ulva intestinalis*) and black lichen (possibly *Verrucaria* sp.) (**Plate 9.1** and **Plate 9.2**). No other species were observed during the site visit or from the photographs.

It may be possible that there are other species colonising the intertidal sections of the structures that are to be removed, some of which may be non-native, however at this stage this cannot be confirmed due to the lack of data from the environment underneath these existing structures.

Plate 9.1 The intertidal area to the south of the existing pier structure near the pumping station, showing poor quality of habitat and limited colonisation and species diversity.

Plate 9.2 The existing South Bank Wharf to be demolished, with the pumping station on the left. Minimal colonisation of the pillars supporting the deck of the wharf is evident.

All site-specific intertidal observations are in line with the intertidal environment observed and surveyed within the vicinity of the NGCT scheme. The biotopes recorded for the NGCT scheme, which are also considered to be the likely intertidal biotopes for the proposed scheme are provided in **Table 9.4**. It should be noted that this intertidal survey targeted areas within the NGCT boundary, therefore are not directly relevant to the proposed scheme, however the intertidal areas along the banks of the Tees estuary are anticipated to be similar in both locations.

Table 9.4 Key biotopes recorded in the 2019 Phase 1 intertidal survey

Habitat	EUNIS code	EUNIS description
A1 – Littoral rock and other hard substrate	A1.32	Fucoids in variable salinity
	A1.33	Red algal turf in lower eulittoral, sheltered from wave action
	A1.45	Ephemeral green or red seaweeds (freshwater or sand-influenced) on non-mobile substrate
A2 – Littoral sediment	A2.12	Estuarine coarse sediment shores

The intertidal area at NGCT was found to be predominantly artificial due to industrial developments. This restricts the ability for a more natural rocky shore community to develop and as such was relatively species poor with only a few biotopes present (Ocean Ecology, 2019, cited within Royal HaskoningDHV, 2020).

The intertidal was generally characterised by ephemeral green algae on non-mobile substrate along the upper shore, fucoids on rock and boulders along the mid shore and red algal turf along the lower shore. Occasional areas of impoverished coarse sediment was also found along the low-mid shore (Ocean Ecology, 2019, cited within Royal HaskoningDHV, 2020).

Benthic ecological survey to validate the position set out above regarding benthic ecology
A site-specific benthic ecological survey will be undertaken during 2020 to provide a detailed understanding of benthic ecology within and adjacent to the proposed scheme footprint and validate the information set out above (the scope of which has been agreed with Natural England). As results from that survey are not available at the time of writing, it has been assumed that the benthic communities within the proposed scheme footprint would be similar in nature to those found during the 2019 survey for the NGCT. This is considered a reasonable assumption given proximity, nature of the subtidal substratum present within the footprint of the proposed scheme and the apparent similarity in the nature of the intertidal communities present at the location of the proposed and the NGCT footprint based on the intertidal walkover survey.

9.4.4 Future evolution of the baseline in the absence of the proposed scheme

In the absence of the proposed scheme, the marine ecological communities within the area potentially affected by the proposed scheme are unlikely to significantly change from the present day.

PDT would continue to undertake maintenance dredging of the river to maintain the advertised dredge depths, which would continue to influence the benthic communities present within the subtidal sediments. The intertidal foreshore and the existing wharf are considered physically stable habitats and, therefore, no material change to the ecological communities is considered likely.

9.5 Potential impacts during the construction phase

9.5.1 Direct loss of habitat due to demolition of existing structures and dredging

9.5.1.1 Demolition of existing structures

Prior to construction works commencing, a programme of demolition would be undertaken to remove the existing infrastructure, namely the existing wharf and three jetties.

The removal of these structures has the potential to temporary disturb the intertidal and subtidal habitats and species immediately adjacent, and would result in the permanent loss of species that are currently colonising the structures.

At the time of writing, there is limited information on the ecology that these structures support, in terms of colonising, sessile fauna and flora. However, observations from recent site visits has indicated that the intertidal sections of the existing structures are not heavily colonised (**Section 9.4.6**). The limited species observed are typical of a disturbed, low-quality intertidal environment. It is possible however, that there are other species colonising the existing structures that are to be removed, some of which may be non-native. None of the species colonising the existing structures are expected to be of conservation interest.

Once the structures are removed (using either land-based or marine plant), it is anticipated that they will be either disposed of on land or re-used on site. As such, all species colonising the structures would be lost, and not be recovered for release back into the marine environment. Any invasive species that these structures support are expected to be sessile and attached to the structures themselves. Therefore, the removal of any invasive species (and appropriate disposal to a suitable facility) prior to re-use of material on site will ensure that there will be no spread of non-native species between sites.

Considering the non-unique nature of the habitat and species the structures to be removed are predicted to support and the small scale of the impact, the magnitude of the impact is considered to be low. This results in an impact significance of **minor adverse**.

Although the removal of the existing structures will result in small-scale intertidal habitat loss, new intertidal habitat is planned to be created, as mentioned in **Section 3.5**, within the quay wall, in the form of verti-pools attached to it in order to enhance habitat potential of this structure during operation. Further detail of this habitat creation and its magnitude is set out within the South Tees Regeneration Masterplan Environment and Biodiversity Strategy.

9.5.1.2 Capital dredging

The proposed capital dredging would result in direct impacts to existing areas of intertidal and subtidal habitat that lie within the proposed dredge footprint, which are certain to occur.

It is recognised that the proposed dredge footprint is within close proximity to the North Tees mudflat, which is a Priority Habitat and is within the Teesmouth and Cleveland SPA and Ramsar site. However, based on the assumed side slopes to be created as part of the proposed dredge, no direct or indirect impact to this area of habitat is predicted.

The impact on the subtidal from the proposed dredging activities within the existing channel and part of the turning circle is not considered to be a long-term habitat loss, as subtidal habitat would still be present and is expected to recover following the dredging activities being carried out. However, in the short term, the benthic community would be removed from areas where dredging will be carried out.

However, the capital dredging that will take place to create the berth pocket, and the rock blanket that will be laid in front of the quay wall, will result in a permanent loss of existing benthic habitat and change to the habitat type. The permanent loss of existing intertidal due to the requirement to create the berth pocket equates to approximately 2.5ha.

The permanent loss of existing subtidal habitat due to the placement of the rock blanket in front of the quay wall during operation is estimated to be 5ha. The area of subtidal to be disturbed by the dredging activities (including within the turning circle) is estimated to be 32.5ha.

A review of the MarLIN website was undertaken to determine the sensitivity of key characteristic species identified during the March 2019 surveys carried out for NGCT, as well as any species of conservation importance recorded during previous surveys in the vicinity to habitat loss and changes as a result of capital dredging. As mentioned in **Section 9.4.4**, as there was no clear dominance of a single species, information has been presented within this section on those species which were recorded at greatest abundances and frequencies (detailed in **Table 9.5**), including species of conservation interest.

A. alba was recorded in 85% of the samples (24 of 28 grab samples) within the Tees estuary, with a total abundance of 814 individuals, making it the sixth most abundant species recorded during the most recent grab sampling campaign. No information from MarLIN is available on the five most abundant species, except for *S. spinulosa* which is covered in the paragraphs below. MarLIN reports that *A. alba* is highly intolerant to substratum loss, however, has an intermediate intolerance and very high recoverability to abrasion and physical disturbance (Budd, 2007). *A. alba* can also reportedly recolonise rapidly following dredging, recruiting from the surrounding population within the year (Diaz-Castaneda *et al*., 1989), although it is recognised that these recoverability assessments likely do not account for continuous physical disturbance/substratum loss (i.e. from maintenance dredging). Based on these, MarLIN reports a medium sensitivity for *A. alba* for substratum loss.

As reported in **Section 9.4.4**, during the subtidal surveys in 2019, two species of conservation importance were recorded, namely *S. spinulosa* and *A. islandica*. Both of these species are reported to be sensitive to substratum loss (moderately and highly sensitive, respectively) (Jackson & Hiscock, 2008; Tyler-Walters & Sabatini, 2017). *S. spinulosa* is a segmented worm that builds tubes from sand or shell fragments and is found in subtidal environments in exposed areas on hard substrate. It typically does not form reefs over much of its range, but rather is more commonly found individually. However, it may form thin crusts or reefs up to several metres across and 60cm in height (Jackson & Hiscock, 2008). *S. spinulosa* is fixed to the substratum it lives on, therefore the removal of substratum will result in mortality, which leads to this species having a high intolerance to this pressure. However, the recruitment rates of *S. spinulosa* are high, and it is often one of the first species to settle on new substrata. However, as mentioned above, this recoverability likely does not account for continuous disturbance of the substratum. MarLIN reports a medium sensitivity for *S. spinulosa* for substratum loss.

A. *islandica* is found buried in sandy and muddy sediments from the low intertidal zone down to 400m and is protected due to its slow growth and longevity (OSPAR, 2009). The species is protected as a Feature of Conservation Importance (England & Wales) although no MCZ has been designated in this area. Resilience of *A. islandica* is low given sporadic and variable recruitment (Tyler-Walters & Sabatini, 2017). Recruitment is continuous at a low level but successful peaks in recruitment occur at intervals in excess of 10 years depending on location (Hennen, 2015). MarLIN reports a medium sensitivity for *A. islandica* for physical disturbance and removal of substratum.

The benthic community is expected to be somewhat sensitive to physical habitat loss from the dredging of the existing channel and part of the Tees Dock turning circle, considering the habitat loss will be permanent. The community recorded during the 2019 surveys are considered to be typical of the Tees estuary and not

unique or designated. Although all species within **Table 9.**5 have different sensitivities to habitat loss, an overall sensitivity of high has been assigned on a conservative basis. The dredging activities will result in an irreversible loss of habitat and substratum (however ultimately the nature of the substratum is predicted to remain similar within the existing channel and turning circle). Considering the limited footprint of the dredging activities, the magnitude of this impact on the benthic community and habitat is considered to be medium. As such, it is concluded that the potential impact on the subtidal habitat and benthic community as a result of habitat loss caused by dredging would be of **moderate adverse** significance.

Table 9.5 Summary of sensitivity of characteristic species (and species of conservation importance) in the Tees estuary which could be directly impacted by the proposed dredging activity (MarLIN, 2020).

Species	Pressure	Intolerance	Recoverability	Resistance	Resilience	Sensitivity	Quality of evidence / confidence
Abra alba	Abrasion and physical disturbance	Intermediate	Very high	-	-	Low	Moderate
	Substratum loss	High	High	-	-	Moderate	High
Sabellaria spinulosa	Abrasion and physical disturbance	Intermediate	High	-	-	Low	Low
	Substratum loss	High	High	-	-	Moderate	High
Arctica islandica	Habitat structure changes – removal of substratum	-	-	None	Very low	High	High
	Abrasion / disturbance of the surface	-	-	Low	Very low	High	High

Some of the mudflat that will be lost as a result of the proposed dredge / excavation is classified as Priority Habitat 'mudflat'. However, the confidence in this habitat classification is low according to Defra's MAGIC mapping. Furthermore, based on professional experience from other projects within the Tees estuary (most recently the NGCT survey work used to inform this assessment), and the photographs from the site visit (**Section 9.5.4**, **Plate 9.1**), such reported areas of mudflat are often not actually mudflat. The intertidal within the proposed scheme footprint appears to be disturbed (with various pieces of debris observed) and of low quality (due to there being a poor species richness from what can be observed, presence of structures that impede the natural movement of sediments and poor transition of habitats). Although there are areas of habitat classed as a Priority Habitat mudflat, based on available data and observations, it is not considered to be of any conservation importance. However, as a conservative estimate, a sensitivity of 'medium' has been assigned for the purposes of this impact assessment, taking in to account the fragmented nature of the habitats within the Tees. Although the loss of the intertidal due to the dredge / excavation works (change to subtidal) will be permanent and irreversible, the footprint of permanent intertidal habitat loss is very small. As such, a magnitude of 'medium' has been assigned. Based on this, it is concluded that the impact on the benthic habitats due to the loss of the intertidal would be of **minor adverse** significance.

Mitigation measures and residual impact

It is recognised that the proposed dredge is a key component of the proposed scheme, and as such the impacts arising from this to the benthic habitats and community are unavoidable. Any loss of biodiversity as a result of these activities is proposed to be offset by the measures described within the South Tees Regeneration Masterplan Environment and Biodiversity Strategy. Furthermore, the footprint of the proposed dredging has been minimised as far as possible, within the constraint of delivering a development that meets the operational requirements of the proposed scheme. The residual impact is therefore predicted to be of **minor adverse** significance.

9.5.2 Effects of increased suspended sediment concentrations during dredging on marine species and habitats

Dredging of approximately 1,800,000m^3 of material will be required for the proposed scheme, over half of which will be for the creation of the berth pocket. Approximately 155,000m^3 of this will be dredging of the intertidal (defined as between Mean Low Water and Mean High Water). The proposed dredging activities will disturb sediment, which will result in localised and short-term increases in suspended sediment concentrations.

Based on sediment quality sampling that was undertaken within the Tees estuary in July 2019 (as reported in **Section 7**), it is not expected that any contaminated sediment would be released into the water column as a result of dredging (at a level exceeding the respective EQSs of relevant contaminants) (**Section 7.5.3**). As such, the impact assessment presented within this section focuses on the potential impacts to marine ecology as a result of increased concentrations of suspended sediment within the water column (i.e. resuspended sediment which does not contain elevations beyond Action Level 2). The dredged sediment would be disposed of at sea, to the Tees Bay C site (the potential impacts of which are assessed within **Section 26**).

An increase in the TSS concentration in the water column would increase turbidity and reduce the depth of water that light can penetrate and, therefore, the amount of light available for primary production by phytoplankton and marine algae. At high levels and/or for prolonged periods of time, an increase in TSS concentrations can inhibit or prevent benthic organisms from feeding by clogging feeding apparatus (e.g. filter feeding molluscs). In addition, high concentrations of suspended sediment may impact on fish through clogging of gill lamellae, potentially leading to death, whilst lower concentrations can result in sub-lethal stress or avoidance reactions. Further consideration of the potential impacts of increased TSS concentrations of fish is provided in **Section 13**.

In general, sediment plumes induced by dredging are considered to pose only a limited risk to water quality (and subsequently marine ecological species) since the affected water usually has the capacity to accommodate an increased oxygen demand, particularly where dredging takes place in open sea or estuaries (CIRIA, 2000). The tidal exchange within the Tees estuary would remain unrestricted during the construction phase and significant peaks in TSS would only occur on a short-term basis during the proposed dredging periods. The sediment plume generated by dredging would likely be dispersed by tidal currents away from the dredging location. The dispersion would either be upstream on the flood tide or downstream on the ebb tide. Larger particles such as sand would typically rapidly fall (within minutes) to the estuary bed upon disturbance of the sediment.

Mean background suspended solid levels in the vicinity of the proposed scheme (based on metocean surveys where water quality samples were collected in July 2020) range from 2.5 mg/L during spring tides to 3.9 mg/L during neap tides (however it should be noted that the metocean survey was undertaken during a very dry period of weather). Maximum concentrations ranged from 7.5 mg/L during neap tides to 8.5 mg/L

during spring tides (**Section 7.4.2**). These are considerably lower than suspended sediment concentrations previously recorded within the Tees (as reported within **Section 7.4**).

For both types of dredger (backhoe and TSHD), peak suspended solids concentrations are predicted in the immediate vicinity of the dredger. Sediment plume modelling predicts different plume extents and suspended sediment concentrations depending on the stage of dredging (as described in **Section 6**). In all cases, the sediment plume is predicted to be very narrow within the river, with the phase of dredging with the highest concentrations predicted to be 100-200 mg/L within the vicinity of the dredger, reducing to 10-20 mg/L within a few hundred metres of the point of release, and further reducing to 0-10 mg/L at the extremities of the plume.

All plumes associated with different stages of dredging in the vicinity of the proposed new quay are confined to the southern bank of the river, whilst all plumes associated with dredging of the turning circle are confined to the northern bank. No plume effects of a significant level above background values are anticipated to occur beyond these reaches (i.e. areas such as Tees Dock, Seal Sands, Bran Sands, North Gare Sands).

The sediment plume modelling reported within **Section 6** also extracted time series plots of changes in SSC from the model at a series of points within the affected river reaches. At the mudflat monitoring points (**Figure 6.51**), it was only during Stage 4 of the dredging (related to dredging of the turning circle) that any discernible effects are predicted, when at the most southerly point (Mudflat 1) SSC is predicted to increase by a peak of 22mg/l, at the middle point (Mudflat 2) it increases by a peak of 10mg/l and at the northernmost point (Mudflat 3) it increases by a peak of 8mg/l (**Figure 6.52**)

As noted in **Section 9.4.4**, Faunal Group A was identified at all stations within the Tees estuary. These communities were comprised of a range of taxa with no dominance of a single taxa. The polychaetes *Chaetozone gibber* and *Dialychone* contributed most to within group similarity (11% and 9% respectively). However, *Tubificoides swirencoides, Abra alba*, and Nematode worms also contributed 9%, 7% and 7% to the within group similarity respectively. A review of the MarLIN website has been undertaken to determine the sensitivity of the key species present within the Tees estuary and any species of conservation importance (where information is available) to increases in suspended sediment. This information is presented below.

S. spinulosa relies on suspended particles for its tube growth. Increased suspended sediment concentrations could therefore facilitate tube construction and population growth. However, an increase in siltation may temporarily inhibit feeding. MarLIN has reported *S. spinulosa* to be of low intolerance, have immediate recoverability (Jackson & Hiscock, 2008). As such, *S. spinulosa* is not considered to be sensitive to increases in suspended sediment concentrations, according to this sensitivity review.

A. islandica typically occurs in silty sediments, in sheltered to wave exposed conditions, where the surface sediment likely gets resuspended regularly, and where accretion rates and moderate to high. *A. islandica* can burrow in the sediment it lives in for several days, thereby it is able to avoid sudden changes in environmental conditions. For this reason, MarLIN reports that *A. islandica* has high resistance, high resilience and is not sensitive to changes in suspended solids (Tyler-Walters & Sabatini, 2017).

The key bivalve species within the subtidal sample results, namely *A. alba,* does not require light and therefore changes in turbidity are not directly relevant, though increases in turbidity may affect primary production in the water column and therefore reduce the availability of phytoplankton food (Budd, 2007; Rayment, 2008). MarLIN reports that *A. alba* has a very high recoverability and very low sensitivity to increases in turbidity (Budd, 2007). Based on the above, this characteristic species within the footprint of the proposed dredge is considered to be of low sensitivity to increases in suspended sediment.

The dominant sediment biotope present within the dredge footprint is EUNIS biotope A5.323, *Nephtys hombergii* and *Tubificoides* spp. in variable salinity infralittoral soft mud. MarLIN reports that this has a high resistance and resilience to changes in suspended sediment and was reported to be not sensitive (to changes in suspended sediment) (De-Bastos, 2016). As such, for the purposes of this assessment, the sensitivity of this biotope has been classed as very low.

Given the temporary and localised nature of the predicted increase in suspended sediment, in addition to the low/very low sensitivity of the key species present in the estuary to increased suspended sediment, an impact of **negligible** significance is predicted.

No impact on the priority habitat 'saltmarsh', a designated feature of the Teesmouth and Cleveland Coast SSSI, is anticipated as there is not considered to be a pathway of impact due to the location of the saltmarsh areas in relation to the proposed scheme.

Mitigation measures and residual impact
No mitigation measures are required. The residual impact is predicted to be of **negligible** significance.

9.5.3 Effects of smothering following dredging on marine species and habitats

During the capital dredging a proportion of the material that is dredged would be disturbed and re-suspended into the water column, dispersed and deposited onto the seabed. The dispersion and deposition of fine material during dredging is described in **Sections 6** and **7**.

The proposed dredging footprint of the scheme is considered to be relatively limited; restricted to the direct footprint of the quay, the adjacent navigation channel and the turning circle further downstream. As mentioned in **Section 9.5.1.2**, the estimated area to be disturbed directly as a result of the dredging activities is 32.5ha. This is expected to cause a very limited extent of suspended sediment concentrations, and thereby also limited smothering of intertidal and subtidal benthic communities and habitats.

Some of the sediment that is suspended as a result of the dredging activities will be deposited to the riverbed, either soon after disturbance occurring during the dredging operation (for coarser-grained sediment fractions), or at a point in time within a few minutes to a few hours after this if it is carried in suspension by the prevailing currents (for finer-grained sediment fractions) (**Section 6**). The modelling carried out on this, as reported in **Section 6**, indicates that much of the resuspended sediment is deposited on the riverbed within the dredging footprint, whilst the deposition that occurs in other parts of the river is much lower, typically less than 5cm, within the same area of river that is affected by the zone of influence from the sediment plumes.

As mentioned in **Section 6** and **Section 9.5.2**, parts of the timeseries plots of changes in riverbed thickness (deposition) from the sediment plume model were extracted at a series of points within the affected river reaches (relating to locations of mudflats, as shown on **Figure 6.53**). Sediment deposition at all of these locations were predicted to be immeasurable (**Figure 6.53**).

In terms of intertidal habitats, although several biotopes were recorded for the NGCT intertidal survey in 2019, photographic evidence of the intertidal areas within the footprint of the proposed scheme indicates that the habitat is likely to be EUNIS biotope A1.32 Fucoids in variable salinity. There are several lower-level, more specific biotopes under this Level 4 biotope. The most likely one to be occurring within the footprint of the proposed scheme is A1.327 *Fucus ceranoides* on reduced salinity eulittoral rock. Typically, where this biotope occurs, the water flow from tides and currents can be moderately strong (1.5 m/s) (Connor *et al*., 2004). This movement of water allows for any deposited sediment to be moved around and away relatively quickly. However, some sediment may still be present long enough to damage the fronds of *F.*

ceranoides, as well as the other species within this biotope. For this reason, MarLIN has assessed the resistance, resilience and sensitivity of this biotope to be medium (Perry & Budd, 2016).

Any smothering caused by the proposed dredging activities is not predicted to result in the deposition of sediments at Seal Sands, Bran Sands or North Gare Sands, due to the limited footprint of dredging activities, and limited pathway of impact for these areas.

In terms of subtidal habitats and species, those recorded during the 2019 survey are characteristic of the Tees estuary and are mobile burrowing fauna; although some are filter feeders which are more susceptible to smothering, regardless of their mobility. However, benthic mud communities are resilient to smothering up to a deposit of 5 cm because they are able to burrow and reposition within the new sediment (Whomersley *et al*., 2010).

The most common faunal group (Faunal Group A) recorded during the 2019 surveys did not have dominance of a single taxa. The polychaetes *Chaetozone gibber* and *Dialychone* contributed most to within group similarity (11% and 9% respectively). However, *Tubificoides swirencoides, Abra alba*, and Nematode worms also contributed 9%, 7% and 7% to the within group similarity respectively. A review of the MarLIN website has been undertaken to determine the sensitivity of the key species present within the Tees estuary, and any species of conservation importance (where information is available) to increases in suspended sediment. This information is presented below.

MarLIN reports that even though smothering by fine sediments may temporarily limit the feeding, growth and potentially reproduction of *S. spinulosa*, it is likely that this species is able to tolerate smothering by fine sediments for up to several weeks, and that recovery would be almost immediate. As such, *S. spinulosa* is considered to be not sensitive to smothering (Jackson & Hiscock, 2008).

Based on field experiments carried out on *A. islandica*, MarLIN concludes that it is able to reach the surface of sediments, with no effect on its growth or population structure being evident as a result of smothering (Powilliet *et al.*, 2006; 2009). As such, it is considered that a deposit of up to 30cm of fine sediments is unlikely to have a negative effect on the species, resulting in high resistance and resilience. Therefore, *A. islandica* is not considered to be sensitive to smothering and siltation rate changes (Tyler-Walters & Sabatini, 2017).

A sudden smothering of 5cm of sediment would temporarily suspend the feeding and respiration of *A. alba* and require the species to relocate to its preferred depth. MarLIN reports that *A. alba* would be expected, in this situation, to relocate with no mortality. This relocation may affect the growth and reproduction of the individuals, however this would return to normal following relocation, as such it is considered to have immediate recoverability. MarLIN has assessed *A. alba* as being not sensitive to smothering (Budd, 2007). Based on the above sensitivity information, for the purposes of this assessment, the sensitivity of the key species, including species of conservation importance has been classed as very low.

The species that were recorded during the 2019 surveys and also previous historical surveys are typical species that characterise fine sediment habitats within estuarine areas (mainly polychaete and oligochaete species, typical of sublittoral microbenthic communities) (Ocean Ecology, 2019). As such, they are tolerant of fluctuating environmental conditions, such as periodic sediment disturbance due to storms and are not considered sensitive in this respect (as confirmed by sensitivity information reported by MarLIN). It is concluded therefore, that the rates of sediment deposition, and the overall degree of sedimentation, that is predicted in this instance would be tolerated by those species present within the subtidal areas that may potentially be affected. It is predicted that the proposed dredging would not give rise to the loss of a

component of the benthic community. Considering this, the predicted rates of sediment deposition, and the limited range of potential smothering, the magnitude of this impact is assessed to be low.

Given the above, an impact of **negligible** significance on marine species and habitats is predicted to arise as a result of the deposition of fine sediments, with **no impact** in the longer term.

No impact on the priority habitat 'saltmarsh', a designated feature of the Teesmouth and Cleveland Coast SSSI, is anticipated as there is not considered to be a pathway of impact due to the location of the saltmarsh areas in relation to the proposed scheme.

Mitigation measures and residual impact
No mitigation measures are required. The residual impact would be of **negligible** significance.

9.6 Potential impacts during the operational phase

9.6.1 Creation of habitat from the berth pocket creation and installation of the quay wall

The proposed quay face is to be located approximately 55m inland of the existing foreshore. As such, the (terrestrial) soils that are present will be excavated to the required depth to allow for the creation of the berth pocket. This will result in the creation of new subtidal habitat. Although, when initially created, the seabed will likely be exposed mudstone (geological material), a rock blanket will be laid on the seabed at this location. The total new subtidal area to be created as a result of this is estimated to 5.5 ha.

As the resulting new habitat will be hard substrata, it is likely that it will initially be colonised by opportunist species such as ascidians, potential red algae species (rhodophyta), bryozoans and hydroids.

As mentioned in **Section 3.5**, the solid piled wall of the quay to be constructed also has the potential to incorporate biodiversity enhancement measures such as 'verti-pools'. This would in effect create new intertidal habitat. It is likely that the 'new habitats' would initially also be colonised by opportunist species such as ascidians, brown algae species (fucoids), bryozoans and hydroids.

The created intertidal and subtidal habitats are likely to be subject to high levels of disturbance (in the form of ship wash and maintenance dredging where required) due to the shipping activities during operation and associated changes in water flow (this is assessed as a separate impact in **Section 6** and **Section 9.6.2**). As such, the new habitat (intertidal and subtidal) is likely to be artificial habitat of low quality.

The magnitude of this effect is likely to be of medium magnitude due to the size area being created (both intertidally and subtidally), even if the habitat will be of low quality. This results in an impact of **minor beneficial** significance on the intertidal and benthic communities from the installation of the quay wall and the creation of the berth pocket.

Mitigation measures and residual impact
No mitigation measures are required. The residual impact would be of **minor beneficial** significance.

9.6.2 Change in flow regime affecting marine communities

The predicted effects of the proposed scheme on the hydrodynamic regime are presented in **Section 6.6**. The scheme is predicted to have very minor effects on the flow regime, with very small increases in flows being predicted for the newly created quayside (general increase of up to 0.1m/s during both stages of the tide). Minor decreases in flow speeds of up to 0.1m/s from the baseline conditions are predicted the middle

of the navigational channel within the scheme footprint. No measurable change in the hydrodynamic flow regime within the turning circle was predicted.

The reductions in current speeds in the middle of the navigation channel within the footprint of the scheme may lead to a slight increase in deposition of sediment (**Section 6.6.2**). In areas adjacent to the north bank opposite the quay, this is positive as it will help the existing North Tees Mudflat be sustained in light of sea level rise. In the main channel the deposition will require periodic dredging to maintain the design depths.

Changes to the cross-sectional area of an estuary due to capital dredging creation of a new subtidal area can influence tidal propagation. As a consequence, the level of high and low water can be affected. This can change the extent of intertidal area exposed at low water.

Benthic community structure is influenced by the tidal regime to which it is subjected and, therefore, a change from intertidal habitat to very shallow subtidal at only certain states of the tide has the potential to impact on community structure.

As reported within **Section 6.6.3**, it is predicted that the scheme, due to the creation of the new quay and berthing pocket, would result in an increase in the tidal prism. This is predicted to be an increase to the existing tidal prism by less than one percent (0.8% to one decimal place) and as such, was not considered to be a cause of significant estuary-wide change in hydrodynamics. In this instance the change is considered to be of very low magnitude and, in terms of an effect on the physical environment to which the benthic community is exposed, the predicted effect would not result in a change in benthic community structure.

No impact on the local wind generated waves at the scheme location are predicted, as the predicted changes in hydrodynamics are very small and localised (**Section 6.6.2** and **6.6.3**).

No impact on the priority habitat 'saltmarsh', a designated feature of the Teesmouth and Cleveland Coast SSSI, is anticipated as there is not considered to be a pathway of impact due to the location of the saltmarsh areas in relation to the proposed scheme.

Overall, the impact of the proposed scheme on marine communities due to changes in the hydrodynamic and tidal regime is predicted to be of **negligible** significance.

Mitigation measures and residual impact

No mitigation measures are required, and the residual impact would be of **negligible** significance.

9.6.3 Change in maintenance dredging regime affecting marine communities

The predicted changes to the rate of sedimentation within the navigation channel as a consequence of the proposed scheme are minimal (**Section 6.6.2**) and, therefore, the existing frequency of maintenance dredging will not change. The areas that are being proposed to be maintenance dredged for the scheme are all areas that are currently already being dredged regularly; there will be no change in the extent of seabed affected by maintenance dredging, with the exception of the newly created berthing pocket.

For the new berth pocket area (i.e. the area that is currently land), the subtidal habitat created here will continuously be disturbed by shipping activity and maintenance dredging and, therefore, this will prevent the establishment of a diverse or sensitive benthic community (i.e. any species colonising would be those adapted to repeated disturbance events). As such, it is expected that there would be **no impact** on marine communities as a result of the maintenance dredging requirement arising from the proposed scheme.

Mitigation measures and residual impact

No mitigation measures are required. There would be **no residual impact**.