REPORT

South Bank Quay

EIA Report

Client: Tees Valley Combined Authority

Reference: PC1084-RHD-SB-EN-RP-EV-1100

Status: S0/P01.01

Date: 06 November 2020

Royal HaskoningDHV

Enhancing Society Together

HASKONINGDHV UK LTD.

Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE
Industry & Buildings
VAT registration number: 792428892

+44 191 2111300 **T**
+44 1733 262243 **F**
info.newcastle@uk.rhdhv.com **E**
royalhaskoningdhv.com **W**

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Author(s):	RHDHV EIA Team
Drafted by:	RHDHV EIA Team
Checked by:	Steven Rayner and Matt Simpson
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Classification
Project related

MANAGEMENT SYSTEM CERTIFICATION DNV·GL ISO 9001 = ISO 14001 ISO 45001

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Appendices

1 INTRODUCTION AND BACKGROUND

1.1 Background

South Tees Development Corporation (STDC) is proposing to construct a new quay at South Bank in the Tees estuary (referred to hereafter as the proposed scheme) (see **Figure 1.1**). The proposed scheme is required to support STDC's landside proposals for general industry and storage or distribution uses within part of the South Industrial Zone (described in **Section 2**). It is envisaged that the new quay would be utilised predominantly by the renewable energy industry, as well as supporting more general industrial and storage/distribution activities.

In summary, the proposed scheme comprises demolition, capital dredging, offshore disposal of dredged material and construction and operation of a new quay (to be set back into the riverbank) (see **Figure 1.1**).

The proposed scheme would require works in both the marine and terrestrial environments and requires Environmental Impact Assessment (EIA) in support of a marine licence application to the Marine Management Organisation (MMO) and a planning application to Redcar and Cleveland Borough Council (RCBC).

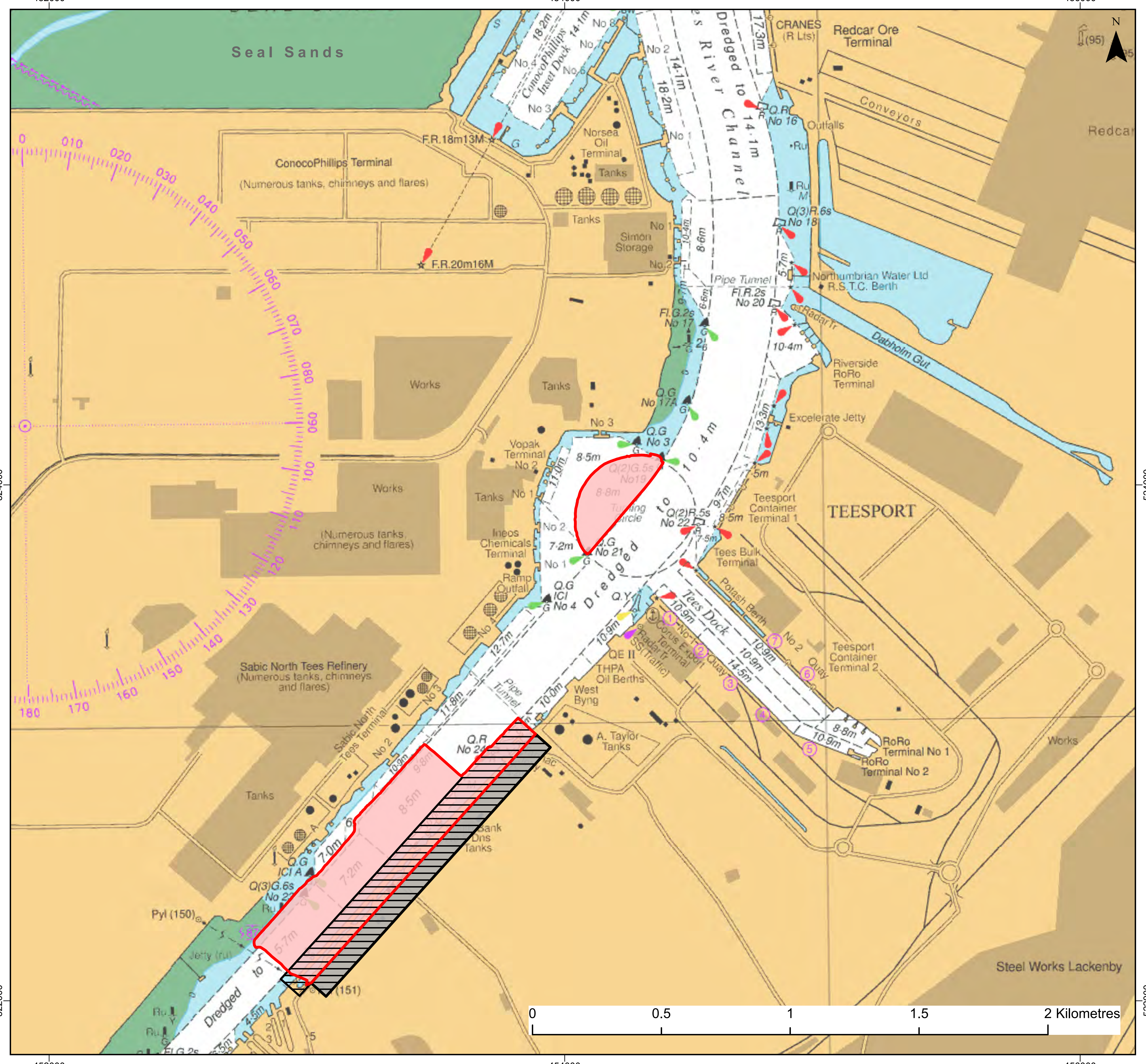
1.2 Study area

The study area for the EIA in respect of the proposed scheme is the area over which the direct and indirect effects of the proposed scheme may be detected during the construction and operational phases. Typically, for estuarine and marine development projects, the study area is defined as the area over which potential effects on tidal currents and sediment transport may occur (i.e. the potential zone of influence). The hydrodynamic modelling domain (which includes the offshore disposal site in Tees Bay and the majority of the Teesmouth and Cleveland Coast Special Protection Area (SPA) and Ramsar site) shown in **Figure 1.2** therefore defines the study area for the marine elements of the proposed scheme (namely the demolition, dredge and disposal activities).

The study area detailed above extends to cover the landside elements of the proposed scheme, namely the construction of the proposed quay within the riverbank. As with the marine parts of the proposed scheme, the study area for the landside parts of the proposed scheme is defined as the area over which potentially significant direct and indirect effects may occur. In this instance, the landside study area is likely to vary by topic (as detailed in the respective technical chapters of this report and summarised in **Table 1.1** below). The study area is shown on **Figure 1.2**. Landscape and visual impact assessment has been detailed separately within **Table 1.1** as the zone of influence for landscape and visual impacts is predicted to extend the greatest distance from the proposed scheme footprint.

Table 1.1 Description of study areas

Technical topic	Study area
Marine topics	The study area for marine topics comprises the hydrodynamic and sedimentary modelling domain, which covers the potential zone of influence of both the dredge and disposal activities.
Landscape and visual impact assessment	The study area extends to 5km and the assessment considers high sensitivity receptors within that zone. The assessment focusses on the area within 2km from the proposed scheme footprint; however, significant impacts are envisaged within a 1km zone only.
Other landside topics	The potential impacts on other landside environmental receptors are not predicted to extend beyond 1km from the proposed scheme footprint. Further detail is provided within the technical chapters regarding study areas being considered, where required.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: Site Location Plan

Figure: 1.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	27/10/2020	TC	SR	A3	1:15,000

Co-ordinate system: British National Grid

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

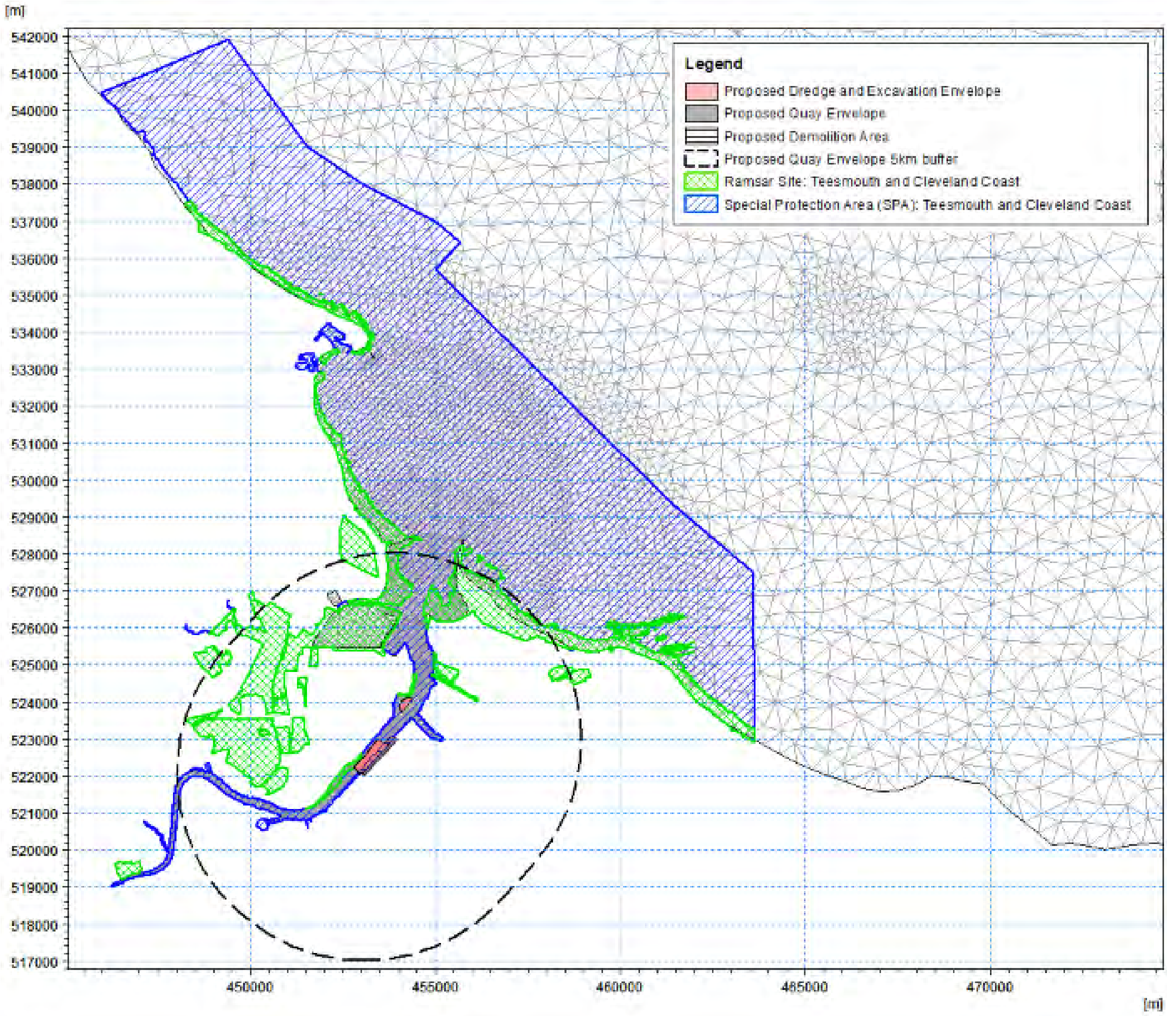


Figure 1.2 Study area

1.3 Report structure

This report presents the findings of the EIA process and explains how the conclusions have been reached. The intention has been to present the information in such a way to allow readers to form their own opinions on the acceptability of the residual impacts associated with the proposed scheme.

Section 1 outlines the background to the proposed scheme and defines the study area. **Section 2** presents the need for the proposed scheme, and **Section 3** discusses the relevant legislative regime, identifying the various consents and licences required. **Section 4** describes the proposed scheme, whilst **Section 5** describes the EIA process and defines the EIA methodology adopted.

Sections 6 to **26** contain the technical assessments of the potential impacts of the proposed scheme. These sections describe the nature of the existing (baseline) environment for various parameters considered during the EIA process. The potential impacts of the proposed scheme during construction and operational phases on each of these parameters are then identified and assessed and, where appropriate and practicable, mitigation measures are defined. The residual impacts (potential impacts remaining assuming the proposed mitigation measures are effectively implemented) are then assessed.

Section 27 presents the assessment of potential cumulative impacts with other plans and projects. **Section 28** considers the implications of the proposed scheme under the requirements of the Water Framework Directive (WFD). **Section 29** considers the implications of the proposed scheme for European and internationally designated sites (for nature conservation). **Section 30** lists the references used during the production of this EIA Report.

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2 NEED FOR THE PROPOSED SCHEME

2.1 Introduction

STDC is the third Mayoral Development Corporation to be established, and the first outside of London. It was created in August 2017 by the then Secretary of State for Communities and Local Government pursuant to Section 198 of the Localism Act 2011 at the request of the Tees Valley Combined Authority (TVCA) and was established by The South Tees Development Corporation (Establishment) Order 2017.

STDC was established as the public sector vehicle for delivering area-wide economic regeneration in the area to augment the wider economic growth plans of the Tees Valley. It delivers this regeneration through its South Tees Regeneration Programme. It has also prepared the South Tees Regeneration Masterplan (STDC, 2019) to support development through the local planning and planning application process. This Masterplan was originally published in 2017 and it was revised to reflect ongoing changes in market demand in November 2019.

The Masterplan sets out the vision for transforming the STDC area into a world-class, modern, large-scale industrial business park. It provides a flexible development framework where land plots can be established in a variety of sizes to meet different occupier needs in the most efficient manner possible. The Masterplan identifies five distinct development 'zones' within the STDC area. The proposed scheme footprint is within the South Industrial Zone. This zone is identified for port related use, offshore energy industries, materials processing and manufacturing and energy generation (i.e. the proposed scheme aligns with the planned use within the South Industrial Zone).

The proposed scheme is required to directly support the economic regeneration plans being progressed by STDC within the Tees Valley region. Of relevance is the outline planning application submitted by STDC in June 2020 to RCBC, on land within the South Industrial Zone (reference R/2020/0357/OOM) (referred to throughout this report as the 'landside EIA'). The planning application was submitted to allow the development of up to 418,000m^2 of general industry and storage or distribution facilities on land at South Bank. The proposed scheme which is the subject of this report is specifically linked to the proposed development of the backing land at South Bank; a quay is required to support with the import and export of materials / products associated with the development of such land. Such requirements have therefore driven the proposed scheme's location with the Tees estuary, and specifically at the South Bank site in the South Industrial Zone.

2.2 Factors influencing the proposed scheme design

As noted in **Section 1**, it is envisaged that the proposed quay would be utilised predominantly by the renewable energy industry, as well as supporting more general industrial and storage/distribution activities. With regard to the renewable energy industry, the proposed quay is to be used to support both manufacturing and staging (pre-assembly and storage) of wind farm components prior to export to offshore wind farm sites.

The proposed quay length is a direct function of the operations that are predicted to be undertaken at the site; the quay has been designed to accommodate up to five vessels at the same time, including two large windfarm installation vessels as well as up to three smaller vessels which are predicted to import products to the site. The assumed size of such vessels has informed the length of quay required.

Similarly, the beam of the widest design vessel has directly informed the size of the berth pocket required (90m wide) and the associated dredging requirements. Consultation with PD Ports' Harbour Master during June 2020 confirmed that the berth pocket should not intrude into the existing navigation channel, but that it would be possible to manage the risk of cargo (e.g. wind farm blades) intruding into the channel during loading operations. These criteria effectively set the riverward extent at which it is possible to locate the berth line and resulted in the proposed construction of the quay set back into the riverbank.

Given the nature of the predicted operations at the site, there is a requirement for inclusion of two heavy lift areas into the quay deck. The number of heavy lift areas required and consequently the number of cranes to be utilised on these areas (i.e. one per heavy lift area) is linked to the number of large windfarm installation vessels that are predicted to berth at the quay simultaneously (two) once operational. Reducing the number of heavy lift areas and consequently the cranes at the proposed port facility would not meet the objectives of the proposed scheme during the operational phase.

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3 DESCRIPTION OF THE PROPOSED SCHEME

3.1 Introduction

The proposed scheme comprises demolition of the existing wharf, jetties and other minor infrastructure along the river bank at South Bank (including an electrical substation), capital dredging (to deepen the northern half of the Tees Dock turning circle, a section of the existing approach channel and to create a berth pocket), offshore disposal of dredged sediments and construction and operation of a new quay (to be set back into the riverbank). Further detail regarding the various elements of the proposed scheme are detailed below.

3.2 Site compound

The proposed scheme would initially comprise the establishment of a site compound. This would be used to store machinery, construction materials, offices, welfare facilities and provide car parking for the duration of the construction activities.

It has been assumed that foul sewage from the welfare facilities would be tankered off site on a regular basis, rather than welfare facilities connecting directly into the sewage network.

The exact location of the compound is unknown at this stage, but it would fit in with the proposed phasing for construction of the proposed quay.

3.3 Demolition

The site of the proposed scheme is currently occupied by a dilapidated wharf approximately 750m in length, two jetties immediately downstream, a further jetty at the extreme downstream end of the proposed scheme footprint with associated conveyor and various buildings and structures on the riverbank and the adjacent hinterland (including a live substation).

STDC has submitted prior approval applications to RCBC for the demolition of the majority of existing infrastructure within the landward part of the proposed scheme footprint. Such prior approval applications comprise the demolition of:

- Five quayside heavy oil tanks and associated structures and pipework (R/2020/0281/PND). RCBC confirmed on 7 July 2020 that prior approval for such demolition is not required (meaning demolition can proceed without planning permission).
- Buildings on land east of Smiths Dock Road at South Bank (R/2020/0302/PND). RCBC confirmed on 10 July 2020 that prior approval for such demolition is not required.
- Pumping station (excluding the pipework which previously abstracted water from the Tees estuary). RCBC confirmed in October 2020 that prior approval for such demolition is not required.

Although the demolition of the above infrastructure is proposed as enabling works to be undertaken in advance of the main scheme, the removal of the heavy duty oil tanks and buildings on land east of Smiths Dock Road was included as part of the scheme description for the landside EIA on the basis that permissions for demolition had not been granted at the point the landside EIA was submitted. As noted above, RCBC has confirmed that demolition of such infrastructure can commence without planning permission, and works to demolish such infrastructure has started. As a result, there is no requirement for the demolition of that infrastructure to be included within the scheme description which is the subject of this report. In addition to the above, a building is present at the extreme downstream end of the proposed scheme footprint. The demolition of this building has been incorporated into the landside EIA and associated planning application and is therefore not included as part of the proposed scheme which is the subject of this report.

Demolition works to be undertaken as part of the proposed scheme which is the subject of this report are therefore limited to the dilapidated wharf, three jetties downstream of the wharf (with the associated conveyor at the downstream end), a live electrical substation on the hinterland, pipework which previously abstracted water from the Tees estuary associated with the pumping station. In addition, it has been assumed that underground utilities and pipework infrastructure would need to be grubbed out / excavated / diverted / capped as part of the demolition process prior to construction of the quay. It has also been assumed that any material stockpiled or stored on the site would need to be removed in advance of works commencing. The assumed approach to demolition of these assets is detailed below.

It should be noted that consultation with the Harbour Master in July 2020 has confirmed that no vessels have utilised any of the jetties within the proposed scheme footprint for a number of years.

The concrete deck of the existing jetties and locally on the wharf is likely to be either broken up using a long reach excavator with hydraulic demolition attachments, working from the shore (and supported by a jack-up barge, slave barge and safety/workboat). Alternatively, the demolition may include cutting sections of the deck and lifting them onto the land for disposal. Best practice working methods would be adopted to ensure that transport of debris into the Tees is minimised. Should any debris fall into the river channel during demolition, this would be removed as early as practicable. It has been assumed that concrete would be crushed on site and re-used as fill as part of the proposed scheme (or by STDC within the wider development areas being brought forward under the STDC Regeneration Masterplan).

The timber parts of the deck of the existing wharf would be removed using a long reach excavator working from the shore, and supported by a jack up barge, slave barge and safety boat. As with the concrete deck, best practice demolition techniques would be adopted to ensure transport of debris into the Tees is minimised, with any debris that does fall into the river being removed as early as practicable. It is proposed that the timber is transported offsite for disposal at an appropriately licensed facility, on the assumption that it would not be suitable for re-use as part of the proposed scheme.

The piles supporting the concrete jetties and the wharf, as well as the pipework feeding the pumping station would all be removed to avoid issues arising during the subsequent capital dredge. It is proposed that the piles would be extracted using vibration techniques. It is anticipated that such works would be undertaking using a jack-up barge with crawler crane, a slave barge and a safety/workboat. This marine plant would be supported through the use of divers.

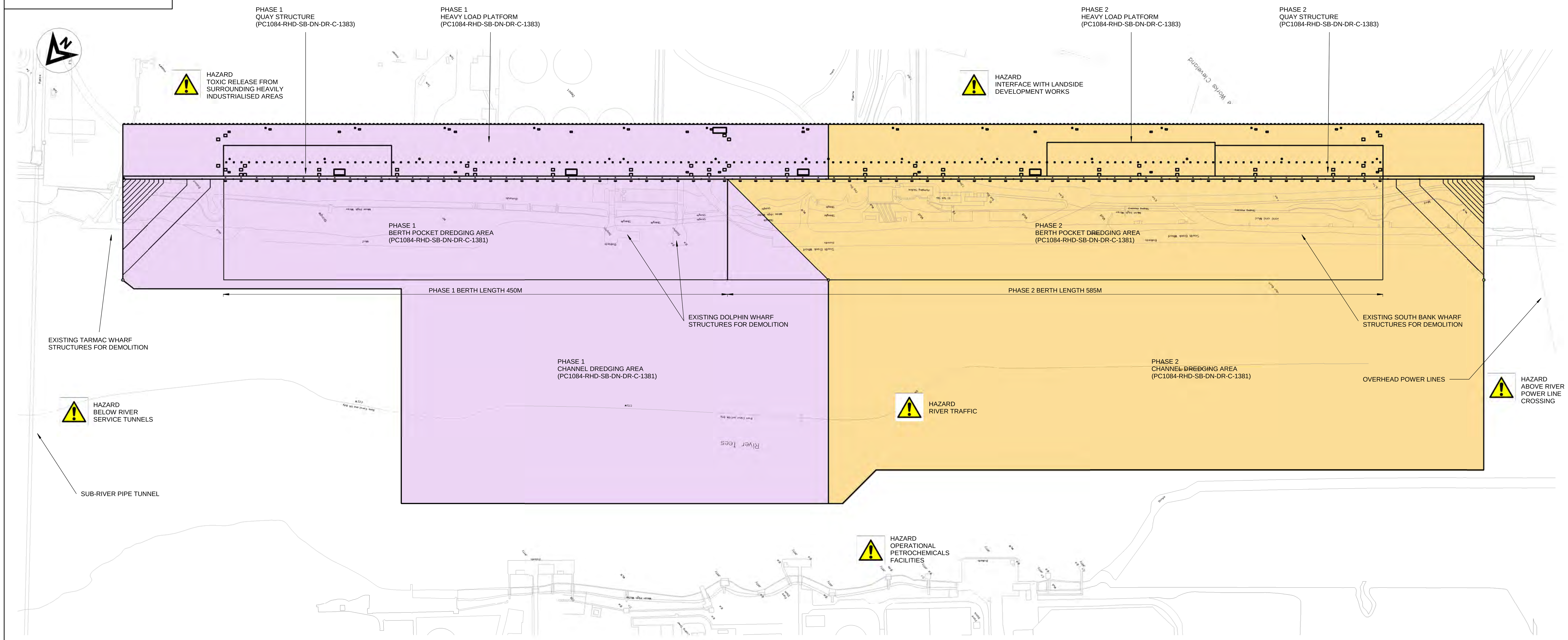
The demolition of the substation will be undertaken using land-based plant. The building materials are proposed to be crushed and re-used on site as fill. Services feeding into and out of the substation will be diverted in advance of demolition commencing so that works could be undertaken safely.

3.4 Quay construction

3.4.1 Quay envelope

The proposed scheme requires the construction of a new solid piled quay structure with approximate dimensions of 30m wide and 1,230m in length (providing approximately 1,050m of usable quay for berthing) (see **Drawing PC1084-RHD-SB-DN-DR-C-1380**, **Drawing PC1084-RHD-SB-DN-DR-C-1383** and **PC1084-RHD-SB-DN-DR-C-1384**). Although the useable surface of the quay itself would be up to 30m wide, the overall footprint of the works required to construct the quay would be up to 50m wide due to the proposals to construct an anchor structure further inland of the quay deck.

PC1084-RHD-SB-DN-DR-C-1380



GENERAL ARRANGEMENT

1 : 2000

SITE PLAN TRUE NORTH

1 : 12000

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ALL LEVELS ARE IN METRES RELATIVE TO CHART DATUM (mCD) UNLESS NOTED OTHERWISE

KEY:

- PHASE 1 DEVELOPMENT AREA
- PHASE 2 DEVELOPMENT AREA

REV	DATE	DESCRIPTION	DRW	CHK	APR
P01	24.08.20	FOR REVIEW AND COMMENT	CH	CF	TJR

REVISIONS

CLIENT

South Tees Development Corporation

PROJECT

TEES STUDY

TITLE

CONCEPT DESIGN
GENERAL ARRANGEMENT

Burns House, Harlands Road
Haywards Heath RH16 1PG
Tel: +44 (0)1444 458551
Email: info@rhdhv.com
Website: www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

DRAWN	CHECKED	APPROVED
CH	CF	TJR

DATE	SCALE AT A1	REF.
24/08/20	As indicated	

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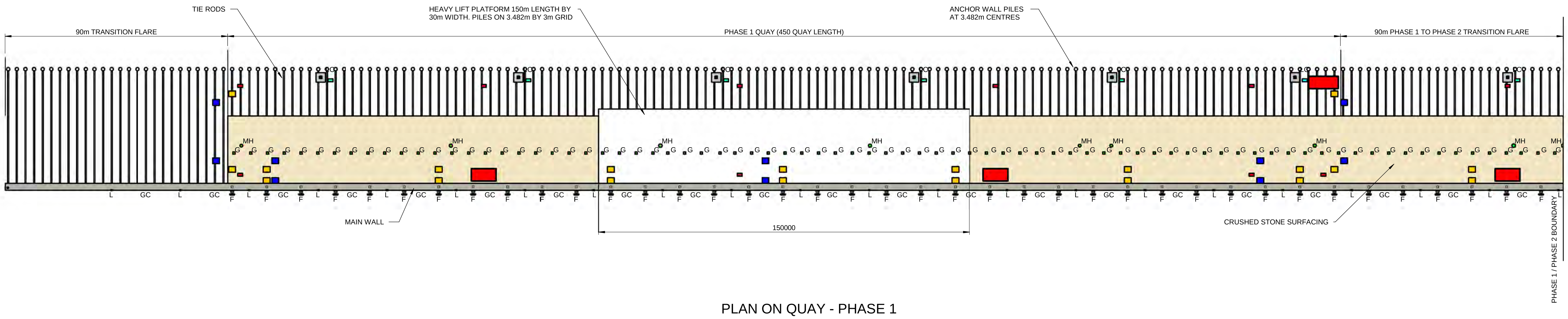
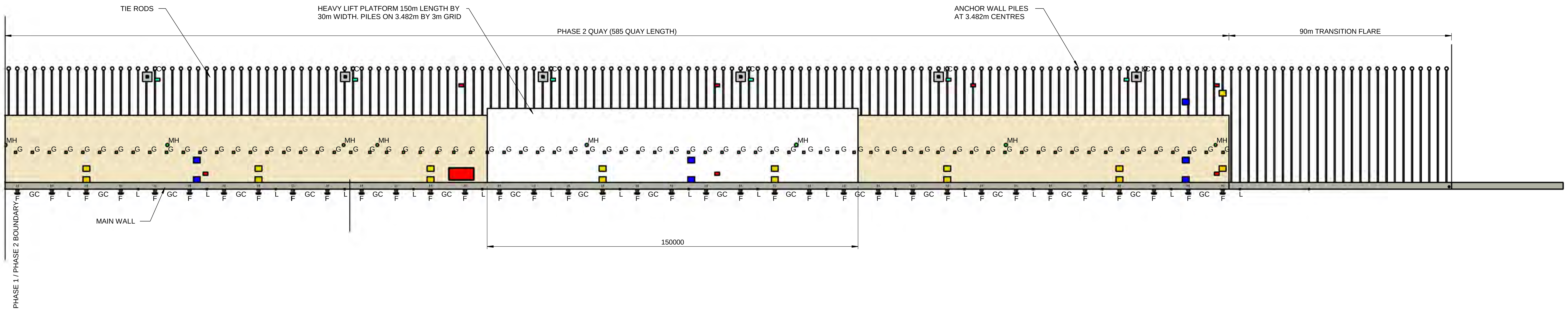
PC1084-RHD-SB-DN-DR-C-1383



PLAN ON QUAY - PHASE 1

1 : 1000



PLAN ON QUAY - PHASE 2

1 : 1000

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ALL LEVELS ARE IN METRES RELATIVE TO CHART DATUM (mCD) UNLESS NOTED OTHERWISE

KEY:

G	GULLY
LC	LIGHTING COLOUMN
F	FENDER
GC	GRAB CHAIN
L	LADDER
MH	MANHOLE
	BOLLARD
	POTABLE WATER SYSTEM (REFER TO DRAWING PC1084-RHD-SB-DN-DR-C-1387
	FIRE WATER SYSTEM (REFER TO DRAWING PC1084-RHD-SB-DN-DR-C-1387)
	LV ELECTRICAL SYSTEM (REFER TO DRAWING PC1084-RHD-SB-DN-DR-C-1386)
	HV ELECTRICAL SYSTEM (REFER TO DRAWING PC1084-RHD-SB-DN-DR-C-1386)
	DRAINAGE SYSTEM (REFER TO DRAWING PC1084-RHD-SB-DN-DR-C-1385)
	SURFACING

REV	DATE	DESCRIPTION	DRW	CHK	APR
P01	24.08.20	FOR REVIEW AND COMMENT	CH	CF	TJR

REVISIONS

CLIENT

South Tees Development Corporation

PROJECT

TEES STUDY

TITLE

CONCEPT DESIGN
QUAY PLAN

Burns House, Harlands Road
Haywards Heath RH16 1PG
Tel: +44 (0)1444 458551
Email: info@rhdhv.com
Website: www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together

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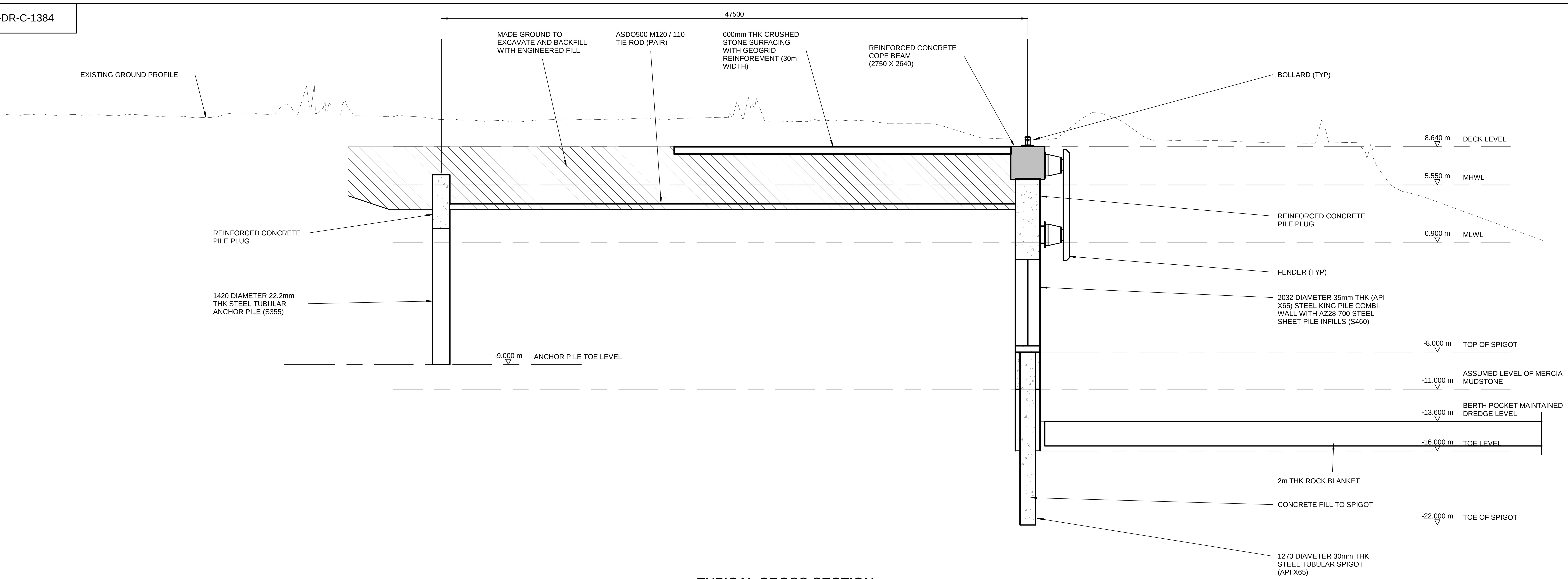
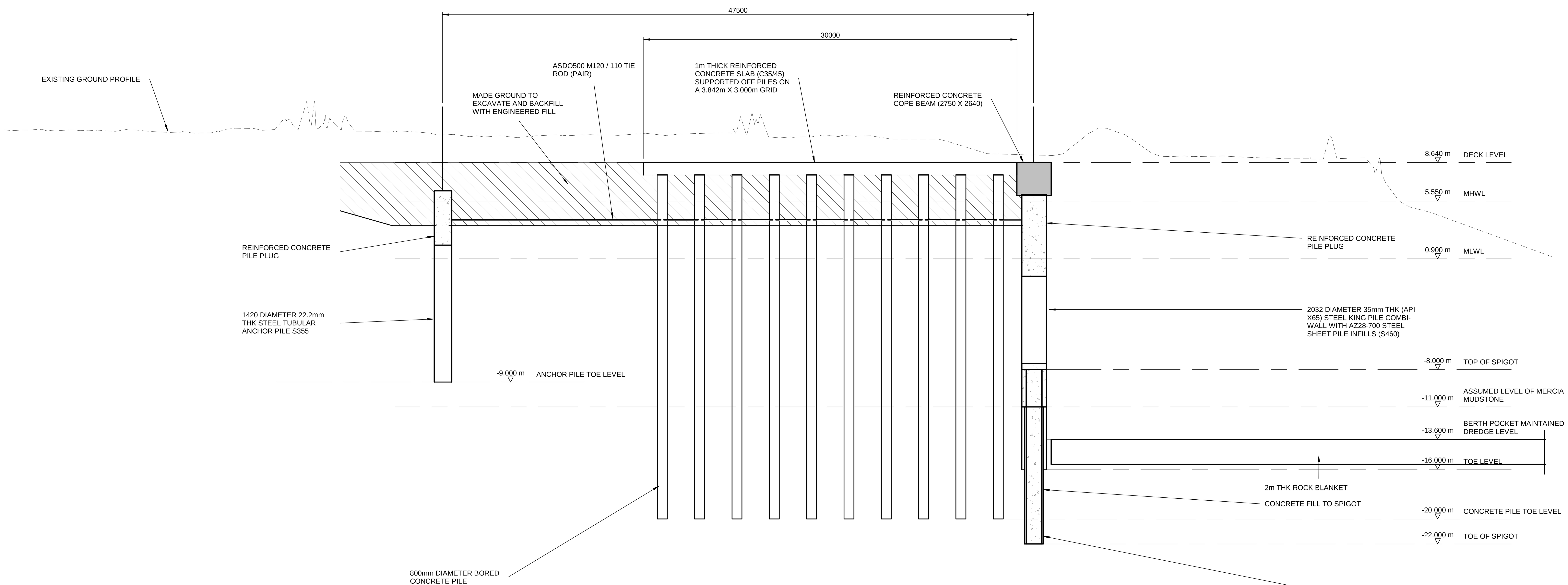
DATE 24/08/20	SCALE AT A1 As indicated	REF.

DRAWING No.	SUITABILITY	REVISION
PC1084-RHD-SB-DN-DR-C-1383	S3	P01

PC1084-RHD-SB-DN-DR-C-1384



TYPICAL CROSS SECTION
1 : 200



TYPICAL CROSS SECTION THROUGH HEAVY LIFT QUAY
1 : 200

NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE
2. ALL LEVELS ARE IN METRES RELATIVE TO CHART DATUM (mCD) UNLESS NOTED OTHERWISE

REV	DATE	DESCRIPTION	DRW	CHK	APR
P01	24.08.20	FOR REVIEW AND COMMENT	CH	CF	TJR

REVISIONS

CLIENT
South Tees Development Corporation

PROJECT
TEES STUDY

TITLE
CONCEPT DESIGN QUAY SECTIONS

Royal HaskoningDHV
Enhancing Society Together
Burns House, Harlands Road
Haywards Heath RH16 1PG
Tel: +44 (0)1444 458551
Email: info@rhdhv.com
Website: www.royalhaskoningdhv.com

DRAWN	CHECKED	APPROVED
CH	CF	TJR
DATE 24/08/20	SCALE AT A1 1 : 200	REF.

DRAWING No.	SUITABILITY	REVISION
PC1084-RHD-SB-DN-DR-C-1384	S3	P01

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The exact alignment of the quay is to be confirmed and, therefore, for the purposes of assessment, a maximum quay envelope of 1,300m x 75m has been assessed (see **Figure 1.1**). STDC does not intend to construct the quay up to the maximum width of this envelope; however, the envelope approach provides flexibility to STDC with regard to its final alignment.

As noted in **Section 1**, it is envisaged that the proposed quay would be utilised predominantly by the renewable energy industry, as well as supporting more general industrial and storage/distribution activities. The use of the proposed quay by vessels that would support the offshore wind industry is considered to be a worst-case scenario from a vessel size and navigation risk perspective. This navigation risk issue has resulted in the proposed quay being set back into the riverbank.

3.4.2 Form of construction

The assessed form of construction for the quay wall is a combi-wall comprising steel tubular king piles with steel sheet pile infills, as shown on **Drawing PC1084-RHD-SB-DN-DR-C-1384**. As noted above, an anchor structure (typically a steel sheet pile wall/combi-wall or discrete anchor structures such as tubular steel piles) would be constructed approximately 50m inland of the combi-wall to provide lateral restraint to the combi-wall. Tie rods would be used to connect the combi-wall to the anchor structure. It has been assumed that the ground level for the quay would be formed with stone surfacing, with the exception of two heavy lift areas which would have a concrete surface. Approximately 25,000m^3 of crushed stone is proposed to be imported to create the surfacing on the quay.

The quay would be constructed at a level of approximately 8.64m chart datum (CD). King piles for the combi-wall would be up to 2,500mm in diameter and it is assumed that these would be installed using percussive techniques through the softer material to a depth of approximately -16mCD, and then drilled into the underlying Mercia mudstone. Up to 400 piles are envisaged for the combi-piled wall. The form of construction for the anchor structure is yet to be confirmed, however it would either comprise steel sheet piles or tubular piles; if a steel sheet piled wall is progressed, up to 1,250m of sheet piles would be required. Alternatively, up to 400 tubular piles of up 1,500mm in diameter would be used.

The quay is proposed to contain two heavy lift areas along its length which would comprise concrete ground slabs supported on approximately 500 vertical bored cast in-situ piles to support each of the heavy lift areas (i.e. up to 1000 piles for the heavy lift areas). Each heavy lift area would be approximately 150m x 30m in size.

A relieving platform is also proposed behind the combi-wall; the purpose of the platform is to take the vertical load from an applied surcharge and carry this on a piled platform. Should a retaining platform be utilised, the diameter of the anchor wall piles would reduce, and the thickness of the combi-wall and the anchor wall would reduce. Given the uncertainty in the design at this stage, the worst-case scenario is that a relieving platform is adopted as part of the design. The relieving platform would require in the order of 1,200 bored concrete piles approximately 800mm in diameter. The assessed pile requirements are summarised in **Table 3.1**.

All piles would be installed through soils on land; no piling is proposed in the river channel. It has been assumed that all piling works will be undertaken using land-based plant, with a safety / workboat proposed to support any activities following the removal of material in front of the quay. The number of piling rigs to be used on site would be driven by the construction programme; however, for the purposes of assessment, it is envisaged that up to four piling rigs would be working at the same time.

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Table 3.1 Assessed piling requirements

Feature	Type of pile	Maximum pile diameter	Maximum number of piles
Combi-wall	King piles – installed using percussive techniques then drilled into the Mercia Mudstone	2,500mm	400
Anchor wall	Tubular steel piles / sheet piles	1,500mm	400
Heavy load platform	Bored concrete piles	800mm	1,000
Relieving platform	Bored concrete piles	800mm	1,200
Total number of piles			**3,000**

Fixed infrastructure to be installed on the quay would be limited to mooring bollards, Demand Side Units (DSUs), lighting towers and a new electrical substation. Lighting towers are proposed to be up to 30m in height. There would be water supply (both potable and fire water) at the quay, as well as the provision for ship to shore power connection (cold ironing).

3.4.3 Site access and transportation of materials to site

Given the proposals to utilise land-based plant for the proposed quay construction, it is envisaged that access to site for construction plant and personnel will be via Smiths Dock Road and / or Tees Dock Road.

All construction materials are predicted to be transported to site by road, with the exception of the following which are anticipated to arrive on site by vessel:

- steel required for piling – delivered using up to six vessels in Phase 1 and six vessels in Phase 2 (12 vessels in total);
- rock required for the rock blanket in the berth pocket – delivered using up to six vessels in Phase 1 and seven vessels in Phase 2 (13 vessels in total); and,
- tie rods – delivered using up to one vessel per phase of development (two vessels in total).

It is anticipated that the vessels transporting the steel and tie rods would arrive to site by sea, with vessels likely to berth in Tees Dock or at a suitable berth along the river channel. The piles and tie rods would then be offloaded onto HGVs and transported to site using the existing road network. Rock for the rock blanket is anticipated to be placed directly into position on the riverbed.

3.4.4 Excavation of soils

There would be a requirement for the excavation of approximately 275,000m^3 of existing soils behind the proposed combi-wall in order to install the tie rods. Such material would be removed using long reach excavators. It has been assumed that the excavated material could be re-used on site, avoiding the requirement for offsite disposal. If the material is not suitable for re-use on site, up to 215,000m^3 of fill material would need to be imported onto site, with the excavated material being removed from site to an appropriately licensed facility.

3.5 Environmental enhancement measures

As the berth length at the proposed quay (1,050m) is less than the proposed quay length (up to 1,330), there is space at the upstream and downstream ends of the quay to undertake environmental enhancement works. There is also the potential to incorporate environmental enhancement works into the berthing, as long as such works do not interfere with the availability to berth at the quay.

A review of the Tees Estuary Edges Enhancement Study (IECS, 2018) and the Greening the Grey framework (Naylor *et al*, 2017) has been undertaken to better understand the opportunities for environmental enhancement. It is considered that there is potential for incorporation of 'verti-pools' into the quay face; these pools are pocket rock pools that are designed to be applied to vertical sea defences to create water retentive habitat features. It is proposed that a number of verti-pools are positioned along the length of the quay face at different heights within the tidal frame to provide a range of different habitat opportunities.

3.6 Capital dredging of marine sediments and excavation of soils / landside materials within the riverbank

Drawing PC1084-RHD-SB-EN-DR-EV-1113 below shows the proposed dredge footprint. For the purposes of this EIA, a dredge envelope has been assessed (**Figure 1.1**). As shown on the drawing, dredging is anticipated to be required within part of the Tees Dock turning circle (currently maintained at a depth of 8.8m below Chart Datum (bCD)), within parts of the existing navigation channel (in areas currently maintained at depths of 8.5m bCD, 7.2m bCD and 5.7m bCD) and within areas not currently subject to maintenance dredging to create a berth pocket. The Tees Dock turning circle and areas of navigation channel are proposed to be deepened to 11m bCD (maintained at 10.4m bCD). The berth pocket is proposed to be dredged to a depth of 15.6m bCD (maintained at a depth of 13.0m bCD). The berth pocket is proposed to be dredged to 15.6m bCD initially in order to allow for the installation of a 2m thick rock blanket (discussed in Section 3.6 below).

As shown on **Drawing PC1084-RHD-SB-EN-DR-EV-1113**, the proposed berth pocket would straddle an area that is currently partly land and estuarine. There would, therefore, be a requirement for dredging of estuarine (marine) sediments and excavation of soils / landside materials within the riverbank to create the berth pocket. The proposed scheme (and consequently the dredging requirements) has been designed to avoid the pipe tunnels which cross underneath the Tees estuary downstream of the proposed quay, as well as the overhead power lines and pylons upstream of the proposed quay.

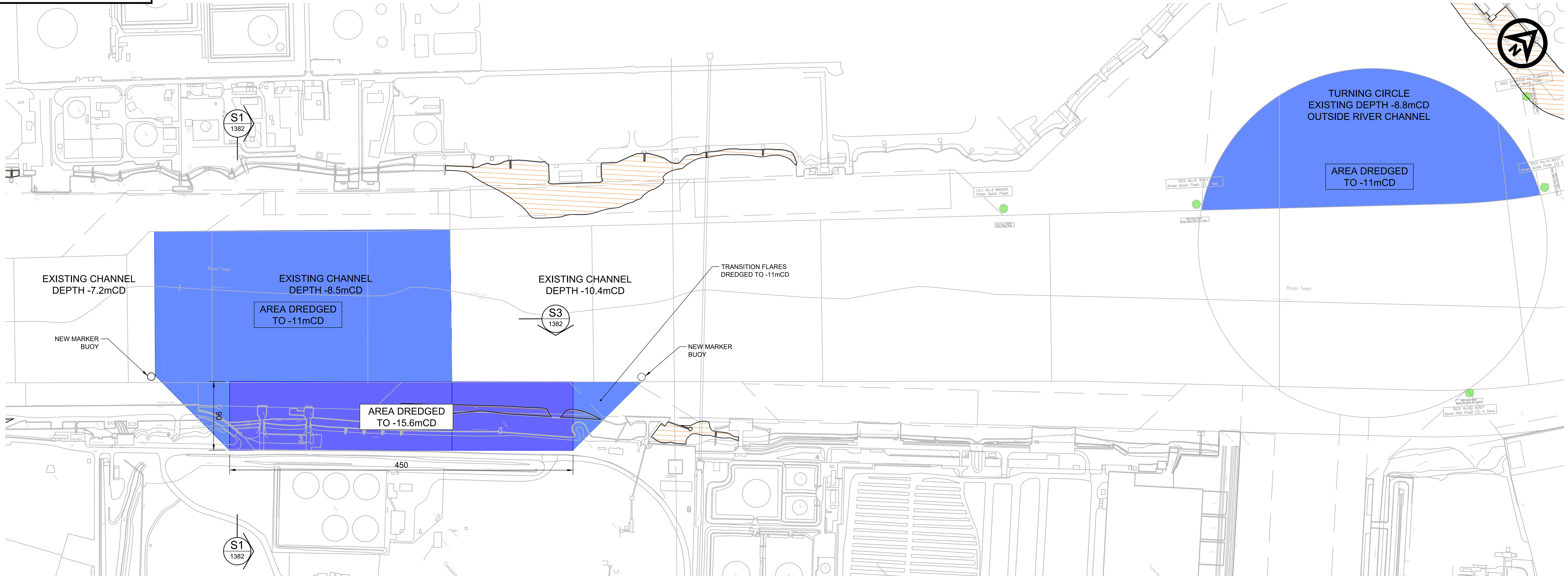
A summary of the proposed design levels and dredge volumes for marine sediments is detailed in **Section 3.4.1 and 3.4.2**, with further information regarding the excavation of soils / materials in the riverbank provided in **Section 3.4.3**.

3.6.1 Volume of marine sediments to be dredged

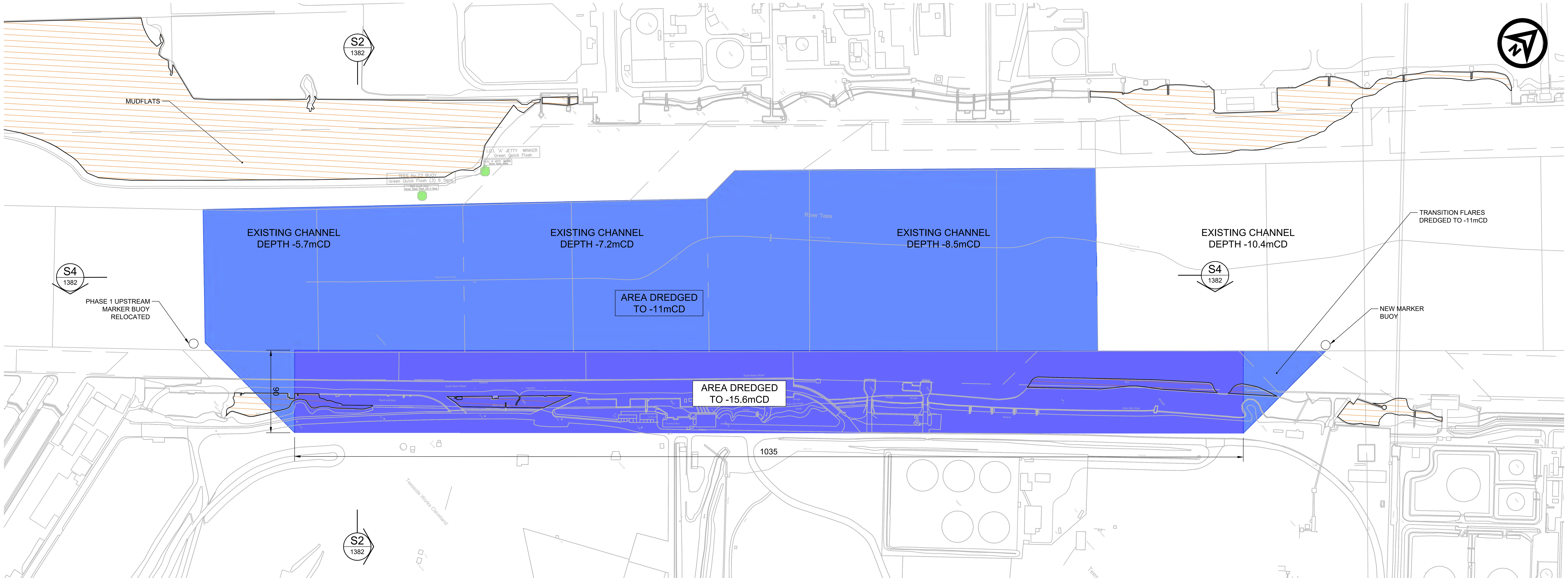
The total dredge volume for marine sediments is predicted to be approximately 1,800,000m^3. As detailed in **Table 3.2**, the dredge is proposed to be undertaken in two phases to match the anticipated phased construction of the quay however the assessment undertaken within this EIA assumes that the dredging is carried out in one campaign as a worst-case scenario. A relatively large proportion of the total volume of dredged material is anticipated to comprise geological material (i.e. mudstone) (approximately 340,000m^3), below an assumed level of 11m bCD (based on recent investigation works). The remaining 1,460,000m^3 of marine sediment is anticipated to comprise Tidal Flat Deposits and Glacial Till. It is proposed that all areas would be dredged to 11m bCD with the exception of the berth pocket which will be dredged to 15.6m bCD.

DRAWING No.
PC1084-RHD-SB-EN-DR-EV-1113

DO NOT SCALE



PHASE 1 PLAN
SCALE 1:3000



PHASE 1 & 2 PLAN
SCALE 1:2500

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES RELATIVE TO ORDNANCE DATUM NEWLYN (mOD). FOR RELATIONSHIP BETWEEN ORDNANCE DATUM AND CHART DATUM REFER TO DIAGRAM BELOW.

+0.00mOD
2.85m
+0.00mCD

3. REPORTED AREAS OF MUDFLAT EXTRACTED FROM NATURAL ENGLAND'S PRIORITY HABITAT INVENTORY DATA SET.

KEY:

- DREDGE TO -11.0mCD
- DREDGE TO -15.6mCD
- MUDFLATS

REV	DATE	DESCRIPTION	BY	CHK	APP
P01	28.10.20	FOR REVIEW AND COMMENT	CC	CF	TJR

REVISIONS

CLIENT

South Tees Development Corporation

PROJECT

TEES STUDY

TITLE

DREDGING PLAN

Royal HaskoningDHV
Enhancing Society Together

Marlborough House, Marlborough Crescent
Newcastle upon Tyne, NE1 4EE
Tel +44 (0)191 211 1300
Email info@newcastle.royalhaskoning.com
Website www.royalhaskoning.com

DRAWN	CHECKED	APPROVED
CC	CF	TJR

DATE	SCALE	REF.
28.10.20	AS SHOWN	

DRAWING No.	SUITABILITY	REVISION
PC1084-RHD-SB-EN-DR-EV-1113	S3	P01

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Table 3.2 Proposed volumes of marine sediments to be dredged (excluding over-dredge volumes)

Material classification	Phase 1 dredge volume (m^3)	Phase 2 dredge volume (m^3)	Total dredge volume (m^3)
Soft material	670,000	790,000	1,460,000
Hard material (mudstone)	150,000	190,000	340,000
Total	**820,000**	**980,000**	**1,800,000**

It is anticipated that dredging will be undertaken using a combination of a Trailing Suction Hopper Dredger (TSHD) and a backhoe dredger. It is envisaged that up to three barges will be required to support with the transport of sediment dredged using the backhoe dredger to the offshore disposal site. It is assumed that a TSHD would be used to dredge soft material and it has been assumed for the purposes of assessment that the overflow within the hopper will be used.

It is expected that the backhoe dredger would be used for both the near surface soft material and the hard material (mudstone). For the purposes of the assessment, it has been assumed that the dredge process would be undertaken in the following stages:

- Removal of soft material above -5m bCD using a backhoe dredger (approximately four weeks).
- Removal of soft material below -5m bCD using a backhoe dredger and a TSHD (approximately four weeks).
- Removal of soft material in the turning circle using a backhoe dredger and a TSHD (approximately one week).
- Removal of hard material using a backhoe dredger (approximately 10 weeks).

3.6.2 Volume of soils / landside materials to be excavated

In addition to the removal of marine sediments, the proposed scheme will require the excavation of soils/landside materials within the riverbank in order to create the berth pocket (as the berth line has been set approximately 90m inland from the edge of the channel). It is anticipated that such material would be excavated using standard long reach excavators working from the land.

This material to be excavated is additional to that which is to be excavated behind the proposed combi-wall in order to install the tie rods to the anchor wall. The total volume of soils / landside materials to be excavated to create the berth pocket is predicted to be 1,140,000m^3 (440,000m^3 during Phase 1 and 700,000m^3 during Phase 2). It has been assumed that such material would be re-used either on site or within the wider STDC development footprint.

3.7 Installation of rock blanket

It has been conservatively assumed that there is a requirement to install a rock blanket within the footprint of the proposed berth pocket (shown in **Drawing PC1084-RHD-SB-DN-DR-C-1380**). This is required to avoid the risk of a jack-up barge 'punching' into the underlying sediments when berthed at the quay during the operation phase. Such an effect could result in instability of the berthed vessel as well as potentially destabilising the quay wall. The implication is that the berth pocket would need to dredged to a greater depth initially (15.6m bCD) to allow placement of the 2m thick rock blanket. The berth pocket would then be maintained at a depth of 13.0m bCD. It has been assumed that a split hopper barge would be used to supply and deposit rock within the berth pocket. Approximately 200,000m^3 of rock is proposed to form the rock blanket, with a weight of 400,000 tonnes.

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3.8 Disposal of dredged material

There are two active disposal sites that potentially could accept dredged material from the Tees estuary: Tees Bay A (TY 160) and Tees Bay C (TY 150). Tees Bay C has predominantly been used in the past for capital dredged material but has received quantities of maintenance material in some years. Tees Bay A (the site closest to the shore) has been used in the past for soft non-cohesive maintenance material (ABPmer, 2005, cited in Royal Haskoning, 2006). DEFRA records from Tees Bay C show periodic small-scale usage with a peak volume deposited in 1999 totalling 1.9 million wet tonnes. However, the typical yearly volume is 0.1 million wet tonnes, with some years showing no usage at all.

For the purposes of assessment and the marine licence application, it has been assumed that all dredged sediments from the river channel would be deposited offshore within the Tees Bay C disposal site. As noted above, soils / landside materials excavated from the riverbank are proposed to be re-used on site, on the assumption that they are suitable for re-use. Should this not be the case following analysis of the results of ground investigations, soils would be disposed of to an appropriately licensed facility.

3.9 Programme of construction works

STDC is intending to commence construction of the facility during 2021 to enable operation of the facility by 2023 (an approximately three-year construction phase). It is proposed that the quay is constructed in phases, with an initial berth length of approximately 450m proposed in Phase 1, housing one heavy lift area.

The Phase 1 quay wall would extend 90m either side of the berth pocket to retain the dredged slopes back up to the existing bed level, resulting in a Phase 1 quay length of up to 630m (usable berth length of 450m). The quay would be extended (equating to a total useable berth length of 1,050m) as required in Phase 2, based on market demands. Phase 2 may be constructed many years following completion of Phase 1, and may not be constructed at all if market conditions do not require it. In addition, the length of quay to be constructed during each phase may also be subject to change depending on financial availability and the market requirements at the time of construction.

In order to provide the greatest flexibility with regard to phasing of the proposed scheme, the EIA has assessed the worst-case scenario of building the quay and dredging the channel in one phase. However, the assessment recognises that the reported effects or impacts would only be partially realised should the development be constructed in phases. In reality, there would be construction phase effects or impacts arising during Phase 1, followed by repeated effects / impacts of a similar magnitude (or likely less magnitude in most instances) during Phase 2.

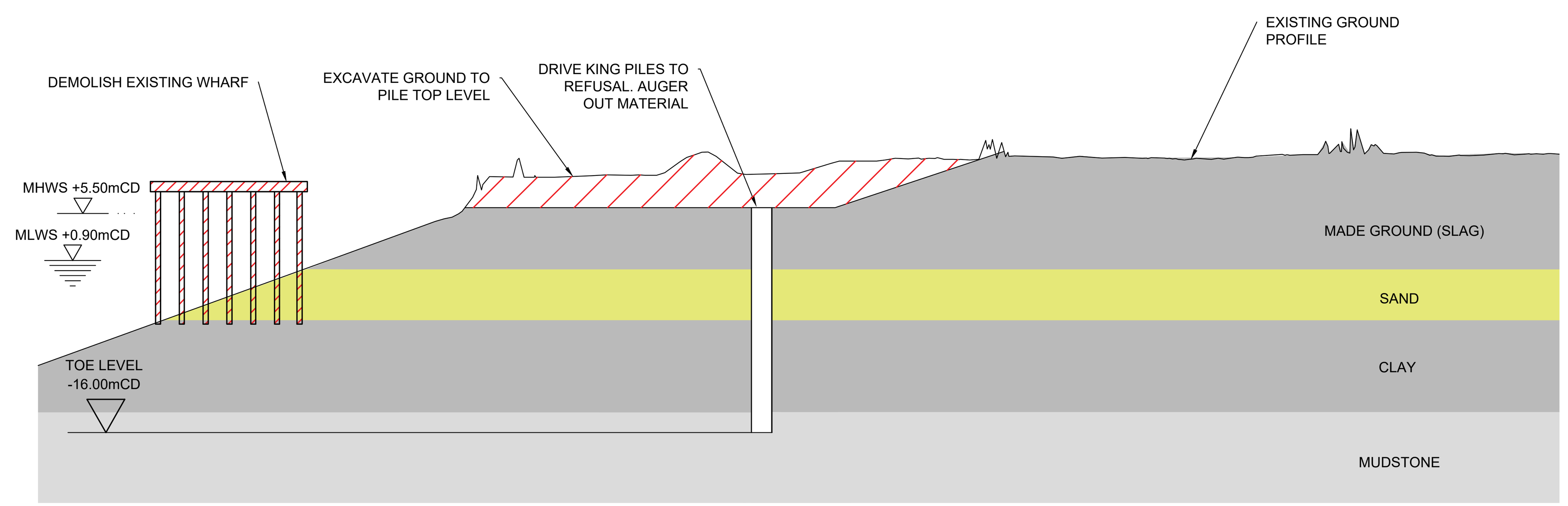
It is envisaged that construction works would be undertaken 24 hours a day, seven days per week. The anticipated durations of each of the main tasks required during the construction phase are detailed in **Table 3.3** below.

It is anticipated that the proposed works would be undertaken in the sequence set out above; i.e. demolition would take place first, following by construction of the quay and then excavation in front of the quay wall and capital dredging (see **Drawing PC1084-RHD-SB-DN-DR-C-1388**). The rock blanket would be installed following completion of the dredge.

It should be noted that piling would not be continuous through the full construction phase for the quay. There would be periods of downtime associated with transport of the piling rig(s) to the next location to undertake works. Piling across the two phases of work is predicted to take approximately 15 months in total (seven months for Phase 1 and eight months for Phase 2).

DRAWING No.
PC1084-RHD-SB-DN-DR-C-1388

DO NOT SCALE



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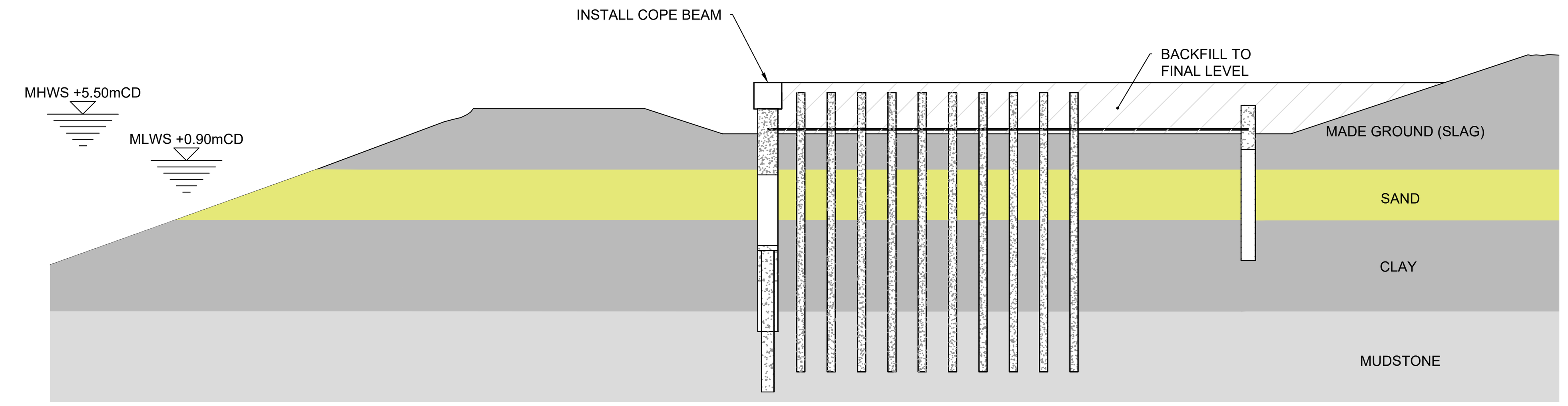

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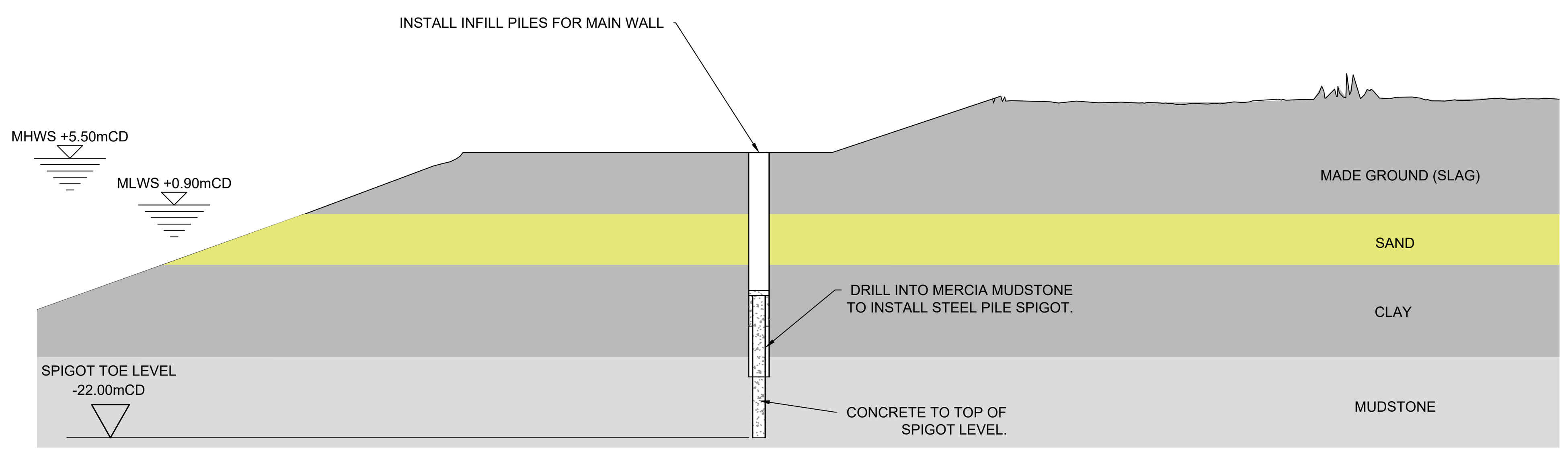

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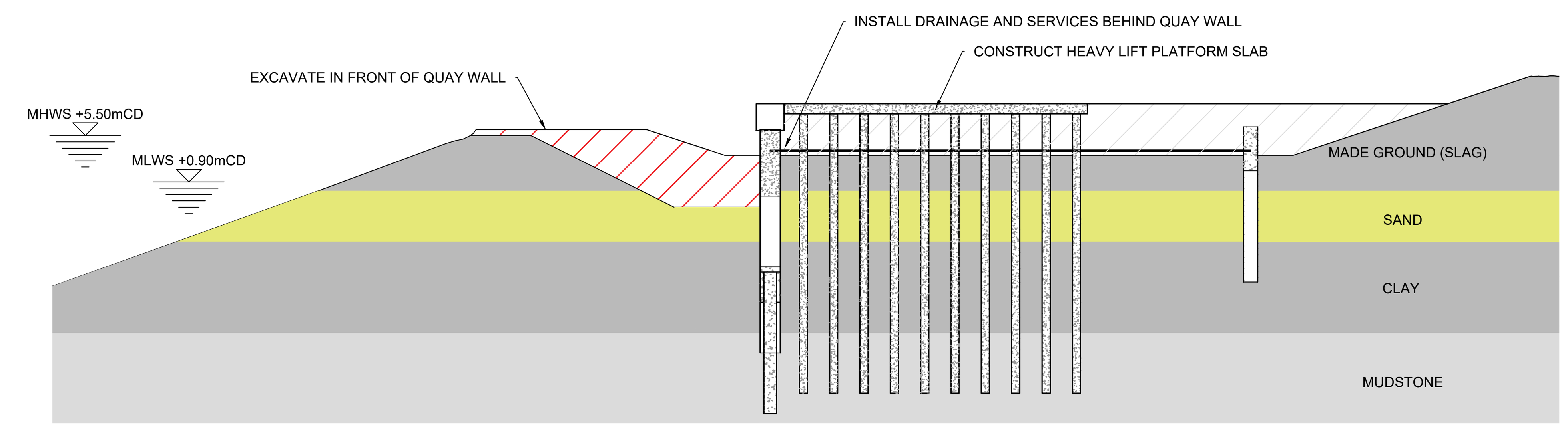

STAGE 6
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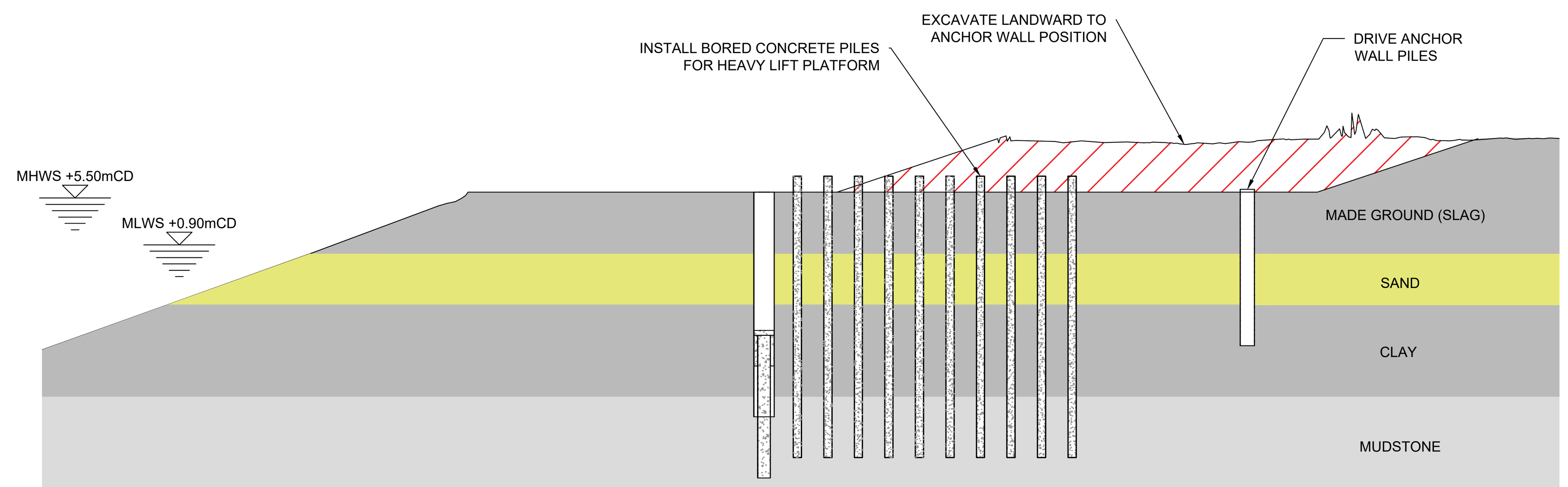

STAGE 3
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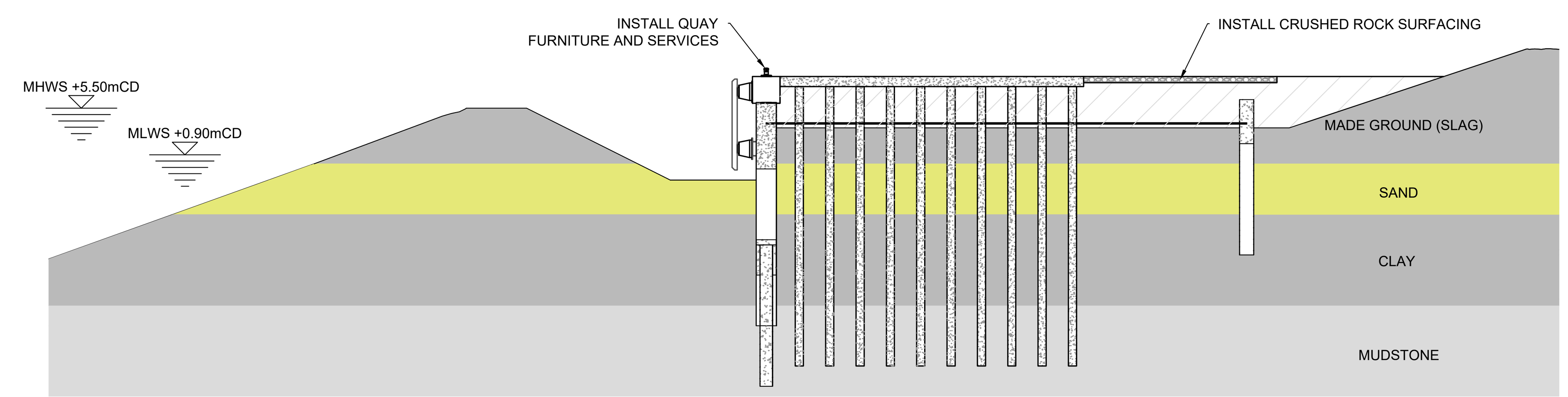

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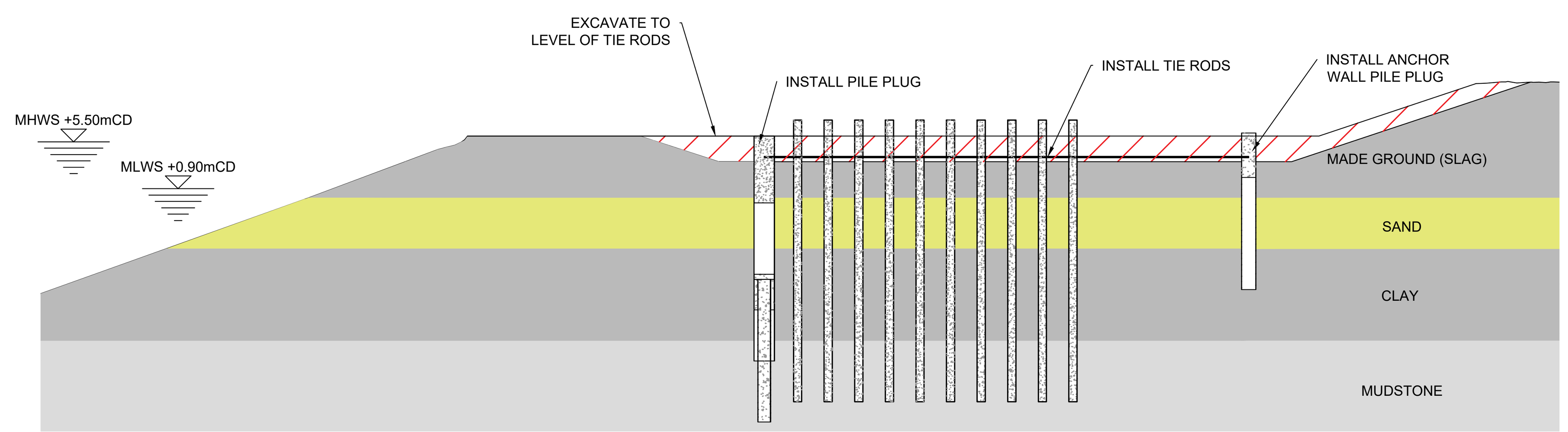
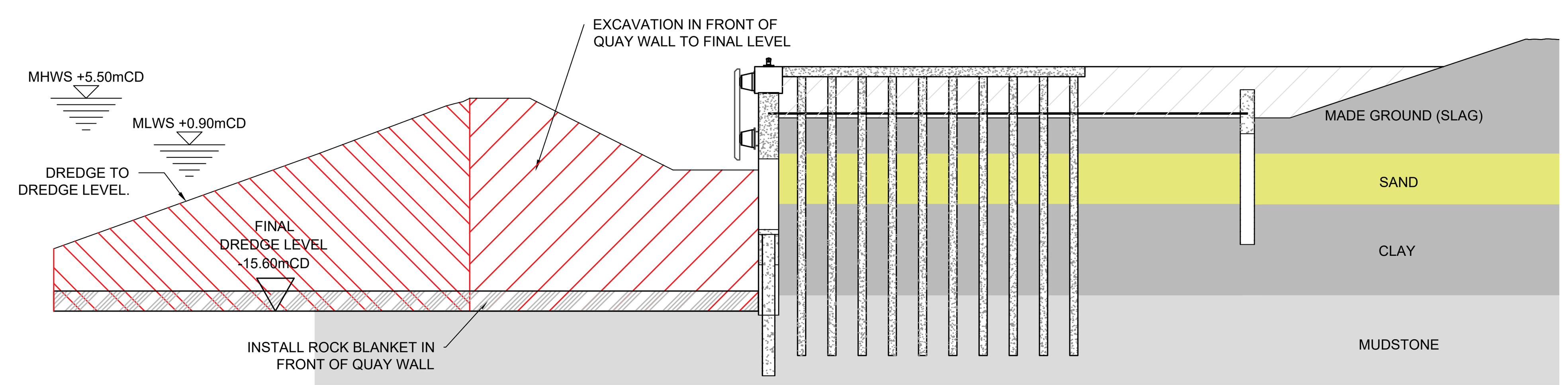


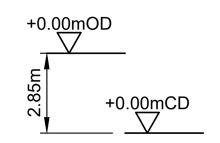
STAGE 4
SCALE 1:500



STAGE 8
SCALE 1:500

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES RELATIVE TO CHART DATUM (mCD). FOR RELATIONSHIP BETWEEN CHART DATUM AND ORDNANCE DATUM REFER TO DIAGRAM BELOW.



REV	DATE	DESCRIPTION	BY	CHK	APP
P01	19.08.20	FOR REVIEW AND COMMENT	BM	CF	TJR

REVISIONS

CLIENT

South Tees Development Corporation

PROJECT

TEES STUDY

TITLE

CONCEPT DESIGN CONSTRUCTION SEQUENCE

Royal HaskoningDHV
Enhancing Society Together

Marlborough House, Marlborough Crescent
Newcastle upon Tyne, NE1 4EE
Tel +44 (0)191 211 1300
Email info@newcastle.royalhaskoning.com
Website www.royalhaskoning.com

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Table 3.3 Indicative durations of proposed main activities

Activity	Phase 1 duration	Phase 2 duration	Phase 1 and 2 combined	Comment
Demolition	-	-	12 months	
Quay construction	14 months	14 months	28 months	-
Excavation of soils in front of the quay wall	4 months	5 months	9 months	-
Capital dredging	2 months	3 months	5 months	This assumes all dredging plant are working at full capacity without any restrictions.
Installation of rock blanket in berth pocket	2 months	2 months	4 months	-

Whilst capital dredging is taking place, there is potential for PDT to be undertaking maintenance dredging within other sections of the Tees estuary at the same time. The potential implications of this have been considered further within the CIA (**Section 27**).

3.10 Construction phase employment

Based on the indicative construction phase costs and the construction phase programme, it is anticipated that a peak of approximately 110 employees would be required to construct the proposed scheme.

3.11 Summary of plant to be used during demolition and construction

It is envisaged that the demolition and construction phases would be undertaken using the following plant:

- Demolition
  - Jack up barge with crawler crane (marine plant)
  - Slave barge (marine plant)
  - Safety / workboat (marine plant)
  - Long reach excavator (land-based plant)
  - Concrete crusher (land-based plant)
- Construction
  - Split hopper barge (marine plant)
  - Coaster vessel (marine plant)
  - Long reach excavator (land-based plant)
  - Piling rigs (land-based plant)
  - Mobile cranes (land-based plant)
  - Rollers (land-based plant)
  - Dump trucks (land-based plant)
  - JCBs (land-based plant)
  - Concrete crusher (land-based plant)
- Dredging plant
  - TSHD
  - Backhoe dredger
  - Barges to transport material from the backhoe dredger to the offshore disposal site.
  - Safety / workboats.

3.12 Embedded mitigation measures

Measures to manage the risk from accidental spillages of oils, fuels and chemicals
During the various construction activities, there is the potential for pollution from spills or leaks of fuel and oil. The risk of this arising can be minimised by following standard good practice with regard to pollution prevention guidance.

The appointed contractor would undertake the construction works in accordance with the Environment Agency's Pollution Prevention Guidelines (PPG) No. 5 on works in, near and liable to affect watercourses, and all vessels would adhere to the requirements of the MARPOL Convention Regulations, in particular the requirement that all ships over 400GT should carry an approved Shipboard Oil Pollution Emergency Plan (SOPEP). Whilst it is noted that the Environment Agency's PPG No.5 has been withdrawn, they still provide good reference material for protection of water courses when working in and around water. STDC would also ensure that the works are undertaken in accordance with Construction Industry Research and Information Association (CIRIA) Coastal and marine environmental site guide (2nd edition) (C744); and CIRIA Guidance note C741Environmental Good Practice on Site Guide (4th Edition).

In the unlikely event of a spill, appropriate spill kits will be available on board the barges and all crew will be trained to use them. In addition, all vessels and plant will ensure that suitable bunding and storage facilities are employed to prevent the release of fuel oils, lubricating fluids associated with the plant and equipment into the marine environment.

In addition to the above, best practice working methods would be adopted during demolition / excavation adjacent to the Tees estuary to ensure that transport of debris into the Tees is minimised as far as possible. Should any debris fall into the river channel during demolition, this would be removed as early as practicable. Any risks to water quality (and consequently marine ecological receptors) will therefore be reduced as far as possible. Such best practice measures would be detailed within a Construction Environmental Management Plan (CEMP) to be produced in advance of construction commencing.

Measures to manage the risk of spreading of introducing invasive species
As reported within **Section 9**, invasive non-native species (INNS) have been identified within the subtidal environment in the Tees estuary. There is a risk that these INNS may be spread to other locations as a result of capital and maintenance dredging, as well as INNS being introduced or spread from ship ballast water exchange and the fouling of ships' hulls. Best practice working methods will be adhered to during construction and operation to minimise the risk of introduction and spread of INNS. These measures are likely to include the production of a biosecurity plan or ballast water management plan. Either of these plans may include management measures such as filtering or treating of ballast water prior to being discharged into the water when not needed. These plans will be in line with any management measures relating to biosecurity or ballast water management that are already in place and enforced by PDT.

In addition to the above, Japanese rose and Japanese knotweed is known to be present within the landside parts of the proposed scheme footprint (see **Section 11**). Construction works risk spreading seeds, plant fragments or contaminated soil from these plants (and any other INNS which subsequently establishes within 10m of the footprint of the proposed scheme), which would constitute a legal offence under Schedule 9 of the Wildlife and Countryside Act 1981. In order to avoid the risk of spreading such invasive species, the following works are proposed:

- An Invasive Species Management Plan will be prepared, focusing on the species listed on Schedule 9 of the Wildlife and Countryside Act, 1981, as amended, which will include best practice measures to be implemented to minimise the risk of construction activities spreading non-native invasive species.

- Equipment, plant and personal protection equipment (PPE) brought to site would be clean and free of material and vegetation.
- A toolbox talk detailing the importance of these plant species will be delivered by a suitably qualified ecologist to all personnel working on site.
- Rigorous inspections are undertaken of all equipment delivered to site, following the Check Clean and Dry campaign.
- A pre-construction survey will be undertaken (between May and August) to ascertain up-to-date locations of any non-native invasive species within the footprint of the proposed scheme and a 250m buffer.
- Known Japanese rose and Japanese knotweed stands (and any other invasive non-native species subsequently recorded) in or within 10m of the proposed scheme footprint will be treated during the season before construction work commences where possible.
- The Invasive Species Management Plan will be included in the CEMP which will detail the policies and good working practices which will be followed to avoid spread of an INNS, including the measures which will be taken if the pre-construction treatment programme is unsuccessful, and any associated removal or disposal activities required.
- A fenced buffer of 10m will be placed around strands of invasive species that have not been treated and are subsequently found on site after construction has begun.

Implementation of the measures detailed in the outline remediation strategy

An outline remediation strategy has been produced (Wood, 2019) in order to manage the risks associated with land quality across the STDC development areas in Tees Valley. Although the outline remediation strategy does not cover the entirety of the proposed scheme footprint which is the subject of this report, it does encompass most of it with the exception of a narrow strip of land bordering the Tees estuary. For the purposes of this EIA, it has been assumed that the measures detailed in the outline remediation strategy (detailed below) will be adopted across the entirety of the proposed scheme footprint.

The outline remediation strategy (Wood, 2019) includes the placement of a capping layer on the surface in order to break pollutant linkages. This technique includes the placement of either hardstanding or chemically ‘suitable for use’ materials up to 0.3m in thickness over contaminated ground. Clean service runs are also recommended, to protect both future land users and utility assets. The option for selective excavation and disposal at the adjacent hazardous waste facility of limited ‘hotspots’ of contamination is also recommended to complement the capping layer remediation approach.

The outline remediation strategy (Wood, 2019) also recommends the testing of soils and materials for re-use within the proposed scheme footprint to determine their suitability and provides chemical re-use criteria for soils to ensure protection of human health under a commercial land-use scenario. No ‘suitable for use’ chemical criteria for soils or groundwater (in order to protect controlled waters) are provided. The embedded ‘control of the works’ measures incorporated into the outline remediation strategy will also be implemented within the proposed scheme. These include adherence to Construction (Design and Management) Regulations 2015, development of a materials management plan (MMP) and development of an Environmental Management Plan. The measures detailed within the outline remediation strategy have been built into the proposed scheme as embedded mitigation.

3.13 Operational phase

3.13.1 Proposed use of the quay

During the operational phase, it is envisaged that the proposed quay would be utilised predominantly to support with the construction of offshore wind farms, as well as supporting more general industrial and storage/distribution activities linked to the works to be undertaken within the general industrial units proposed for the backing land (which have been subject to a separate planning application and EIA).

With regard to the wind farm industry, it has been assumed that the quay would be used to support both staging (pre-assembly and storage) and manufacturing of wind farm components.

The proposed quay has been designed with two heavy lift platforms along its length. It has been assumed as a worst-case scenario that two crawler cranes would be present on the quay, up to 192m in height, with up to two smaller cranes also likely to be present. Such cranes would be utilised to assist with the lifting of wind turbine components and general cargo on and off vessels when berthed at the quay. It has also been assumed that wind turbine components of up to 150m in height would be temporary stored on the quay for loading onto vessels. It is also envisaged that the quay would be used by Self-Propelled Modular Transporters (SPMTs) and generators to power small tools and welding equipment.

3.13.2 Operational phase vessel calls

Assuming a worst-case scenario from a vessel size perspective (whereby the scheme is utilised for the offshore wind industry), the proposed scheme has been designed to accommodate a vessel with an overall length of up to 169m, breadth of up to 60m and laden draft of 11m. In addition to the vessels used to support with the manufacturing and staging of wind farm components, it is envisaged that other smaller installation vessels would also utilise the quay including general cargo vessels.

It has been estimated that up to 390 offshore wind vessel calls would take place at the facility on an annual basis. This includes approximately 300 vessel calls per year associated with offshore wind staging and 90 vessel calls per year associated with offshore wind manufacturing activities.

As noted earlier, the proposed scheme has been designed to avoid impacts to the pipe tunnels which are known to cross underneath the Tees estuary. As dredging is not proposed to be undertaken above the pipe tunnels, a tidal restriction will be placed on certain sized vessels accessing / egressing to and from the proposed quay. Analysis has shown that vessels with a draft of less than 8.4m would not be subject to tidal restrictions. As noted above, the maximum draft of vessels anticipated to use the quay during operation is 11m; analysis has illustrated that such a vessel would not be subject to tidal restrictions for the vast majority of the time.

3.13.3 Lighting and power

It has been assumed that approximately 18 lighting towers (high masts) up to 30m will be utilised during the operational phase. The lighting towers are envisaged to have 50 Lux and will be spaced approximately 80m apart along the quay. As noted above, a new electrical substation is proposed to be constructed on the quay in order to provide the necessary power requirements. Given the proposal to include shore power into the scheme design, it has been assumed that all vessels to be used during operation would connect to the shore power, rather than running auxiliary engines when berthed at the quay.

3.13.4 Surface water runoff and foul sewage

It is anticipated that the quay would be surfaced with crushed stone. Surface water would drain through the crushed stone into the underlying material without the need for a formal drainage system.

A drainage system would however be required on the heavy lift areas, as such areas are proposed to be surfaced with concrete. Such a system would capture surface water runoff from the heavy lift areas through a series of gullies. The collected water will be discharged into the Tees estuary through the quay wall, via an interceptor.

Welfare facilities are not proposed on the quay itself in order to maximise the available space to support with operations; there would therefore be no foul sewage generated as a result of the proposed scheme.

3.13.5 Operational phase employment

It has been assumed that a workforce of approximately 10 employees would be required during the operational phase of the proposed scheme.

3.14 Decommissioning phase

The proposed scheme does not have a planned decommissioning phase, and therefore decommissioning has not been considered further in this report.

3.15 Description of alternatives

3.15.1 Alternative locations for the facility with the Tees estuary

STDC considered a number of locations within the Tees estuary for the proposed facility prior to selecting the South Bank site as the preferred option. The options which were originally considered comprised the existing Redcar Bulk Terminal (RBT), the currently undeveloped Bran Sands site and the disused South Bank site.

All three sites were considered to be environmentally feasible solutions, however the RBT site would have resulted in complex and potentially time-consuming discussions regarding land ownership / lease agreements / commercial agreements. The existing RBT quay structure has also likely exceeded its original design life and therefore it was anticipated that a new quay wall would be required riverward of the existing wall to provide the required design life for the proposed scheme. RBT was therefore removed from further consideration.

The Bran Sands site is complicated by the existence of a Development Consent Order (DCO) held by Anglo American (formerly Sirius Minerals) for the construction of a harbour facility to export polyhalite. Detailed commercial discussions would have been required with Anglo American to progress that site, as well as detailed discussions with legal representatives, the Planning Inspectorate and the Department for Transport (DfT) to understand the implications regarding amendments of the DCO. The Bran Sands site was removed from further consideration. The South Bank site was selected as the preferred location for the proposed scheme.

The environmental impacts associated with each of the three possible options were largely the same, and therefore the decision regarding which site to progress was predominantly driven by technical and commercial decisions. However, the South Bank site is beneficial from an environmental consenting (timescale) perspective, as a third party had previously undertaken an environmental scoping exercise for construction of a new port facility at the site in 2019, as well as submitting a sampling plan request to the

MMO. The responses provided to the third party in 2019 which are publicly available online were therefore advantageous with regard to progression of the South Bank site, as they provided a steer to the scale of assessment likely to be required.

3.15.2 Alternative designs

Alternative designs and construction techniques for the quay wall
A number of options for construction of the quay wall have been considered by STDC, namely:

- Concrete block wall.
- Concrete caisson wall.
- Tied sheet walls to create a gravity structure.
- Combi piled wall.
- Seacant wall.
- Suspended deck.

The concrete block wall would require heavy marine plant to place the blocks and a casting yard / loading facility. Due to the difficulties in accurately placing concrete blocks in a silt laden river, this option was not considered viable from an engineering perspective. The concrete caisson wall would require caissons to be cast and floated to the site; given the difficulties with securing a facility to cast the caissons, this option was not considered viable. The tied sheet wall to create a gravity structure was also not considered viable due to the need for placing the lower ties underwater, as well as the requirement to double handle excavated material.

A piled suspended deck structure would be technically feasible, however this option would require more extensive excavation on land (approximately 370,000m^3 more compared to the combi-piled wall) and piling within the river channel. More extensive excavation on land compared to the solid piled wall options would result in greater disturbance impacts and result in a requirement to re-us or dispose of greater volumes of soils.

Piling within the river channel would result in the creation of underwater noise disturbance to fish, marine invertebrates and marine mammals; such impacts would not arise from the solid piled wall options. The suspended deck option also reduces the potential for the incorporation of environmental enhancement measures into the design; a solid piled wall has potential to incorporate a range of enhancement measures such as ‘verti-pools’. The suspended deck also offers reduced future flexibility compared to the combi-piled wall in terms of sustainability and futureproofing; significant engineering works would be required to the suspended deck should STDC seek to increase the load rating of the quay in the future. The suspended deck option was therefore ruled out due to both environmental and engineering options.

Whilst a seacant wall remains a feasible solution, the anchored combi-piled retaining wall has been selected as the assessed solution based on the ground conditions at the site and the buildability of the anchored combi-piled wall from a technical perspective.

Alternative dredging plant
There is likely to be a requirement to utilise a number of different types of dredger depending on the nature of the material being dredged. Therefore, for different parts of the dredging it will be necessary to use a TSHD or backhoe. The environmental implications of using these dredgers have been assessed and no other alternatives exist that could undertake the work.

Approach channel and berthing pocket dredge
The proposed dredged depth in the navigation channel has been chosen to maximise the tidal window to which the quay and channels are accessible for vessels of particular drafts. The proposed depth of the berthing pocket is required to enable berthing of vessels at the quayside throughout the tidal cycle. The width of the proposed berth pocket has been set by the widest vessel which is anticipated to use the facility. There are no real alternatives to the proposed design depths and widths as these are inherent to the proposed scheme design.

Phasing of the development
Phasing of the development (specifically phasing of the construction of the quay wall) has not yet been defined and will be subject to the capital cost of the first phase of the development, taken together with the customer demand and the utilisation of the existing facilities. Options with respect to phasing include differing lengths for an initial phase of the development with the completion of the remaining length during a subsequent phase (or number of phases). For the purposes of the assessment, it has been assumed that the scheme would be constructed in phases, with an initial berth length of 450m, being subsequently extended as required up to the full 1,050m.

Alternative positions along the river axis
The South Bank site is bounded at the upstream end by a large electricity pylon with overhead power lines, and a set of pipe tunnels which cross underneath the River Tees at the downstream end. These constraints severely limit the alternative positions for the proposed quay along the river axis.

3.15.3 Alternative uses of dredged material

The Waste Framework Directive provides a general duty to ensure that waste is dealt with in an environmentally acceptable manner. In accordance with the Directive, it is necessary to seek alternative uses for the dredged arisings, with disposal at sea being the least preferred option (in accordance with the waste hierarchy, see Figure 4.1). Alternative uses can include habitat creation or improvement and use in reclamation projects. The alternative options that have been considered for the disposal of dredged material are presented below.

Use as engineering fill within construction projects
The proposed dredge is predicted to give rise to boulder clay, sand and silts. Sand and boulder clay could have the required geotechnical properties to be used as engineering fill for construction purposes. However, STDC is not aware of any construction projects within the local area that require the use of dredged material, and, therefore, this option is not considered to be a viable solution at the time of writing. STDC will however continue to remain open to the re-use of dredged material within construction projects.

Creation of bird roost sites / breeding areas
During production of the recent Hartlepool approach channel EIA Report (Royal HaskoningDHV, 2019), Hartlepool Borough Council (HBC) recommended that the creation of safe, shorebird roost island(s) (possibly doubling as little tern nesting islands) could be created using the dredged material from Hartlepool channel. In terms of Hartlepool borough and the wider Teesmouth and Cleveland Coast, HBC also advised that the lack of safe shorebird roost islands is a conservation issue of great concern to the Council, particularly as existing 'slag' islands have eroded and recreational disturbance is adversely affecting wader roosts.

Further consultation with HBC was undertaken during September 2018 to discuss possible locations for the creation of bird islands. HBC identified four locations at the mouth of the Tees estuary which could be suitable locations for the re-use of dredged sediment; three were located adjacent to the South Gare Breakwater, with one adjacent to the North Gare Breakwater. Consultation with Natural England in October

2018 prior to submission of the Northern Gateway Container Terminal (NGCT) marine licence application confirmed that the creation of bird islands as an environmental enhancement measure to the proposed scheme by beneficially re-using dredged material would be welcomed. It is considered that such beneficial re-use of dredged material could also represent a possible option for the South Bank scheme.

STDC will continue to investigate the option of creating bird islands using dredged material, possibly linking with the aims and desires of the Tees Estuary Partnership. Such creation of bird islands at the mouth of the Tees (or any beneficial use of dredged material in the marine environment) would require a separate marine licence application to deposit dredged material, or potentially a variation to the marine licence for the proposed scheme (if granted) should it be possible to implement the bird islands in parallel with the proposed scheme. STDC will continue to liaise with the Tees Estuary Partnership and will aim to develop or input into strategic beneficial use schemes to benefit the overall Tees estuary and the wider Teesmouth and Cleveland coast. However, for the reason set out above, it has been assumed that beneficial use to create bird islands would not be undertaken as part of the proposed scheme.

4 LEGISLATIVE FRAMEWORK

4.1 Marine and Coastal Access Act

Part 4 of the Marine and Coastal Access Act 2009 (MCAA) provides a framework for the marine licensing system for those 'licensable marine activities' undertaken within the UK marine area. Under the MCAA, the 'UK marine area' is defined as:

- The area of sea within the seaward limits of the territorial sea adjacent to the UK;
- Any area of sea within the limits of the exclusive economic zone;
- The area of sea within the limits of the UK sector of the continental shelf; or
- Including the bed and subsoil of the sea within the areas listed above.

The MMO is the regulatory authority for marine licensing in English inshore and offshore waters. As detailed in Part 4 of the MCAA, there are seven categories of activity that may need a marine licence from the MMO, namely:

- Construction;
- Dredging;
- Deposit of any substance or object;
- Removal of any subject or object;
- Incineration of any substance or object;
- Scuttling (sinking) of any vessel or floating container; or
- Use of explosives.

The elements of the proposed scheme which will require a marine licence comprise:

- Capital dredging (removal activity).
- Offshore disposal of dredged material (deposit activity).
- Removal / demolition of the existing timber wharf and concrete jetties (removal activity).
- Deposit of rock within the proposed berth pocket to form the rock blanket (deposit activity).

The proposed dredge footprint is located predominantly within an area subject to maintenance dredging by PD Teesport (PDT) (under licence L/2015/00427/1). However, the proposed berth pocket is located outside of the existing maintenance dredge footprint, and therefore a variation to the licence held by PDT is envisaged to increase the source area of maintenance dredged material following construction of the proposed scheme.

4.2 Harbours Act

The proposed scheme footprint is located partly outside of the existing harbour limits (given the requirement to construct the proposed quay on land). It is therefore anticipated that a non-works Harbour Revision Order (HRO) application would be required to vary the boundary of PD Ports' jurisdiction. As such an application would not directly or indirectly authorise a project, prior notification to the MMO under Harbours Act 1964 is not required. However, engagement with the MMO would be carried out throughout the non-works HRO application, to ensure that the correct process is followed.

The non-works HRO application is not linked to this EIA or the related marine licence application. However, reference to this has been mentioned for completeness.

4.3 Town and Country Planning Act

The Town and Country Planning Act 1990 (TCPA) regulates the development of land in England and Wales. Planning permission is required if the work being undertaken meets the statutory definition of 'development', set out in Section 55 of the TCPA. 'Development' includes:

- Building operations;
- Material changes of use to land and buildings;
- Engineering operations; and
- Mining or other operations in, on, over or under land.

The jurisdiction of the planning authority (in this case Redcar and Cleveland Borough Council (RCBC)) extends down to the level of mean low water. The elements of the proposed scheme to be located on land, namely demolition of existing infrastructure and construction of the proposed quay require planning permission from RCBC.

4.4 Environmental Impact Assessment Directive

The requirement for EIA is established by the European Directive 2011/92/EU (codifying previous EIA Directives), as amended by 2014/52/EU on the assessment of the effects of certain public and private projects on the environment (the EIA Directive). The EIA Directive is implemented via various regulations; in this instance, The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) and the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 are applicable to the proposed scheme.

An agreement was previously reached between a third party and the MMO to undertake an EIA for a very similar scheme to that currently proposed at South Bank under the Marine Works (Environmental Impact Assessment) Regulations 2007, as amended. We assume that RCBC is of the opinion that an EIA is also required under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as a Scoping Opinion was issued by RCBC in 2019. We have therefore proceeded on the basis that an EIA is required under both sets of EIA Regulations, without undertaking a formal EIA screening process (on the basis that the fundamentals of the project previously presented to the MMO and RCBC by the third party remain the same).

4.5 Habitats Directive

The Conservation of Species and Habitats Regulations 2017 (the Habitats Regulations) implement the Habitats Directive (92/43/EEC) in England and Wales. The Habitats Regulations also transport elements of the Wild Birds Directive (2009/147/EC) in England and Wales.

In accordance with Section 63 of the Habitats Regulations, Appropriate Assessment is required for any plan or project, not connected with the management of a European site, which is likely to have a significant effect on the site, either alone or in-combination with other plans or projects. European sites comprise Special Protection Areas (SPA) and Special Areas of Conservation (SAC). Appropriate Assessment is also required as a matter of government policy for potential SPAs (pSPA), candidate SACs (cSAC) and listed Ramsar sites for the purpose of considering development proposals affecting them (ODPM, 2005).

The proposed scheme footprint is located with the footprint of the Teesmouth and Cleveland Coast SPA and is immediately adjacent to the Teesmouth and Cleveland Coast Ramsar site. There is therefore potential for the proposed scheme to affect these designated sites. This is considered further via an HRA (see **Section 29**).

4.6 Wildlife and Countryside Act (as amended)

Public bodies (such as planning authorities, in this case RCBC, and the MMO) are responsible for permitting others to carry out works that are likely to damage or affect SSSIs designated under the Wildlife and Countryside Act 1981.

Natural England has undertaken a review of SSSIs around the Teesmouth and Cleveland coast, which has resulted in the notification of the Teesmouth and Cleveland Coast SSSI. This site includes the majority of the area protected by the previous SSSIs in the area, linking and combining them with substantial extensions. The Seal Sands SSSI remains designated in part approximately 2.5km to the west of the Tees estuary. Part of the existing Seal Sands SSSI is not considered to be of special interest and has therefore been denotified.

Consent under Section 28 of the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act, 2000) would be intrinsic to Natural England's overall response to the marine licence application and planning application, and therefore a separate application under the Wildlife and Countryside Act 1981 has not been submitted.

4.7 Water Framework Directive

The WFD (2000/60/EC) establishes a legal framework to protect and restore clean water across Europe to ensure long-term, sustainable use. It applies to waters out to one nautical mile from the baseline from which territorial waters are drawn.

One of the aims of the WFD is to ensure that all European waterbodies are of Good Ecological Status or Potential (for 'heavily modified' and 'artificial' waterbodies) by 2021 by the setting of Environmental Quality Objectives (EQOs) for water chemistry, ecological and hydromorphological quality parameters. The WFD is transposed into English and Welsh law through The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

A WFD compliance assessment has been undertaken, the findings of which are presented in **Section 28**.

4.8 Waste Framework Directive

The Waste Framework Directive (2008/98/EC) consolidates earlier legislation regulating waste. The Directive sets out the general rules applying to all categories of waste, a key objective of which is to provide measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use.

Article 3(1) of the Directive defines waste as:

"….any substance or object….which the holder discards or intends or is required to discard".

More generally, the Directive provides a general duty to ensure that waste is dealt with in an environmentally-friendly way. The key to this is the 'waste hierarchy', which emphasises prevention (in the first instance) and then re-use, recycling and recovery of waste (see **Figure 4.1**). Disposal to landfill or at sea is the least favourable option. Further detail regarding applicable waste policy is outlined in **Appendix 1**.

Options for the disposal of waste (i.e. the material to be dredged from the approach channel, turning circle and berth pocket as well as material to be generated from proposed demolition activities) have been investigated in accordance with the waste hierarchy. Possible alternative options for dredged material have been presented in **Section 3.3**.

Figure 4.1 The waste hierarchy

4.9 National, regional and local planning policy

All proposed development must take account of existing planning policy and guidance, and there are a number of national, regional and local plans and policies relevant to the proposed scheme.

4.9.1 North East Inshore and North East Offshore Marine Plan

The north east marine plan area includes the north-east inshore and the north-east offshore marine plan areas. The north-east inshore marine plan area covers an area of approximately 690km of coastline stretching from the Scottish border to Flamborough Head, and out to 12 nautical miles offshore, covering over 6,000km^2 of sea.

A review of the North East Inshore and North East Offshore Marine Plan (Draft for Consultation) (issued in January 2020) (MMO, 2020) has been undertaken. The following objectives for the marine plan area are defined (amongst others).

- (1) Infrastructure is in place to support and promote safe, profitable and efficient marine businesses.
- (2) The marine environment and its resources are used to maximise sustainable activity, prosperity and opportunities for all, now and in the future.
- (3) Marine businesses are taking long term strategic decisions and managing risks effectively. They are competitive and operating efficiently.
- (4) Marine businesses are acting in a way which respects environmental limits and is socially responsible. This is rewarded in the market-place.

Given the nature of the proposed scheme and its overall aims and objectives (predominantly to serve the offshore wind industry), it is considered to be in direct accordance with the aims of the plan.

The proposed scheme is also considered to be compliant with the applicable policies of the plan, namely:

- Policy NE-DD-3 – *proposals for the disposal of dredged material must demonstrate that they have been assessed against the waste hierarchy*. The waste hierarchy assessment is presented in **Section 3.3** and is examined further in **Appendix 1**.
- Policy NE-PS-1 – *only proposals demonstrating compatibility with current activity and future opportunity for sustainable expansion of port and harbour activities will be supported*. The requirement for the proposed scheme is detailed in **Section 2**.
- Policy NE-REN-1 – *proposals that enable the provision of renewable energy technologies and associated supply chains, will be supported*. The proposed scheme has been designed with a primary focus towards the renewable energy industry (however the proposed scheme could also be utilised by other industries depending on operational need). The need for the proposed scheme in this respect and the description of proposals are detailed in **Section 2** and **Section 3** respectively.
- Policy NE-EMP-1 – *proposals that result in a net increase to marine related employment will be supported*. The impact that the proposed scheme will have on the marine related employment market has been set out in **Section 3** and **Section 21**.
- Policy NE-AIR-1 – *proposals must assess their direct and indirect impacts upon air quality and greenhouse gas emissions*. The potential impacts of the proposed scheme on air quality have been assessed in **Section 18**.
- Policy NE-BIO-3 and Policy NE-NG-1 – *proposals that deliver environmental net gain for coastal habitats where important in their own right and / or for ecosystem functioning and provision of ecosystem services will be supported*. Information regarding the environmental enhancements to be included within the proposed scheme are detailed in **Section 3**. STDC is in the process of developing a South Tees Regeneration Masterplan Environment & Biodiversity Strategy (the 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 which is the subject of this report). The extent and location of compensatory habitat creation and enhancements will be agreed with Natural England and RCBC. It is anticipated that the measures outlined in the Strategy will mean that the proposed scheme results in a biodiversity net gain.
- Policy NE-CE-1 – proposals which may have adverse cumulative effects with other existing, authorised or reasonably foreseeable proposals must demonstrate that they will, in order of preference avoid, minimise, mitigate significant adverse cumulative and in-combination effects. **Section 27** of this report presents the CIA.

4.9.2 National Policy Statement for Ports

Section 1.2 of the National Policy Statement for Ports (NPS) (Department for Transport, 2012) states that in addition to being part of the planning system established under the Planning Act 2008, the NPS is a relevant consideration for the MMO when deciding other port development proposals (i.e. projects that are not considered Nationally Significant Infrastructure Projects, such as the proposed scheme which is the subject of this report).

In summary, the UK Government seeks to:

- Encourage sustainable port development to cater for long term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the

needs of importers and exporters cost effectively and in a timely manner, thus contributing to long term economic growth and prosperity.
- Ensure all proposed developments satisfy the relevant legal, environmental and social constraints and objectives, including those in the relevant European Directives and corresponding national regulations.

In order to help meet the requirements of the government policies on sustainable development, new port infrastructure should also:

- Contribute to local employment, regeneration and development.
- Ensure competition and security of supply.
- Preserve, protect and where possible improve marine and terrestrial biodiversity.
- Minimise emissions of greenhouse gasses from port related development.
- Be well designed, functionally and environmentally.
- Be adapted to the impacts of climate change.
- Minimise use of greenfield land.
- Provide high standards of protection for the natural environment.
- Ensure that access to and condition of heritage assets are maintained and improved where necessary.
- Enhance access to ports and the jobs, services and social networks they create, including for the most disadvantaged.

It is considered that the proposed scheme is compliant with the items stated above and is therefore compliant with the NPS.

4.9.3 RCBC Local Plan

Under the National Planning Policy Framework (NPPF), local planning authorities have been encouraged to develop a Local Plan where all relevant spatial and land use policies are combined within one document. In line with this, RCBC published a Local Plan in 2018 (Redcar and Cleveland Borough Council, 2018). Relevant policy from the Local Plan, and how the scheme is compliant with this is detailed below.

- ED6 Promoting Economic Growth – the proposed scheme lies within the South Tees Area, as identified under Policy ED6.2 and is planned to be developed and safeguarded for employment purposes. The area is identified within the Local Plan as being suitable for specialist uses, such as heavy processing industries and port logistics, falling within Use Classes B1, B2 and B8. This Policy also advises that suitable employment related sui-generis uses will be supported. The need for the proposed scheme and a description of the development are provided in **Section 2** and **Section 3**, respectively. In summary, the proposed scheme would directly promote economic growth of the area by regenerating an area of river frontage which contains a dilapidated wharf and unused jetties.
- LS4/ED6 South Tees Development Corporation – the proposed scheme is within the South Tees Development Corporation area, as illustrated on the Policies Map. This has been set up to promote the economic growth and commercial development of the Tees Valley by converting assets in the South Tees area into opportunities for business investment and economic growth. The need for the proposed scheme and a description of the development are provided in **Section 2** and **Section 3**, respectively.
- N4 Biodiversity and Geological Conservation – the proposed scheme is located within and adjacent to environmentally designated sites. Potential impacts and any associated conservation/net gain measures have been provided in **Section 5** and **Section 9.** As noted above, the South Tees Regeneration Masterplan Environment & Biodiversity Strategy 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 which is the subject of this report).

- SD3 Development Limits – the proposed scheme is within the development limits identified in the RCBC Local Plan, Policies Map (Map 2).

In line with Policy ED6, this report has also reviewed the South Tees Area Supplementary Planning Document (SPD), which seeks to support the economic and physical regeneration of the South Tees Area. The SPD sets out the vision and core objectives for the Area and provides greater detail on how adopted planning policies will be interpreted during the decision-making process for planning applications. In this regard, the key reference point is Development Principle STDC14, ‘South Industrial Zone’, which indicates that development proposals for port-related uses, including port-based fabrication, offshore energy industries, including manufacturing, materials processing and manufacturing, contract fabrication and energy generation and, potentially, rig and large equipment decommissioning within the area will be encouraged. Given the nature of the proposed scheme, it is concluded that such development is in accordance with Development Principle STDC14 and consequently should be encouraged from a planning perspective.

Royal HaskoningDHV

5 APPROACH TO THE EIA

The purpose of EIA is to provide an independent assessment of a project's potential environmental impacts to enable authorities, and the public, to understand the potential impacts before making decisions on whether consent for the development should be granted. This section sets out the approach for the assessment of impacts which has been adopted within this EIA Report. In summary, this section presents:

- A summary of the EIA process.
- A summary of the consultation undertaken in relation to the proposed scheme and how issues raised have been addressed through the EIA process.
- The results of the scoping exercise undertaken to define the issues to be addressed by the EIA process and the approach to be taken to the assessment of these issues.
- The approach adopted to define the baseline environment (specific details are provided for each environmental topic considered in the relevant chapter).
- The generic approach taken to assess potential impacts, including the evaluation of significance (where a different approach has been adopted for a specific topic, this is set out in the relevant chapter).
- The generic approach taken to the derivation of mitigation measures and the assessment of residual impacts.
- The approach taken to the assessment of cumulative impacts with other plans and projects.
- The approach taken to WFD compliance assessment.
- The approach taken to the HRA.

5.1 The EIA process

EIA is an iterative tool for systematically examining and assessing the impacts and effects of the construction, operation and decommissioning phases of the proposed scheme on the environment. The formal reporting mechanism for an EIA is the EIA Report. In accordance with Schedule 3 of the 2007 Regulations (as amended), the EIA Report should include such information as is reasonably required to assess the likely significant environmental effects of the proposed scheme and which the applicant can reasonably be required to compile, including:

- A description of the project and of the regulated activity, in particular:
    - A description of the location of the project.
    - A description of the physical characteristics of the whole project and regulated activity.
    - A description of the main characteristics of the operational phase of the project and the regulated activity.
    - An estimate of expected residues and emissions resulting from operation of the proposed project and the regulated activity.
- A description of the reasonable alternatives studied by the applicant which are relevant to the proposed project, the regulated activity and their specific characteristics, and an indication of the main reasons for selecting the chosen option.
- A description of the relevant aspects of the current state of the environment (baseline scenario), and an outline of the likely evolution thereof without implementation of the project.
- A description of the factors specified in Regulation 21A(2)(a) to (e) likely to be significantly affected by the project and the regulated activity: population, human health, biodiversity, land, soil, water, air, climate, material assets, cultural heritage and landscape.
- A description of the likely significant effects of the project and the regulated activity on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects of the project.

- A description of the forecasting methods or evidence used to identify and assess the significant effects on the environment including any difficulties encountered.
- A description of the measures envisaged to avoid, prevent, reduce or if possible offset any identified significant adverse effects on the environment and where appropriate any proposed monitoring arrangements.
- A description of the expected significant adverse effects of the project and the regulated activity on the environment deriving from the vulnerability of the project and the regulated activity to risks of major accident or disaster which are relevant to the project.
- A non-technical summary of the information provided under this part of the EIA Regulations.
- A reference list detailing the sources used for the description and assessments included in the report.

The following stages were included in this EIA:

- Review of scoping opinions previously issued by the MMO and RCBC.
- Consultation with stakeholders.
- Desk-based data collection to establish the baseline environment.
- New data collection and surveys (where necessary) to supplement desk-based information and to fill any data gaps.
- Impact identification and the evaluation of significance.
- The identification of mitigation measures (where required) to reduce the significance of, or avoid, any identified adverse impacts.
- The evaluation of impacts, post-mitigation, to determine the significance of residual impacts.
- The assessment of cumulative impacts with other past, present and reasonably foreseeable future developments and plans.
- Identification of appropriate monitoring requirements.

5.1.1 Screening

An agreement was previously reached between a third party and the MMO to undertake an EIA for a proposed scheme very similar to that which is the subject of this report under the Marine Works (Environmental Impact Assessment) Regulations 2007, as amended. In addition, RCBC issued a Scoping Opinion in June 2019 to the aforementioned third party which confirmed that various environmental assessments would be required in support of a planning application and the outputs presented in an Environmental Statement (ES).

On this basis, STDC has undertaken an EIA for the proposed scheme voluntarily under the Marine Works (Environmental Impact Assessment) Regulations 2007, as amended, and the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, without submitting a formal EIA Screening Request.

5.1.2 Scoping

As noted above, RCBC issued a Scoping Opinion in June 2019 and the MMO issued a Scoping Opinion in August 2019; these Scoping Opinions were issued to a third party for a scheme which was very similar to that which is the subject of this report.

A scoping note was submitted in July 2020 to the MMO and RCBC to inform discussions regarding the validity of the 2019 Scoping Opinions to inform this EIA (see **Appendix 2**). The scoping note presented the following information:

- A comparison of the key marine elements of the proposed scheme with that previously proposed in 2019.
- A commentary on the reasons that the Scoping Opinions provide adequate direction on the scope of the EIA for the proposed scheme in light of the preferred option for the berth length, alignment and structural concept for the quay structure.
- A summary of the Scoping Opinions previously issued by the MMO and RCBC.
- The key elements of the proposed approach to the marine EIA for each environmental parameter.

Meetings were held with RCBC in July 2020 and the MMO in August 2020 to confirm the scope of environmental assessment which was proposed within the scoping note. In summary both the MMO and RCBC confirmed that the proposed scope was acceptable. The MMO confirmed this through submission of a letter to our scoping enquiry in September 2020, and RCBC provided a scoping response in September 2020 (both within **Appendix 3**).

5.1.3 Description of the baseline environment

A wide range of information has been gathered and activities undertaken to define the baseline environment for the proposed scheme, including but not limited to the following:

- desk-based review of existing published data;
- data provided by consultees; and,
- field survey and site investigation information.

The term 'baseline environment' is used to describe the nature, scale, condition, and other relevant information to provide a detailed description of a given environmental receptor that falls within the scope of the EIA Report. Within this EIA Report, the description of the baseline environment consists of the following aspects:

- the spatial location and extent of the environmental features or receptors;
- a description of the environmental features or receptors and their character;
- the context of the environmental features or receptors in terms of rarity, function, and population at the local, regional and national level;
- the sensitivity of the environmental features or receptors in relation to physical, chemical or biological changes; and,
- the value of the environmental features or receptors (e.g. designated status).

Receptor 'sensitivity' and 'value' are considered further below.

Receptor sensitivity

All receptors will exhibit a greater or lesser degree of sensitivity to the changes brought about by the proposed scheme and defining receptor 'sensitivity' as part of the definition of the baseline environment helps to ensure that the subsequent assessment is transparent and robust. The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected, and is defined by the following factors:

- Adaptability – the degree to which a receptor can avoid, adapt to or recover from an effect.
- Tolerance – the ability of a receptor to accommodate temporary or permanent change.
- Recoverability – the temporal scale over and extent to which a receptor will recover following an effect.

In order to define the sensitivity of a receptor, the guidelines presented in **Table 5.1** have been adopted in this EIA Report and the conclusions reached regarding the sensitivity of receptors has been presented in the baseline sections of each relevant environmental topic.

Table 5.1 Generic guidelines used in the determination of receptor sensitivity and value

Sensitivity	Description
Very high	Receptor has very limited or no capacity to accommodate physical or chemical changes or influences. Receptor possesses fundamental characteristics which contribute significantly to the distinctiveness, rarity and character of the resource, is of very high importance and rarity that is international in scale (e.g. designated sites such as SACs, SPAs, Ramsar Sites and Habitats Directive Annex II species), and has very limited potential for substitution / replacement).
High	Receptor has a limited capacity to accommodate physical or chemical changes or influences. Receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the resource, is of high importance and rarity that is national in scale (e.g. designated sites such as SSSIs, NNRs, UK Biodiversity Action Plan (BAP) habitats and species, Scheduled Monuments, Grade I and II* Listed Buildings), and has limited potential for substitution / replacement.
Medium	Receptor has a limited capacity to accommodate physical or chemical changes or influences. Receptor possesses key characteristics which contribute to the distinctiveness and character of the resource, is of medium importance and rarity that is regional in scale (e.g. designated sites such as County Wildlife Sites (CWS), Grade II Listed Buildings, Local BAP), and has limited potential for substitution / replacement.
Low	Receptor has a moderate capacity to accommodate physical or chemical changes or influences. Receptor possess characteristics which are locally distinctive only, are of low to medium importance and rarity that is local in scale (e.g. designated sites such as Local Nature Reserves), and potentially can be substituted / replaced.
Very low	Receptor is generally tolerant of and can accommodate physical or chemical changes or influences. Receptor characteristics do not make a significant contribution to local character or distinctiveness, and are of very low importance and rarity, are not designated, and are easily substituted / replaced.

Value is defined as the measure of a receptor's importance; this forms part of the definition of sensitivity. In some instances, the inherent value of a receptor is recognised by means of designation, and the 'value' element of the composite criterion recognises and gives weight in the assessment to that designation. However, irrespective of the recognised value, all receptors will exhibit a greater or lesser degree of sensitivity to the potential changes brought about by the proposed scheme. It should be noted that the assessment of sensitivity is informed by a number of factors, including the findings of studies / monitoring / surveys as well as judgement applied by professional experts based on the receptors within the relevant study area.

5.1.4 Impact identification and assessment

The EIA has been undertaken within a framework that allows for a transparent approach to the assessment and the resulting conclusions presented within this EIA Report. This section sets out the assigned definitions that are used in the assessment process for a number of topics considered in the EIA Report. In addition, a description of the approach taken to the specific impact assessment for each environmental topic is provided (in each relevant chapter) so that it is clear to the reader how impacts have been defined, particularly where such an approach differs to that described within this section.

EIA provides an assessment of the impacts on sensitive receptors as a result of the effects of a development upon the environment. The terms ‘effects’ and ‘impacts’ have, in the past, been used interchangeably, but they are in fact different and one drives the other. Effects are physical changes in the environment that are set in motion as a consequence of a particular development or activity. Effects do not impact all receptors, as some receptors are not always sensitive to them.

Effects are measurable physical changes in the prevailing environment (e.g. volume, time and area) arising from construction and operation activities. Effects can be classified as primary (e.g. the physical presence of a built element of the development) or secondary (e.g. increase in erosion due to a change in the rate of discharge of surface water).

Impacts consider the possible changes in potentially sensitive receptors as a result of an effect. Impacts can be classified as direct or indirect, permanent or time-limited and beneficial or adverse.

The relationship between effects and impacts is not always straightforward. For example, a secondary effect may result in both a direct and indirect impact on a single receptor. Given this the EIA framework used herein is based on the ‘source-pathway-receptor’ conceptual model process used to provide a systematic and auditable approach to understanding the potential for effects to arise, the spatial extents of the effect-receptor interactions, impact pathways, and potential impact significance. The conceptual *‘source-pathway-receptor’* model is effective in the identification of potential effects and the means by which these can manifest themselves on the receiving environment and its sensitive receptors.

The term ‘source’ describes the origin of potential effects (e.g. construction activities) and the term ‘pathway’ describes the means (e.g. through air, water, or ground) by which the effect reaches the receiving sensitive ‘receptor’ (e.g. terrestrial habitats, archaeology and human receptors). If the source, pathway or receptor is absent, no linkage exists and thus there will be no potential for an impact to manifest.

For each effect, the assessment identifies receptors within the study area that are sensitive to that effect and implements a systematic approach to understand the impact pathways and the level of impacts on given receptors. The process considers the following:

- the magnitude of the effect;
- the sensitivity of a receptor to the effect;
- the probability that an effect-receptor interaction will occur;
- the determination and (where possible) qualification of the level of impact on a receptor, considering the probability that the effect-receptor interaction will occur, the spatial and temporal extents of the interaction and the significance of the resulting impact; and,
- the level of certainty at all stages.

The magnitude of effect

The magnitude of an effect is typically defined by four factors:

- Extent – the area over which an effect occurs.
- Duration – the time for which the effect occurs.
- Frequency – how often the effect occurs.
- Severity – the degree of change relative to existing environmental conditions.

In order to help define effect magnitude, the criteria presented in **Table 5.2** have been adopted for the purposes of this EIA. While this table provides guidelines of a generic nature, it should be noted that more specific guidelines in relation to impact magnitude have been adopted for the topics assessed, where considered necessary.

Table 5.2 Generic guidelines used in the determination of magnitude of effect

Magnitude	Description
Very high	Loss of resource; severe damage to key characteristics, features or elements (Adverse). Permanent / irreplaceable change, which is certain to occur. Large scale improvement of resource or attribute quality; extensive restoration or enhancement (Beneficial).
High	Loss of resource; partial loss of or damage to key characteristics, features or elements (Adverse). Permanent / irreplaceable change, which is likely to occur. Improvement to, or addition of, key characteristics, features or elements of the resource; improvement of attribute quality (Beneficial).
Medium	Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements; measurable change in attributes, quality or vulnerability (Adverse). Long-term though reversible change, which is likely to occur. Minor improvement to, or addition of, one (maybe more) key characteristics, features or elements of the resource; minor improvement to attribute quality (Beneficial).
Low	Very minor loss of, or alteration to, one (maybe more) key characteristics, features or elements; noticeable change in attributes, quality or vulnerability (Adverse). Short- to medium-term though reversible change, which could possibly occur. Very minor improvement to, or addition of, one (maybe more) key characteristic, feature or element; very minor improvement to attribute quality (Beneficial).
Very low	Temporary or intermittent very minor loss of, or alteration to, one (maybe more) characteristic, feature or element; possible change in attributes, quality or vulnerability (Adverse). Short-term, intermittent and reversible change, which is unlikely to occur. Possible very minor improvement to, or addition of, one (maybe more) characteristic, feature or element; possible improvement to attribute quality (Beneficial).

The determination and qualification of impact significance

The significance of an impact is determined by combining the predicted magnitude of the effect with the sensitivity of the receptor; for example, as defined in **Table 5.3**. Impact statements carry a degree of subjectivity, as they are based on expert judgement regarding the effect-receptor interaction that occurs and on available data. As such, impact statements should be qualified appropriately.

The probability of an effect occurring (i.e. an effect-receptor interaction) should also be considered in the assessment process; capturing the probability that the effect will occur and also the probability that the receptor will be present. For example, the magnitude of the effect and the sensitivity of the receptor may have been established, and it may be highly probable that the effect will occur; however, the probability that the receptor will be present at the same time should also be considered.

In the context of the EIA Regulations, 'significant impacts' are taken to be those of moderate or major significance (as defined above); albeit that appropriate mitigation, where available, should be sought for all impacts.

It should be reiterated that, although this section sets out the overall approach adopted for this EIA (using, for example, magnitude and sensitivity to determine the level of impact), individual sections may take their own approach where industry standard methodologies are appropriate or another approach has been agreed with the relevant regulator. Where a different approach is taken, this is explained in the relevant methodology section.

Table 5.3 Impact assessment matrix

Receptor sensitivity (inclusive of value)	Magnitude of effect				
	Very high	High	Medium	Low	Very low
Very high	Major	Major	Moderate	Moderate	Minor
High	Major	Moderate	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Minor	Negligible
Low	Minor	Minor	Minor	Negligible	Negligible
Very low	Minor	Negligible	Negligible	Negligible	Negligible

Mitigation

Mitigation measures have been proposed, where available and practical, in those cases where adverse impacts have been identified. It is important to note that the mitigation measures applied should be proportionate to the scale of the impact predicted.

'*Mitigation through design'* is an important factor in ensuring that the environmental impacts of a proposed scheme are minimised. Through the development of the proposed scheme, and the iteration of the engineering and environmental impact studies, mitigation has been built into the design of the proposed scheme. Where significant impacts potentially remain, further issue-specific mitigation measures are defined.

Whilst mitigation for minor or negligible impacts may not be specifically defined as a matter of course, industry standard or 'embedded' mitigation often applies in these cases (and is set out herein). It is also recognised that minor and negligible impacts could become significant when considered cumulatively with other pressures on a receptor and, in this event, mitigation may be required.

With regard to the HRA (presented in Section 29), the recent ruling (April 2018) by the Court of Justice of the European Union (CJEU) referred to as *People Over Wind and Sweetman v Coillte Teoranta (C-323/17)* is relevant to the treatment of mitigation in HRA. The CJEU ruling determined that "…*it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site*". In the context of HRA, the phrase …"*measures intended to avoid or reduce the harmful effects...*" is interpreted as meaning any mitigation measures that are not clearly an intrinsic part of the design of a plan or project. The effect of this ruling is that mitigation measures, which are not clearly intrinsic to the proposed scheme design, have not been considered when determining likely significant effect (LSE) at the HRA screening stage.

Monitoring

Appropriate mitigation measures have been identified and recommended in this EIA Report where the EIA process has identified an adverse impact and mitigation is available (see above). In some cases, in order to ensure that the mitigation measures are successful or where there is significant uncertainty with respect to important receptors, monitoring requirements have been identified and are presented within the relevant topic chapters of this EIA Report.

Residual impacts

Where further mitigation measures are identified, the significance of the residual environmental impact (i.e. the post-mitigation impact) is assessed.

Assumptions and limitations

The EIA Regulations and relevant guidance require an EIA Report to provide an indication of any difficulties (technical deficiencies or lack of know-how) encountered during the assessment process. Any such assumptions or limitations are identified within the relevant topic chapter, where relevant.

The EIA Regulations also require that an EIA Report is prepared by competent experts. This EIA Report has been compiled by Royal HaskoningDHV, a company which is a corporate member of the Institute of Environmental Management & Assessment (IEMA) (number 0001189) and also a Corporate Registered Assessor for EIA under IEMA's voluntary EIA Quality Mark scheme. Through this scheme, EIA activity is independently reviewed, on an annual basis, to ensure it delivers excellence in areas including EIA management, team capabilities, regulatory compliance, content, presentation and improving practice.

5.1.5 Net gain / enhancement

In 2018, the Government sought views on proposals to improve the planning system in England to protect the environment. Consultation proposals for a mandatory requirement (to incorporate net gain into proposals) did not include nationally significant infrastructure project or marine projects (such as the marine elements of the proposed scheme).

After a period of consultation on a mandatory requirement for all new developments within the Town and Country Planning Act to deliver net gain for nature, the Government announced in March 2019 its favourable view on mandating biodiversity net gain for developments in England. This means that coastal and intertidal habitats will have to be considered to account for the whole regime of the Act, including the intertidal area down to the mean low water mark. Government advised in July 2019 that nationally significant infrastructure and net gain for marine development (meaning development under the Marine and Coastal Access Act, 2009) will remain out of scope of mandatory requirement in the Environment Bill.

The Chancellor also announced in 2019 that the Defra biodiversity metric 2.0 would be the mechanism used to calculate the amount of habitat creation or improvement needed to enable net gain in biodiversity. This metric has been developed for terrestrial habitats and was expanded to include coastal habitat. Natural England published a paper in April 2019 which presents a metric for intertidal habitat. Within this paper, Natural England (2019) states that net gain will be attained when the 'post-intervention' biodiversity units (i.e. the effect of implementation of habitat creation or improvement measures) are at least 10% higher than the original ('pre-intervention') biodiversity units, plus the predicted impact of the proposed scheme (i.e. loss of biodiversity units due to development).

STDC is in the process of developing a South Tees Regeneration Masterplan Environment & Biodiversity Strategy (the 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 which is the subject of this report). The extent and location of compensatory habitat creation and enhancements will be agreed with Natural England and RCBC. It is anticipated that the measures outlined in the Strategy will mean that the proposed scheme results in a biodiversity net gain.

5.1.6 Cumulative Impact Assessment

Impact inter-relationships

Council Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment (the EIA Directive) states that an EIA should identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following receptors:

- Population and human health.
- Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC.
- Land, soil, water, air and climate.
- Material assets, cultural heritage and the landscape.
- The interaction between the factors referred to above.

This EIA Report has given due consideration to the potential for different residual impacts to have a combined impact on key sensitive receptors. The objective is to identify where the accumulation of impacts on a single receptor, and the relationship between those impacts, potentially gives rise to a need for additional mitigation. Inter-relationships have been assessed within the relevant sections of the topic chapters of the EIA Report.

Cumulative impacts

In line with IEMA's Guidelines for EIA (2004), cumulative impacts are defined as: *"…the impacts on the environment which result from incremental impacts of the action when added to other past, present and reasonably foreseeable future actions …"*

There is no legislation that outlines how cumulative impact assessments (CIAs) should be undertaken. However, the EIA and Habitats Directives and their associated regulations require the consideration of direct impacts and any indirect, secondary and cumulative effects of a project. Government guidance states that: "cumulative effects could refer to the combined effects of different development activities within the vicinity" (Department for Communities and Local Government, 2006, Paragraph 121).

The EIA Regulations do not define 'cumulative' but guidance on cumulative effects assessment is provided in a number of good practice documents (e.g. the European Commission, 1999). This guidance is not prescriptive, but rather suggests various approaches which may be used, depending on their suitability to the project (for example the use of matrices, expert opinion, consultation, spatial analysis and carrying capacity analysis).

A tiered approach has been adopted for the CIA, based upon the following definitions:

- Site-specific (or within-development) cumulative impacts - different effects associated with the proposed scheme have the potential to interact and, together, influence common receptors (e.g. noise and visual effects on ecology). Where applicable, these inter-relationships are considered in the CIA (in **Section 27**) and the HRA (**Section 29**).
- Wider cumulative impacts which are the combined impacts (additive or interactive) that may occur between the proposed scheme and any other relevant development(s).

With respect to 'past' projects, a useful ground rule in CIA is that the environmental impacts of schemes that have been completed should be included within the environmental baseline; as such, these impacts will be taken into account in the EIA process and, generally, can be excluded from the scope of CIA. However, the environmental impacts of recently completed projects may not be fully manifested and, therefore, the potential impacts of such projects should be taken into account in the CIA.

Project-wide and wider cumulative assessment has been documented within **Section 27**.

6 HYDRODYNAMIC AND SEDIMENTARY REGIME

6.1 Introduction

This section presents the baseline conditions with regard to the hydrodynamic and sedimentary regime of the Tees estuary and describes the predicted effects of the proposed scheme on the estuarine system. It incorporates previous work (outlined in **Section 6.3.2**) as well as recent data from a metocean survey undertaken in July 2020 (**Section 6.3.3**) to characterise the baseline understanding and draws upon numerical modelling and expert geomorphological assessment for the assessment of potential effects.

While the proposed scheme has the potential to alter hydrodynamic and sedimentary processes, the significance of such changes or effects have not been defined in this section as 'impacts'. This is because coastal processes themselves are not considered to be receptors sensitive to change. Hence, while a change to a physical process can be predicted and described with respect to the known baseline in terms of its magnitude, it is not appropriate to predict the significance of an impact on the physical process. The significance of this change is nevertheless assessed with respect to those environmental receptors that could be influenced, such as water quality, marine ecological interests, navigation and marine waterbird populations, within the other relevant sections of this EIA Report.

6.2 Policy and consultation

6.2.1 National Policy Statement for Ports

The assessment of potential effects on the hydrodynamic and sedimentary regime has been made with reference to the NPS for Ports (Department for Transport, 2012). The particular assessment requirements that are relevant to the hydrodynamic and sedimentary regimes, as presented within the NPS for Ports, are summarised in **Table 6.1**.

Table 6 Summary of NPS for Ports requirements with specific regard to coastal processes

NPS requirement	NPS reference	Section where requirement has been addressed
Where relevant, applicants should undertake coastal geomorphological and sediment transfer modelling to predict and understand impacts and help identify relevant mitigating or compensatory measures	Section 5.3.4	**Section 6.5** and **6.6.**
The ES should include an assessment of the effects on the coast. In particular, applicants should assess: • the impact of the proposed project on coastal processes and geomorphology, including by taking account of potential impacts from climate change. If the development will have an impact on coastal processes, the applicant must demonstrate how the impacts will be managed to minimise adverse impacts on other parts of the coast; and • the implications of the proposed project on strategies for managing the coast, as set out in Shoreline Management Plans, any relevant marine plans, River Basin Management Plans and capital programmes for maintaining flood and coastal defences.	Section 5.3.5	**Section 6.5** and **6.6** and the Planning Statement which supports the planning application**.**
The decision-maker should not normally consent new development in areas of dynamic shorelines where the proposal could inhibit sediment flow or have an impact on coastal processes at other locations. Impacts on coastal processes must be managed to minimise adverse impacts on other parts of the coast. Where such proposals are brought forward, consent should only be granted where the decision-maker is satisfied that the benefits (including need) of the development outweigh the adverse impacts.	Section 5.3.9	**Section 6.5**

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6.2.2 Marine Policy Statement

The UK Marine Policy Statement (MPS) (HM Government, 2011) provides the framework for preparing Marine Plans and taking decisions affecting the marine environment. The MPS sets out high level objectives for marine planning, which have directed development of the Plan at a local level. Marine Plans must be in accordance with other relevant national policy and are intended to contribute to the achievement of sustainable development in the UK marine area. The Marine and Coastal Access Act 2009 requires all public authorities taking authorisation or enforcement decisions that affect, or might affect, the UK marine area to do so in accordance with the MPS unless relevant considerations indicate otherwise. Regarding the topics covered by this section, the key references from the MPS are summarised in **Table 6.2**.

Table 6.2 MPS requirements relevant to hydrodynamic and sedimentary regime

Policy Description	MPS Reference	Section where requirement has been addressed
Marine plan authorities should not consider development which may affect areas at high risk and probability of coastal change unless the impacts upon it can be managed. Marine plan authorities should seek to minimise and mitigate any geomorphological changes that an activity or development will have on coastal processes, including sediment movement.	Section 2.6.8.6	**Section 6.5**

6.2.3 North East Marine Plan

Public consultation on the draft North East Marine Plan (MMO, 2020) concluded on 20th April 2020 and the MMO is currently finalising plans for submission to the Secretary of State for Environment, Food and Rural Affairs for adoption. **Table 6.3** summarises the policies of the North East Marine Plan that are relevant to hydrodynamics and the sedimentary regime.

Table 6.3 North East Marine Plan policies relevant to hydrodynamic and sedimentary regime

Policy Code	Policy text	Section where requirement addressed
NE-DD-2	Proposals that cause significant adverse impacts on licensed disposal areas should not be supported. Proposals that cannot avoid such impacts must, in order of preference: a) minimise b) mitigate c) if it is not possible to mitigate the significant adverse impacts, proposals must state the case for proceeding.	**Section 6.5.2** and **6.6.4**.
NE-DD-3	Proposals for the disposal of dredged material must demonstrate that they have been assessed against the waste hierarchy. Where there is the need to identify new dredge disposal sites, proposals should be supported which are subject to best practice and guidance.	**Section 3.14**.

6.2.4 Consultation

A summary of consultation responses relevant to the assessment of hydrodynamics and sedimentary regime, and how these are addressed within this section, is presented in **Table 6.4**.

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Table 6.4 A summary of relevant consultation responses

Consultation	Summary of Response	Section where response addressed
MMO Scoping Opinion (previously proposed scheme from 2019)	The ES needs to be based on the physical characteristics of the site, which should include a description of the proposed works; geography of the site; seabed properties, and; tidal/estuarine dynamics (tidal range and currents). The type of data used and detail required will depend on the sensitivity of each receptor (identified by the applicant) to these physical factors and the evidence the applicant requires to present their case. The use of in-situ and/or modelled data may be necessary to demonstrate a point. The MMO is unable to provide further comment on what should and should not be included in the assessment without further information. The applicant should conduct their own scoping assessment based on the physical characteristics of the site as described above.	**Section 6.4** describes the existing environment. **Sections 6.5.2** and **6.6.3** presents the findings of modelling undertaken for the proposed scheme.
Environment Agency (general)	The Environment Agency advised that updates to two guidance documents on climate change became available in July 2020, • Flood and coastal risk projects: https://www.gov.uk/guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances • Flood risk assessments: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances The 'flood risk assessment guidance' is coarser, providing allowances for different epochs for whole river catchment basins, whereas the 'flood and coastal risk projects guidance' is more specific to individual sites, encouraging the use of the UKCP18 User Interface.	**Section 6.4.3.**
Environment Agency (letter dated 14th August 2020)	The Environment Agency's response to RCBC during scoping consultation listed three aspects of relevance to hydrodynamics and sedimentary processes, namely: • Impacts of dredging on the tidal prism of the estuary, and therefore the extent and condition of existing intertidal habitats and the resultant impact on WFD ecological classification elements should also be included within the WFD assessment. • In addition to the initial capital dredge, consideration of the impacts associated with the continued maintenance of the dredged area in future years should be assessed too, in terms of the continued impact to fish, as well as water quality. • it is likely that dredging activity will need to take into account the protection of vulnerable fish species such as European Eel, Atlantic Salmon and Lamprey during critical migration periods. This would entail limiting dredging activity to certain times of the year and/or providing suitable monitoring and mitigation such as stop start thresholds for parameters such as suspended sediment and dissolved oxygen levels.	Impacts of dredging on the tidal prism of the estuary are addressed in **Section 6.6.3**. Consideration of impacts associated with maintenance dredging is made in **Section 6.6.4.** Impacts to fish and water quality are addressed in **Section 13** and **Section 7** respectively.

6.3 Methodology

6.3.1 Study area

For hydrodynamics and sedimentary processes, the study area needs to cover all areas of river, adjacent coastline and offshore seabed that potentially could be affected by the proposed scheme, including the dredging and offshore disposal activities. For this reason, the study area shown in **Figure 6.1** has been applied. Key locations referred to in this section are shown in **Figure 6.2**.

Figure 6.1 Study area for assessing potential effects on hydrodynamics and sedimentary processes

6.3.2 Review of existing information

There has been much previous work to characterise the baseline hydrodynamic and sedimentary regime of the River Tees estuary, undertaken over many decades. This work is summarised below in **Table 6.5**, together with an overview of how it has been developed and incorporated into subsequent studies.

Table 6.5 Review of existing information on the baseline hydrodynamic and sedimentary regime

Date	Study	Reference	Comments
1989	Tees Barrage - Effect of the barrage on marine mud siltation.	HR Wallingford, 1989	Incorporated within NGCT ES 2006.
1989	Tees Weir Feasibility Study - Correlation between waves, tides and suspended mud concentrations in Tees Bay.	HR Wallingford, 1989	
2002	Teesmouth Sediment Study.	HR Wallingford, 1989	
2002	Conceptual model of estuary processes.	ABPmer, 2002	
2005	Maintenance dredging baseline document.	ABPmer, 2005	
2006	NGCT Environmental Statement.	Royal Haskoning, 2006	Baseline characterisation and assessment of construction and operation effects, based upon numerical modelling. Informed NGCT ES 2020.
2007	NGCT Environmental Statement Supplement.	Royal Haskoning, 2007a	Further information relating to sediment contamination and potential impact on water quality, and further information on changes in tidal prism at north Tees mudflats. Reviewed for consideration within NGCT ES 2020.
2007	Tees maintenance dredging baseline document.	Royal Haskoning, 2007b (updated by Royal	Documents the maintenance dredging material regularly removed from the Tees

Date	Study	Reference	Comments
		HaskoningDHV in 2017a, 2018, 2019a and 2020a)	estuary, and the potential implications of maintenance dredging and disposal for European and Ramsar sites. Informed NGCT ES 2020.
2009	QEII Berth Development – Environmental Statement.	Royal Haskoning, 2009	Baseline description largely based on NGCT 2006 ES, but updated with further information about maintenance dredging regimes and materials arising from above and informed by modelling for scheme-related effects. Informed NGCT ES 2020.
2011	Tees Dock No.1 Quay – Technical Note.	Royal Haskoning, 2011	Agreed with regulators that existing modelling results from the NGCT and QEII schemes could be used to provide suitable evidence upon which to base predictions of possible effects from the proposed dredging operations required for this scheme. Informed NGCT ES 2020.
2014	Anglo American Harbour Facilities – Environmental Statement.	Royal HaskoningDHV, 2014	Modelling of scheme-related effects included tidal flow modelling, wave modelling, sediment transport, bed change modelling and modelling of sediment plume released from construction activities. Informed NGCT ES 2020.
2017	Northern Gateway No. 1 Container Operation - Vessel navigation assessment using numerical modelling of current flows.	Royal HaskoningDHV, 2017b	3-D numerical modelling of the tidal current streams within the Tees (particularly in the vicinity of the turning circle and Tees Dock) to provide input data to a vessel simulator for PDT. Informed NGCT ES 2020.
2019	Tidal Stream Atlas.	Royal HaskoningDHV, 2019b	Atlas of tidal current streams within the Tees (particularly in the vicinity of the turning circle and Tees Dock) derived from 3-D numerical modelling of the tidal current streams to inform vessel pilots for PDT. Informed NGCT ES 2020.
2020	NGCT - Environmental Statement.	Royal HaskoningDHV, 2020b	Baseline description largely based on NGCT 2006 ES and corroborated through review of all above further information. Supplemented with further analysis of climate change projections using UKCP18 outputs and Environment Agency (EA) guidance December 2019.

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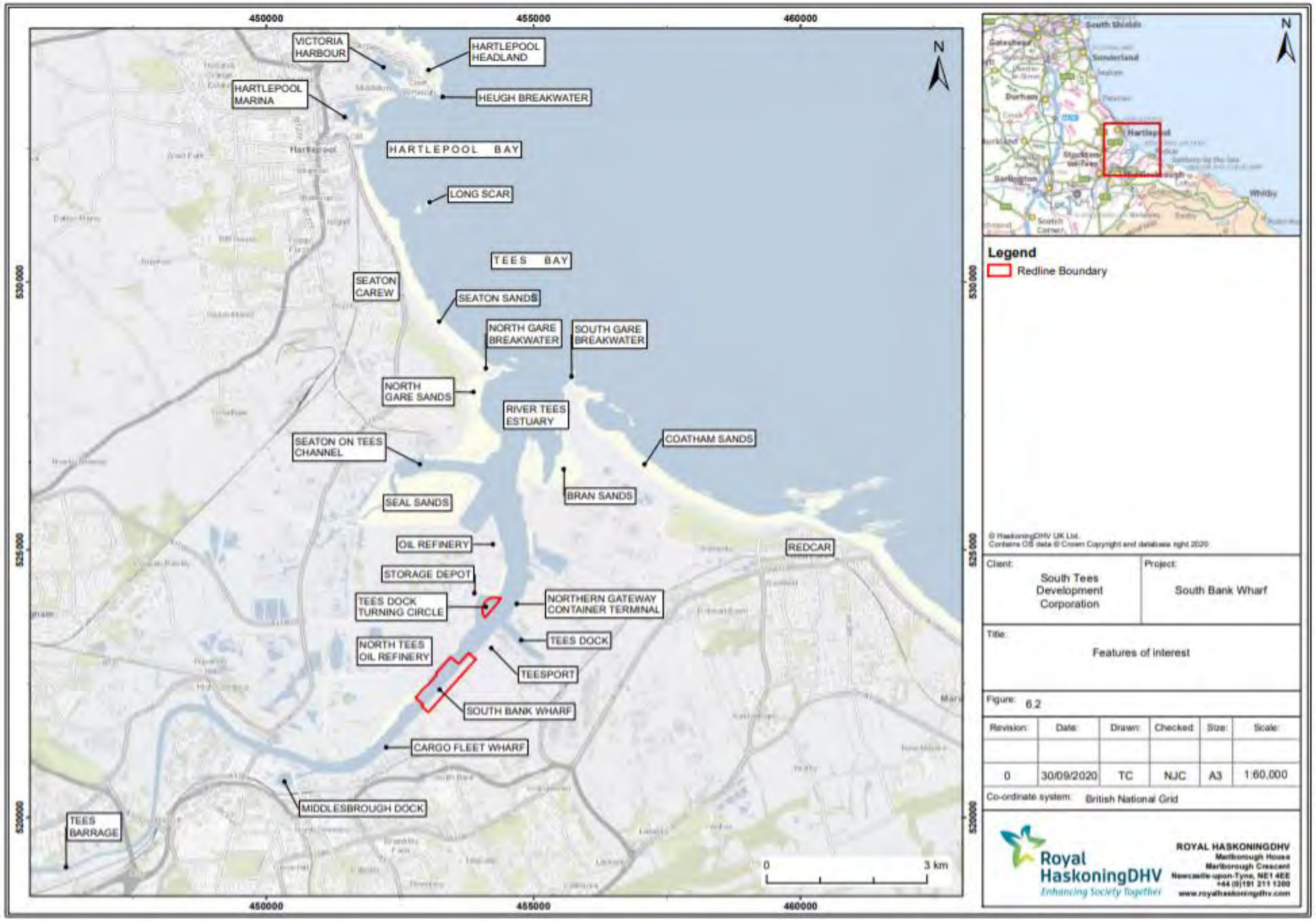

Figure 6.2 ***Features of interest***

6.3.3 Review of existing information

There has been much previous work undertaken to characterise the baseline hydrodynamic and sedimentary regime of the Tees estuary, carried out over many decades. This work is summarised below in **Table 6.6**, together with an overview of how it has been developed and incorporated into subsequent studies.

Table 6.6 Review of existing information on the baseline hydrodynamic and sedimentary regime

Date	Study	Reference	Comments
1989	Tees Barrage - Effect of the barrage on marine mud siltation.	HR Wallingford, 1989	Incorporated within NGCT ES 2006.
1989	Tees Weir Feasibility Study - Correlation between waves, tides and suspended mud concentrations in Tees Bay.	HR Wallingford, 1989	
2002	Teesmouth Sediment Study.	HR Wallingford, 1989	
2002	Conceptual model of estuary processes.	ABPmer, 2002	
2005	Maintenance dredging baseline document.	ABPmer, 2005	
2006	NGCT Environmental Statement.	Royal Haskoning, 2006	Baseline characterisation and assessment of construction and operation effects, based upon numerical modelling. Informed NGCT ES 2020.
2007	NGCT Environmental Statement Supplement.	Royal Haskoning, 2007a	Further information relating to sediment contamination and potential impact on water quality, and further information on changes in tidal prism at north Tees mudflats. Reviewed for consideration within NGCT ES 2020.
2007	Tees maintenance dredging baseline document.	Royal Haskoning, 2007b (updated by Royal HaskoningDHV in 2017a, 2018, 2019a and 2020a)	Documents the maintenance dredging material regularly removed from the Tees estuary, and the potential implications of maintenance dredging and disposal for European and Ramsar sites. Informed NGCT ES 2020.
2009	QEII Berth Development – Environmental Statement.	Royal Haskoning, 2009	Baseline description largely based on NGCT 2006 ES, but updated with further information about maintenance dredging regimes and materials arising from above and informed by modelling for scheme-related effects. Informed NGCT ES 2020.
2011	Tees Dock No.1 Quay – Technical Note.	Royal Haskoning, 2011	Agreed with regulators that existing modelling results from the NGCT and QEII schemes could be used to provide suitable evidence upon which to base predictions of possible effects from the proposed dredging operations required for this scheme. Informed NGCT ES 2020.
2014	Anglo American Harbour Facilities – Environmental Statement.	Royal HaskoningDHV, 2014	Modelling of scheme-related effects included tidal flow modelling, wave modelling, sediment transport, bed change modelling and modelling of sediment plume released from construction activities. Informed NGCT ES 2020.
2017	Northern Gateway No. 1 Container Operation - Vessel navigation assessment using numerical modelling of current flows.	Royal HaskoningDHV, 2017b	3-D numerical modelling of the tidal current streams within the Tees (particularly in the vicinity of the turning circle and Tees Dock) to provide input data to a vessel simulator for PDT. Informed NGCT ES 2020.
2019	Tidal Stream Atlas.	Royal HaskoningDHV, 2019b	Atlas of tidal current streams within the Tees (particularly in the vicinity of the turning circle and Tees Dock) derived

Date	Study	Reference	Comments
			from 3-D numerical modelling of the tidal current streams to inform vessel pilots for PDT. Informed NGCT ES 2020.
2020	NGCT - Environmental Statement.	Royal HaskoningDHV, 2020b	Baseline description largely based on NGCT 2006 ES and corroborated through review of all above further information. Supplemented with further analysis of climate change projections using UKCP18 outputs and Environment Agency (EA) guidance December 2019.

This section makes best use of existing information from the sources listed in **Table 6.6** and combines it with newly collected project-specific data from bespoke metocean surveys to characterise the baseline environment.

In addition, an analysis of historical data, including dredge and disposal volumes and land reclamation from the Tees Estuary, was used to identify past and predict future trends in morphology through an Historical Trend Analysis (HTA) (Pye and van der Wal, 2000a).

6.3.4 Metocean survey

A metocean survey was undertaken within the Tees estuary by Partrac in July 2020 to provide relevant information to inform the baseline understanding and input to the numerical modelling and design of the proposed scheme. This involved the collection of: (i) tidal levels; (ii) tidal current velocities; (iii) conductivity, temperature and depth (CTD) casts; (iv) water samples for assessment of turbidity; and (v) wind speed.

Vessel-based surveys were undertaken along three transects crossing the river channel in the vicinity of the proposed scheme to characterise the channel bathymetry using single-beam echo sounder and record tidal currents using vessel mounted Acoustic Doppler Current Profiler (ADCP). The start and end coordinates of these transects is shown in **Table 6.7** and the transects are plotted in **Figure 6.3**. CTD casts and water sampling for turbidity were undertaken at the central point of the middle transect (Transect 8). Surveys were undertaken on 24th July 2020 to characterise a spring tide event (with a predicted tidal range of 3.9m) and on 30th July 2020 to characterise a spring tide event (with a predicted tidal range of 2.7m). During both the spring and neap survey dates, each of the three transects was surveyed, in sequence, on a total of 26 occasions, thus providing a record of the tidal cycle over 13 hours on each day. In addition, 26 CTD casts and water samples were collected from each of the spring and neap surveys.

Table 6.7 Metocean survey transect locations

Transect	Start of Line (OSGB36)		End of Line (OSGB36)		Length (m)
8	453255.98	522407.69	453066.33	522573.64	252
9	452799.73	521863.71	452590.08	522029.66	252
11	453629.00	522878.99	453439.35	523044.94	252

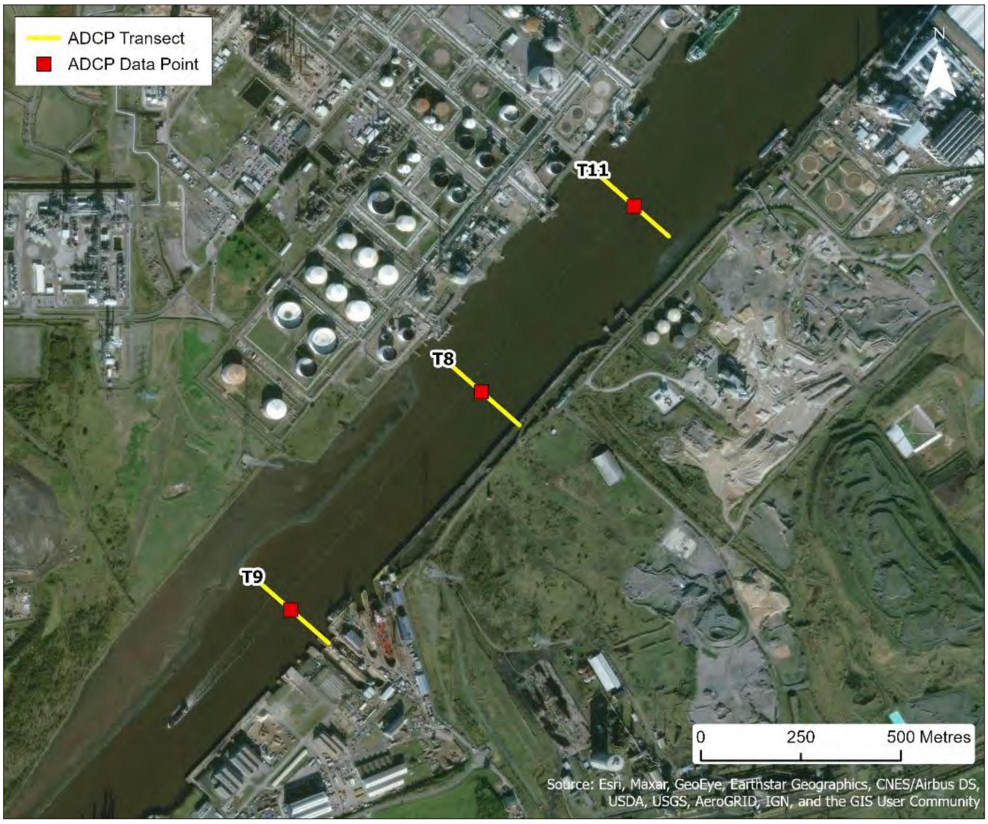

Figure 6.3 Metocean survey transect locations

Measured tidal levels from Tees riverside and wind velocities from South Gare were obtained from PDT for a period coincident with the vessel-based surveys to aid in the analysis.

Full details of the surveys, including operations, equipment, calibrations and verifications, configuration, mounting, software configuration, data quality control, data processing, survey vessel and health, safety and environmental performance, is provided in the survey report (Partrac, 2020 - see **Appendix 4**).

6.3.5 Numerical modelling

The baseline understanding and assessment of potential effects of the proposed scheme draws from results of numerical modelling which has adopted the following approaches:

- **Wave and wind conditions**: Since the site is well sheltered from North Sea swell waves, it is locally-generated wind waves that are of more significance at the proposed scheme. To demonstrate this understanding of the baseline wave conditions, an established North East Coast Wave Model built in MIKE-SW was used to transform extreme offshore waves (1 in 1 year and 1 in 100 year) to the site. In addition, extreme value analysis was undertaken for extreme wind conditions in the Tees Estuary. Locally-generated waves caused by extreme winds were then hindcast using a Tees Estuary Wave Model, also built in MIKE-SW.

- **Hydrodynamic modelling**: An existing 2D North East Regional Tidal Model built in MIKE-2D was used to provide boundary conditions for an existing 3D Tees Estuary Tidal Model built in MIKE-3. The latter model was updated with new bathymetry data and its mesh was refined around the site of the proposed scheme. The model was re-calibrated and then further verified using the acoustic doppler current profiler (ADCP) data newly-collected as part of the metocean survey. The updated and verified 3D model was then used to characterise baseline conditions and predict potential local and estuary-wide changes in hydrodynamics caused by the proposed scheme. The model was run for three different fluvial flow conditions (e.g. mean daily flow, Q_{med} and 1 in 100 year flow).

- **Sediment plume modelling**: The updated and verified 3D Tees Estuary Tidal Model was used to predict movement of suspended sediment from the proposed dredging and disposal activities by coupling with a sediment plume model built in MIKE21-MT software. The sediment plume model was run for the entire dredging and disposal period under astronomic tidal and daily mean fluvial flow conditions.

6.3.6 Impact assessment

Results from the review of existing information, HTA, metocean survey and numerical modelling were synthesised and used in combination with knowledge of other factors, such geological constraints, sediment supply, physical processes and anthropogenic activities, to describe the effects of the proposed scheme on the baseline hydrodynamic and sedimentary regime through an Expert Geomorphological Assessment (EGA) (Pye and van der Wal, 2000b).

6.4 Existing environment

6.4.1 General overview

Tees Bay is largely dictated at a macro-scale by the Permian Magnesium Limestone outcrop at Hartlepool Headland (the physical effect of which is exacerbated by the presence of the Heugh breakwater) and a sandstone outcrop at Redcar. Between these constraints, the coastline within Tees Bay has few rock exposures and mostly consists of boulder clay and alluvial deposits up to 30m thick overlying Sandstone and topped by marine-derived sand. Within this context, the mouth of the Tees estuary exerts a significant influence, effectively dissecting the frontage into two.

In the north, Hartlepool Headland (and, by way of an accentuation of its effect, The Heugh breakwater) causes a wave sheltering effect (**Figure 6.4**) and induces a tidal current gyre in its lee (**Figure 6.5**) at the northern end of Hartlepool Bay. As a consequence, there is a deposition of some sand in the navigation approach channel to Victoria Harbour. Due to their sheltered locations, there is also deposition of sand in the harbour and marina berths. All of these locations require dredging to maintain a safe navigable depth of water.

South of Hartlepool Old Town, there is generally a southerly drift of sand within the littoral zone, but this is interrupted initially by the Long Scar rock outcrop, which acts to pull the shoreline forward by creating shelter in its lee, and then by the North Gare Breakwater at the mouth of the Tees estuary.

The effect of the North Gare Breakwater in retaining beach sand on its updrift side is well demonstrated by the increasing beach widths to the south along Seaton Carew. At this location, there was historically sand extraction from the dunes and foreshore. This activity continues, on a small scale, inside the mouth of the estuary on North Gare Sands, but this is in an area where there is considerable sand deposition because the outer estuary acts as a major sink for marine sand and the North Gare Breakwater provides shelter against waves and induces a tidal current gyre, in a similar manner to that previously described at Hartlepool Headland.

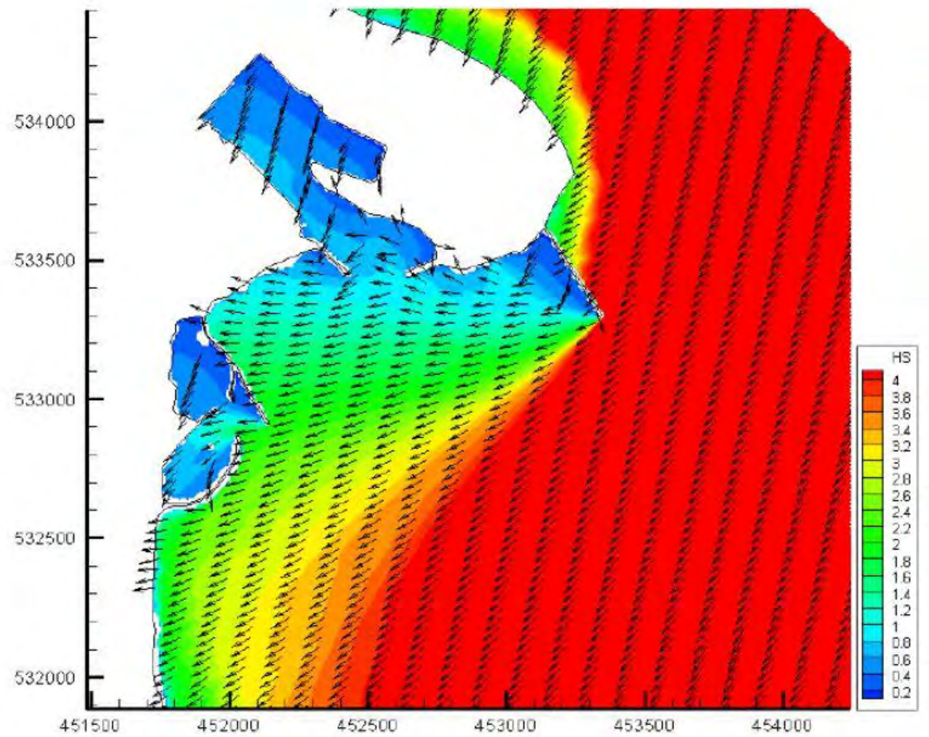

Figure6.4 Wave shelter in the lee of Hartlepool Headland (Royal HaskoningDHV, 2013)

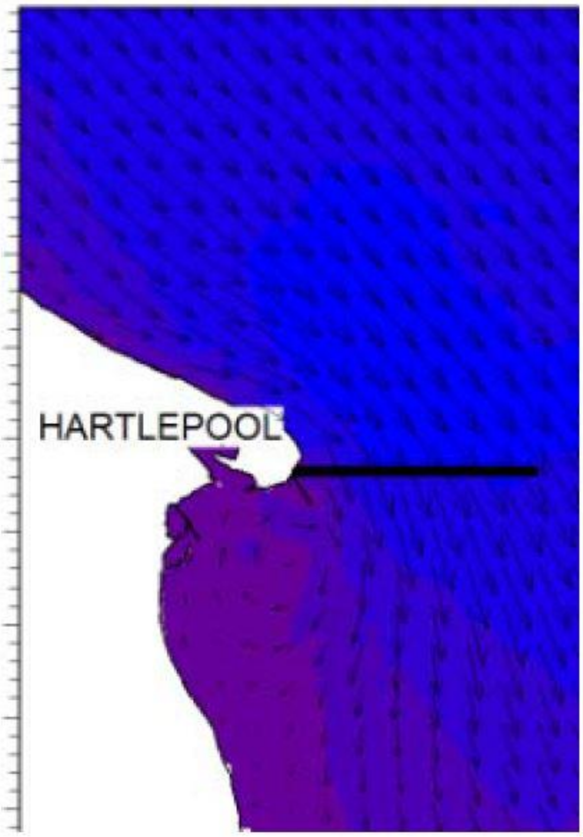

Figure 6.5 Tidal gyre in the lee of Hartlepool Headland (Royal HaskoningDHV, 2013)

Further upstream of the mouth, the Tees estuary also acts as a major sink for river-born silts and a number of reaches require maintenance dredging to remove both sands and silts. The volume of sediments dredged annually from the Tees estuary and Hartlepool's Victoria Harbour and approaches varies depending on the rates of accumulation that have been experienced, but over the long term is of the order of 1.1Mm^3 cumulatively (Royal HaskoningDHV, 2013). A notable proportion of this sediment is marine sand that is dredged from the river mouth and navigation approach channels within Tees Bay, with river silts mainly dredged from within the berths and river channel further upstream in the Tees estuary.

Prior to the mid-19th century, the Tees estuary was a wide, shallow estuary bordered by extensive wetlands and had tidal ingress for about 44km inland from the mouth (see **Figure 6.6**). Since this time, the estuary has undergone substantial anthropogenic changes as the channel was trained, land was reclaimed and the channel deepened to its present depth. The role of the River Tees in supplying fine sediment to the coastal zone has been reduced considerably by the construction of the Tees Barrage. The barrage was designed to allow bypassing of sediment, but observed accumulations upstream, and a 24% reduction in the dredging requirement of the harbour, indicates that much of the river sediment is trapped by the structure (Royal Haskoning, 2014).

Figure 6.6 Tees Estuary OS One Inch, 1885-1900 map series (reproduced with the permission of the National Library of Scotland, 2020)

Anthropogenic activities over the last 150 years have therefore resulted in an estuary that now is, essentially, a narrow 'canalised' channel bordered near the estuary mouth by sandy/muddy intertidal areas with a channel that is partly trained by various historic training works. The level and form of much of the intertidal area is controlled by the presence of these training works. Within this area, a remnant of the originally larger Seal Sands is divided from the other intertidal areas by Seaton on Tees Channel.

6.4.2 Bathymetry

Historical charts suggest that the natural channel level at the mouth of the Tees estuary is around -10m OD (Newlyn) (7.15m below CD). As a result of training works and deepening by dredging, the current depth at the mouth is about double this natural level. Dredging and training works have occurred since the establishment of the first dredged channel of 4.3m from Middlesbrough Docks to the sea after 1853.

No significant changes in estuary bathymetry have occurred since the NGCT ES was written in 2006. The only notable project undertaken since that time has been the dredging and re-strengthening of No.1 Quay in Tees Dock; all works associated with this project were contained within Tees Dock, and therefore it is considered that this removes the potential for any significant impacts to have arisen to the bathymetry of the estuary.

Generally, there has been net infilling of the estuary (the estuary and the wider Tees Bay act a sink for sediments) which is offset by maintenance dredging and disposal at offshore licenced disposal site Tees Bay A (see **Section 6.4.4**).

PDT is required by the Tees and Hartlepool Port Authority Act 1966 to publish dredge depths; the published Admiralty Charts show the maximum licensed depths for the channel and berths. A summary of the dredge depths is provided below.

The present main channel in the Tees has a declared depth of 15.4m bCD in the approach channel (i.e. in Tees Bay), 14.1m bCD to upstream of Redcar Ore Terminal, 10.4m below CD up to Teesport and then progressively less depth up to 4.5m below CD in Billingham Reach. Parts of the channel now declared at 14.1m below CD were originally dredged to a deeper depth.

The declared depth of berths and docks varies depending on the location and the vessels which require access. The berth pocket within Tees Dock has been dredged to a depth of 14.5m below CD, with the general dock area dredged to 10.9m below CD.

Single beam echo sounder data recorded during the July 2020 metocean survey (Partrac, 2020) reveal the channel bathymetry to be broadly similar and largely featureless along the three surveyed transects (T8, T9 and T11). Directly adjacent to the proposed scheme at T8, the bed depth is around -10mODN with a shallow bank towards the southern edge. Upstream at T11 the channel is deeper, at around -12 to -14mODN but the shallower bank on the southern edge is also present. Downstream at T9, the channel is slightly shallower than at T8, at around -9.5 to -10.0mODN, with a bank on the northern edge.

6.4.3 Hydrodynamic regime

Water levels

Tidal water levels are predominantly governed by astronomical effects but can also be significantly influenced (elevated or depressed) by meteorological influences and surge effects.

Astronomical tidal levels

The tidal curve at the mouth of the Tees estuary is observed to be very close to sinusoidal in shape with ranges of 4.6m and 2.3m for mean spring and neap tides, respectively (UKHO, 2020). The other astronomical tidal parameters of the estuary mouth are presented in **Table 6.8**.

Table 6.8 Tidal levels for the Tees estuary

Description	Level (m CD)	Level (m ODN)
Highest astronomical tide	6.10	3.25
Mean high water spring tide	5.50	2.65
Mean high water neap tide	4.30	1.45
Mean sea level	3.20	0.35
Mean low water neap tide	2.00	-0.85
Mean low water spring tide	0.90	-1.95
Lowest astronomical tide	0.00	-2.85

Extreme water levels

The regular, predictable astronomical tidal levels can strongly be influenced by meteorological effects, such as wind set-up and surge. This can clearly be seen from a timeseries of measured water level data at Tees Dock tide gauge from 2005 (**Figure 6.7**) where around the 29/30th April a 'spike' in the measured data occurs compared with modelled data covering the same period. This correlates with the occurrence of a real-time surge which was captured by the measured data.

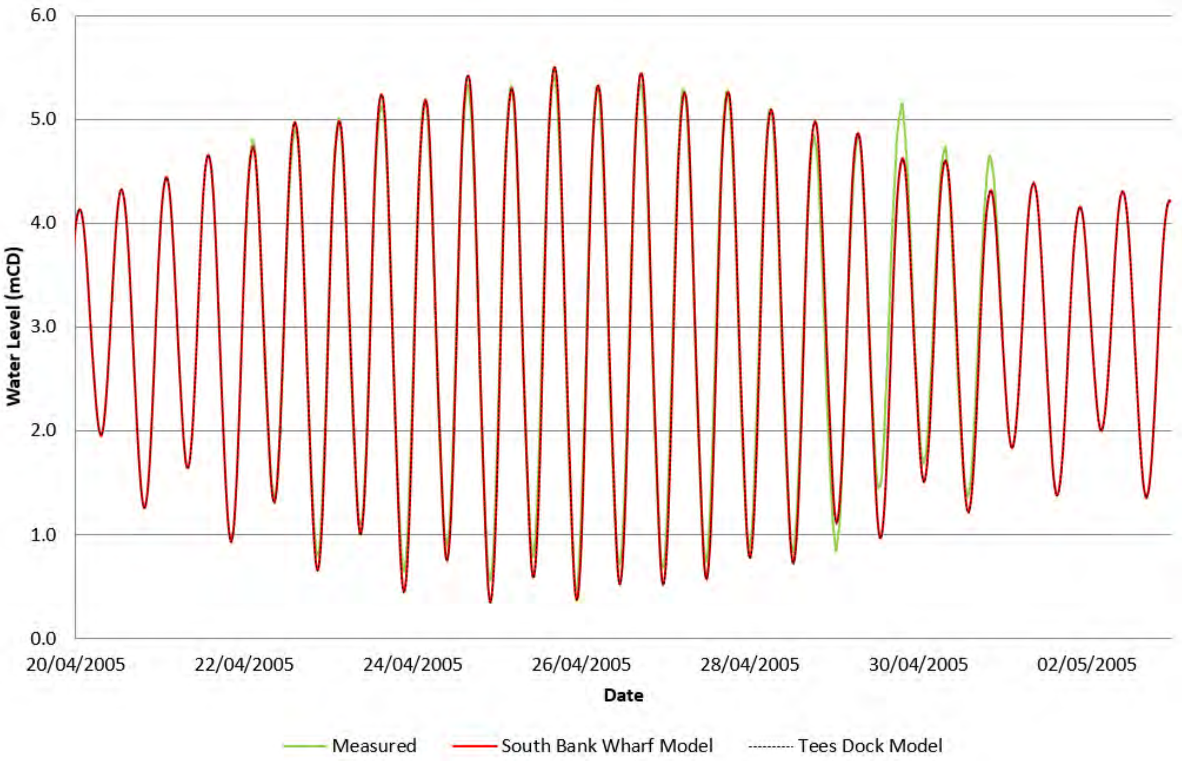

Figure 6.7 Comparison of Measured and Modelled Tidal Elevation at Tees Dock Tide Gauge

The most recent published sources of information on extreme water levels are the Environment Agency's Coastal Flood Boundaries (CFB) outputs for Tees Bay (Environment Agency, 2018) and the Environment Agency's Tees Estuary modelled outputs that are used to inform published flood risk maps. Extreme water level values from these sources for various return period events, together with associated confidence levels where published, are presented in **Table 6.9**. Note that the Tees Estuary model was run by the Environment Agency for only the 1 in 200 year and 1 in 1,000 year events and has a base date of 2011, whereas the CFB outputs cover a wider range of return periods (with confidence levels) and have a base date of 2017.

Royal HaskoningDHV

Table 6.9 **Extreme water levels for Tees Bay and Tees Estuary (2017 baseline)**

Return Period	Tees Bay (2017 base date)		Tees Estuary (2011 base date)
	Level (m ODN)	Confidence limits (m)	Level (m ODN)
1 in 1 year	3.36	± 0.1	-
1 in 5 years	3.56	± 0.1	-
1 in 10 years	3.65	± 0.1	-
1 in 25 years	3.77	± 0.1	-
1 in 50 years	3.86	± 0.1	-
1 in 100 years	3.96	± 0.2	-
1 in 200 years	4.07	± 0.2	4.13
1 in 1000 years	4.32	± 0.4	4.39

Measured water levels

During the metocean surveys in July 2020, water levels were measured over both a spring and neap tidal cycle using vessel-based Real Time Kinematics (RTK) and compared against measured data from the permanent tide gauge installed and operated along the riverbank by PDT. There was excellent correlation between the two datasets. **Figures 6.8** and **6.9** show the tidal curves for the spring tide survey and neap tide survey, respectively.

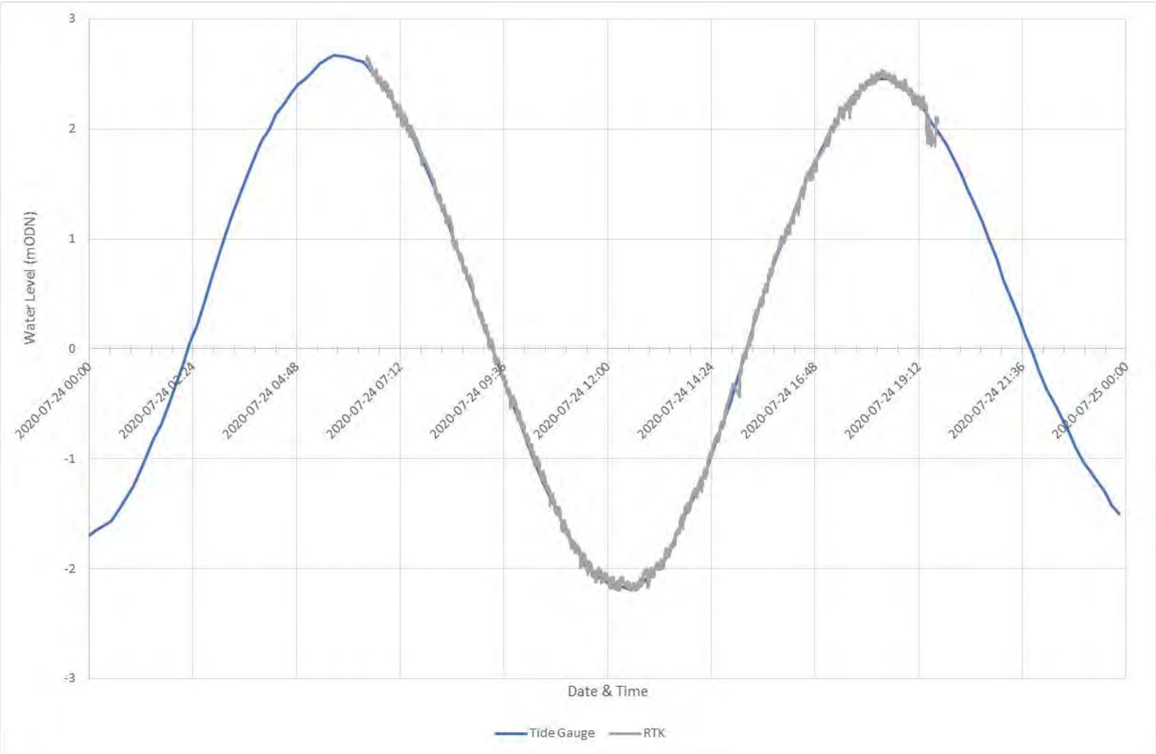

Figure 6.8 **Measured tidal data during spring tide metocean survey**

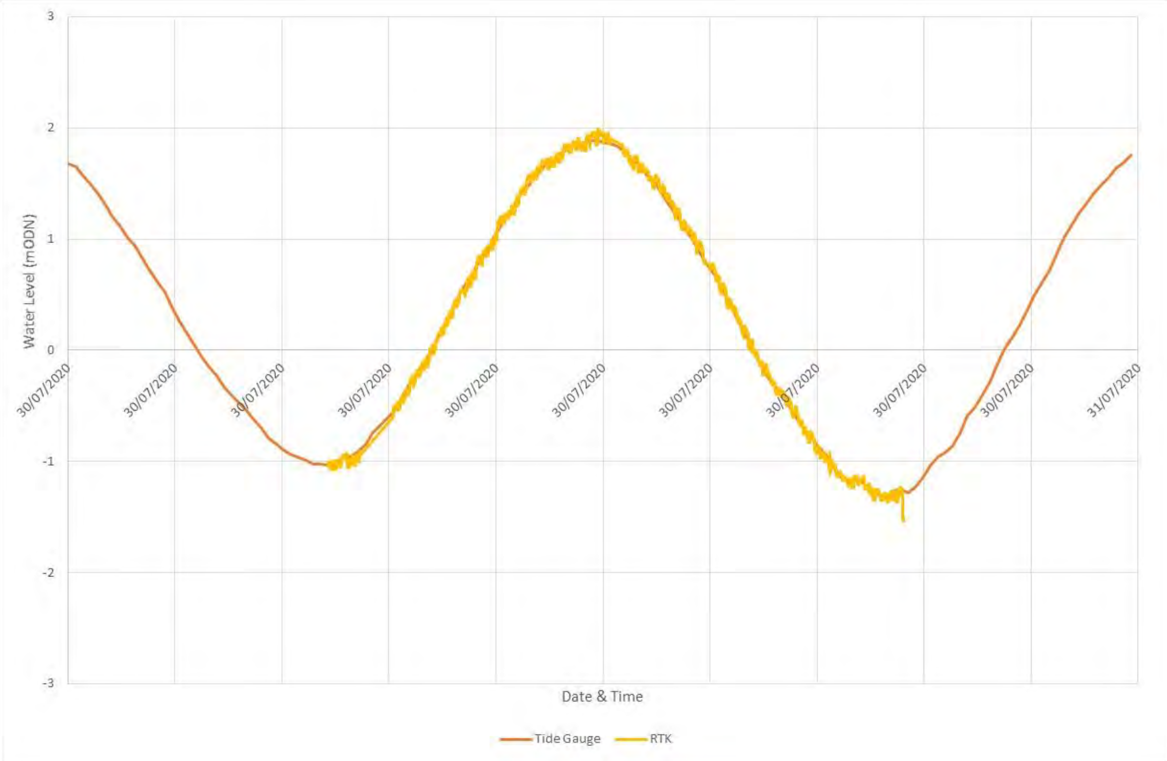

Figure 6.9 Measured tidal data during neap tide metocean survey

Tidal currents

Tees Bay and the Tees estuary attract sediment because the tidal current flows are generally quite low compared to many other coastal areas. This is due to Tees Bay forming a shallow embayment within the general alignment of the north east coastline. The low tidal current flows mean that sands brought into Tees Bay from the North Sea tend to settle on the sea or riverbed below the water surface, gradually building up over time.

The tidal current flow patterns within Tees Bay generally run parallel to the shore, flowing towards the south on the flooding tide and towards the north on the ebbing tide. Generally, these tidal flow patterns determine the transport of sediment within Tees Bay, with an overall tendency for southerly directed transport because the flood tides are stronger than the ebb tides. The larger waves that occur during storm events will stir sediment from the seabed enabling more to become transported by the tidal currents during these storms. However, there are also more complex patterns in the vicinity of features which interrupt the general flow patterns, as previously discussed for the Hartlepool Headland and the North Gare Breakwater, and these subtleties locally influence sediment transport in these locations.

Within the River Tees estuary, tidal current measures were recorded along a series of cross-channel transects from 22nd to 30th April 2005 (covering both a spring tide and a neap tide) using vessel-mounted ADCP. The location of these transects is shown in **Figure 6.10**. These data have previously been used to characterise baseline conditions and calibrate a MIKE-21/ MIKE-3 flexible mesh hydrodynamic (HD) model of the Tees for use in many previous studies.

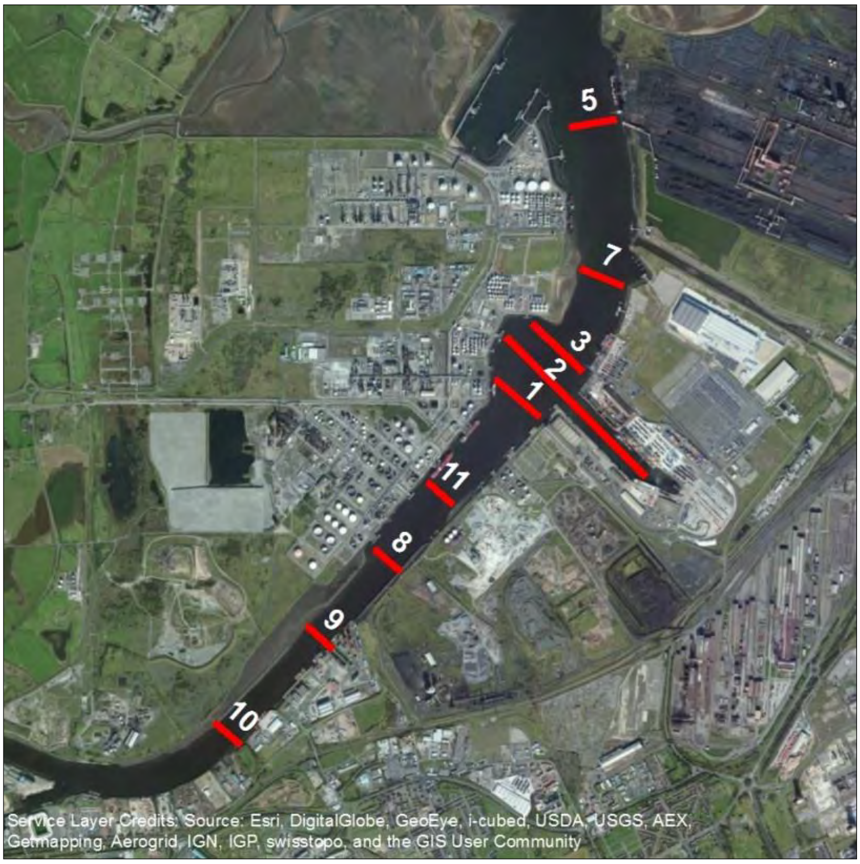

Figure 6.1 Location of ADCP transects in the River Tees (2005 survey)

Due to the length of time that has passed since these data were collected, vessel-mounted ADCP data were newly collected from transects 11, 8 and 9 in July 2020 to inform the present study. These transects represent river channel sections downstream (#11), at (#8) and upstream (#9) of the proposed scheme. Current velocities recorded during this most recent survey are presented in **Table 6.10**, indicating relatively low current speeds within the estuary, even during spring tides. It is also notable that peak current speeds during neap tides occurred on the ebb phase of the tide, whereas the reverse was observed during the spring tides. This indicates that the river flows have a relatively lesser effect on overall currents during spring tides.

Table 6.10 Tidal current velocities for the Tees estuary

Transect	Tide Condition	Recorded current during July 2020 ADCP Survey			
		Minimum Speed (m/s)	Average Speed (m/s)	Maximum Speed (m/s)	Direction at Maximum Speed (°N)
T8 (at site)	Neap	0.00	0.11	0.23	215 (i.e. ebb tide)
	Spring	0.01	0.18	0.40	42 (i.e. flood tide)
T9 (upstream)	Neap	0.00	0.12	0.25	221 (i.e. ebb tide)
	Spring	0.01	0.18	0.35	40 (i.e. flood tide)
T11 (downstream)	Neap	0.00	0.08	0.18	228 (i.e. ebb tide)
	Spring	0.01	0.14	0.31	41 (i.e. flood tide)

Numerical modelling of hydrodynamic currents during both neap and spring tides was undertaken, each with a mean daily river flow through the Tees Barrage (20 cumecs), to further characterise the baseline conditions. **Figures 6.11** and **6.12** show the peak current speeds during the flood and ebb phases of a neap tide with a mean daily river flow, whilst peak current speeds during corresponding phases of a spring tide with a mean daily river flow are shown in **Figures 6.13** and **6.14**. These plots confirm the findings of the measured data, showing maximum current speeds greater on the spring tides than the neap tides and a tendency for ebb dominance during neap tides and flood dominance during spring tides. Note that the layout of the proposed scheme is shown on these figures for context only (these model runs represent the baseline conditions without the scheme in place).

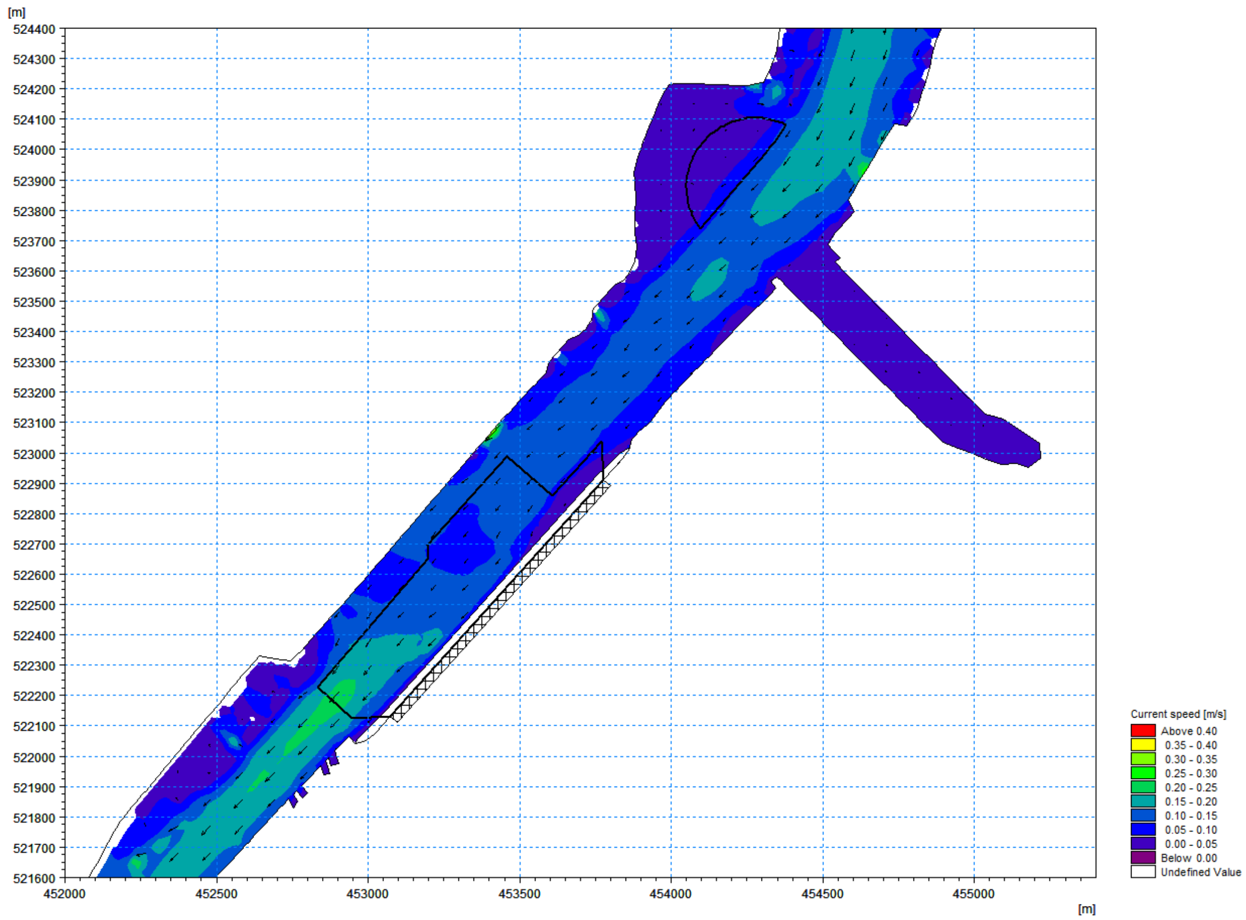

Figure 6.11 Peak current velocities during the flood phase of a neap tide with mean daily river flow - baseline

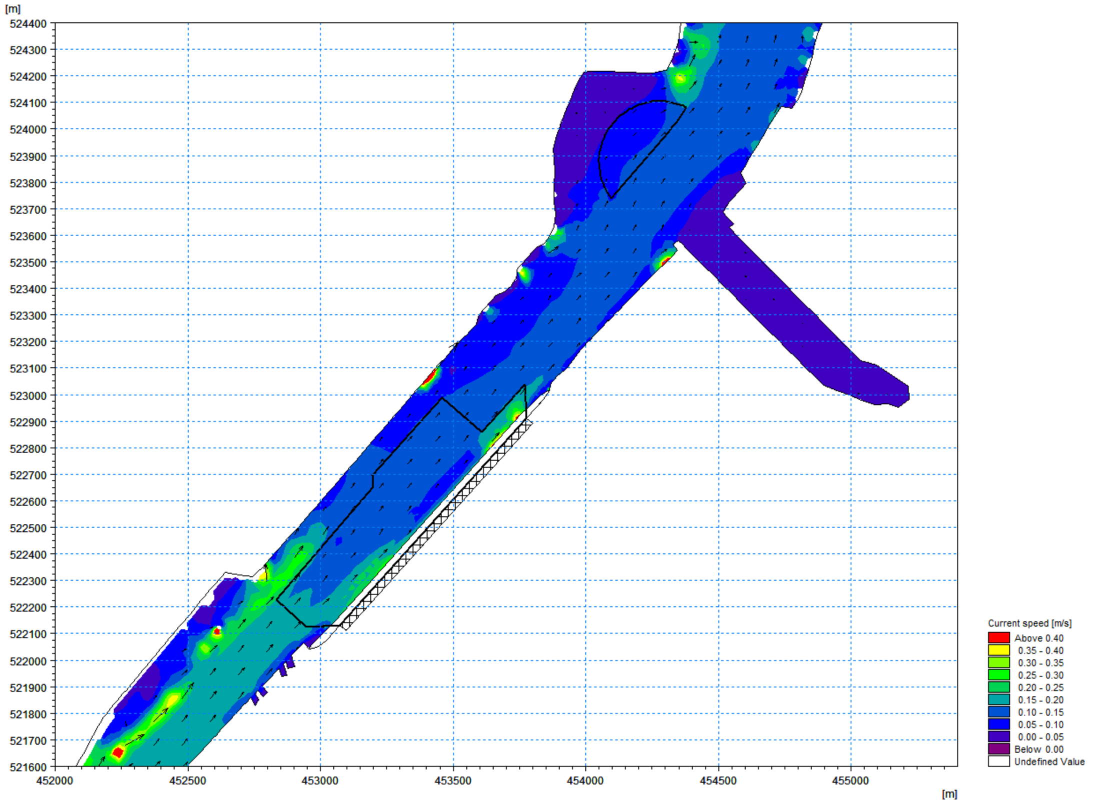

Figure 6.12 Peak current velocities during the ebb phase of a neap tide with mean daily river flow - baseline

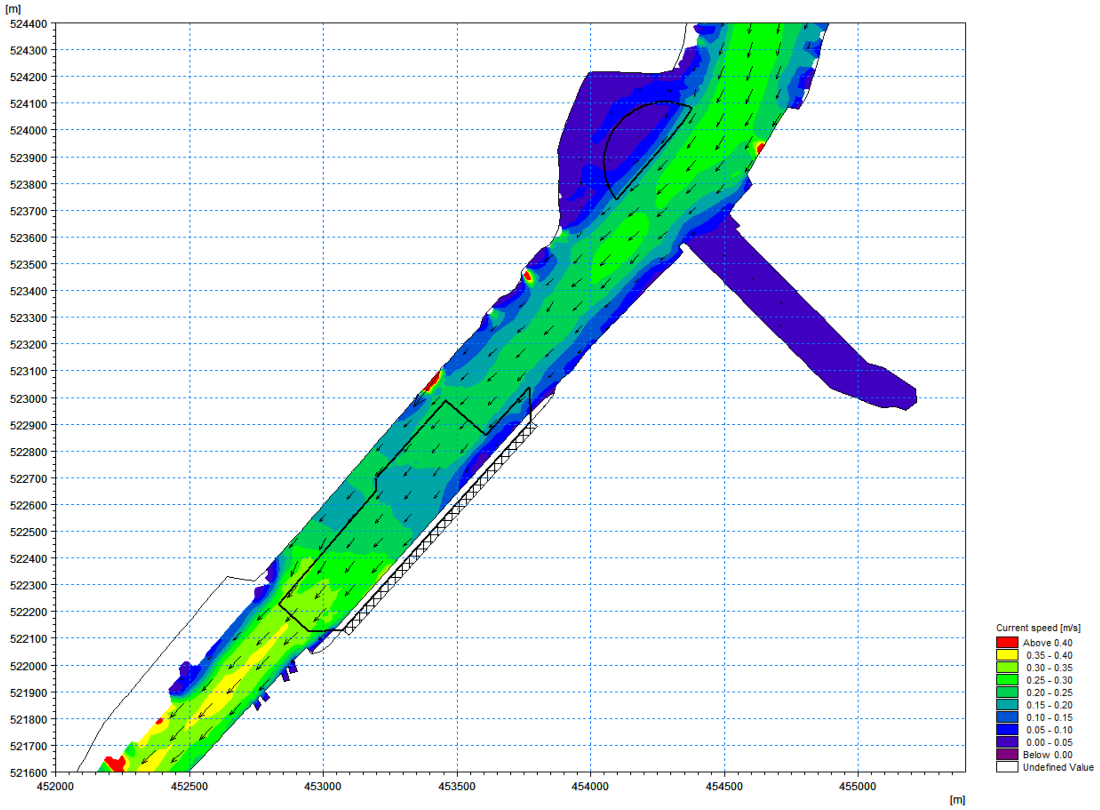

Figure 6.13 Peak current velocities during the flood phase of a spring tide with mean daily river flow - baseline

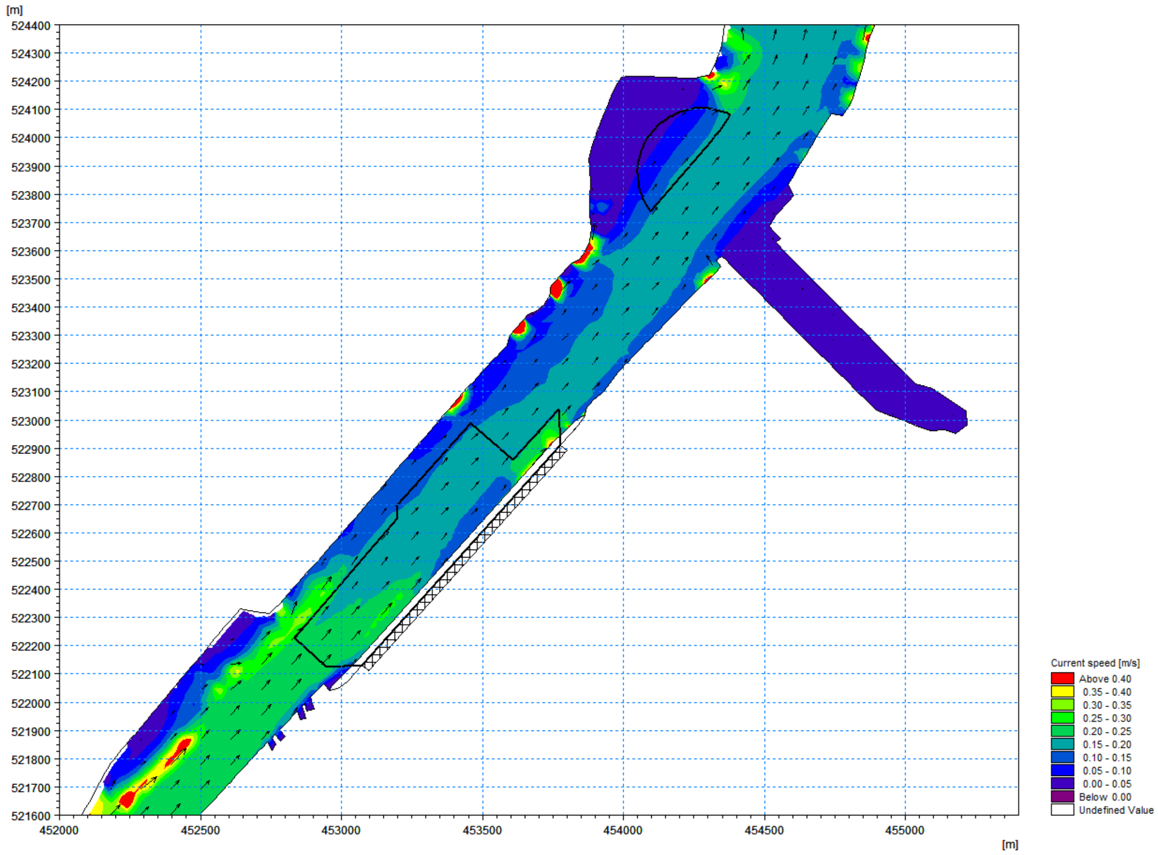

Figure6.14 Peak current velocities during the ebb phase of a spring tide with mean daily river flow - baseline

Flow discharges and mixing

The River Tees has its source about 160km from the sea on Cross Fell in the Pennines and drains a catchment of 1932km^2. The main freshwater input to the estuary is measured at Low Moor. HR Wallingford (1992) calculated the long term monthly mean flows for the period 1981-88 as shown in **Table 6.11**.

Table 6.11 Monthly mean flow at Low Moor

Month	Mean daily flow (m^3/s)	Month	Mean daily flow (m^3/s)
Jan	36.7	Jul	8.6
Feb	21.2	Aug	11.2
Mar	26.6	Sep	12.5
Apr	19.6	Oct	22.0
May	12.5	Nov	26.1
Jun	9.3	Dec	30.0

Lewis *et al.* (1998), also looked at the flows at Low Moor and presented a long-term average flow of 20m^3/s, a maximum recorded flow of 563m^3/s, a minimum of less than 3m^3/s and a 10% exceedance flow of about 47m^3/s.

Before reaching the proposed scheme, the Tees' fluvial flow is regulated by the Tees Barrage, which is operated to maintain upstream water levels and prevent the upstream penetration of saline water. The regulated flow through the barrage is, therefore, very unlike the natural flow that would otherwise occur, especially as the flows are no longer continuous. **Figure 6.15** shows the time history of recorded discharge through the barrage during June – July 2020.

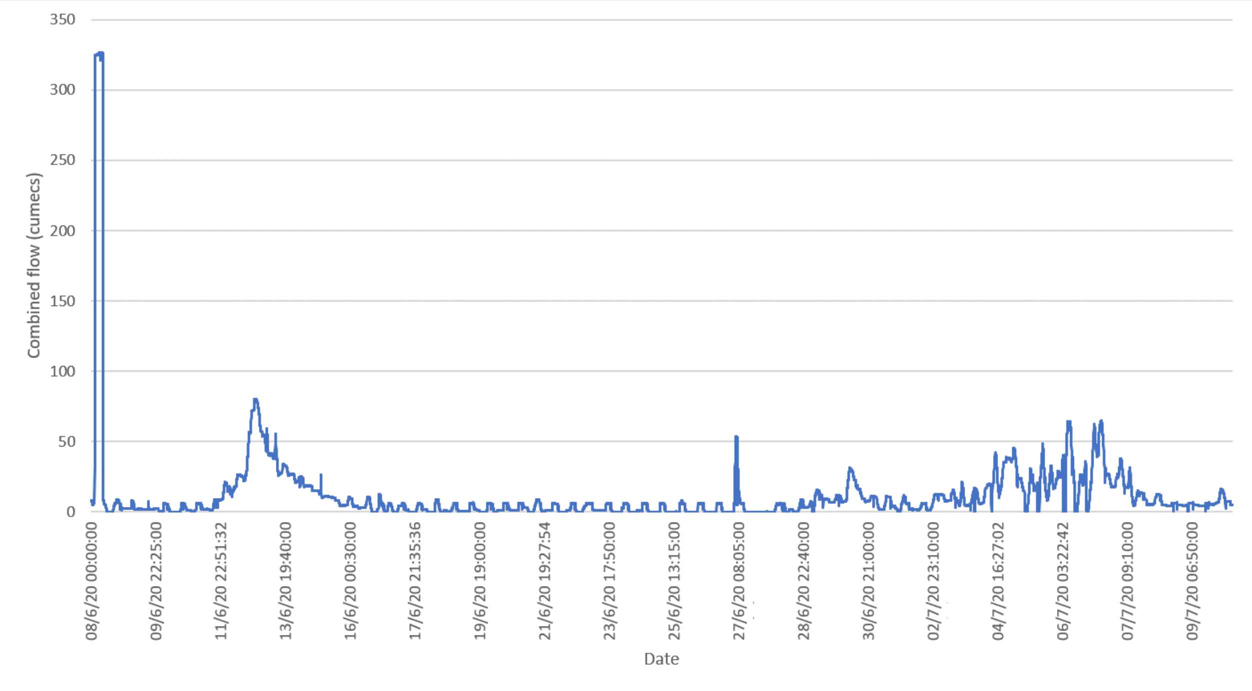

Figure 6.15 Flow measured through the Tees Barrage June – July 2020 (Canal and Rivers Trust, 2020)

The regulated freshwater flow enters the estuary and partially mixes with saline water entering through the estuary mouth. This partial mixing and the longitudinal salinity gradient both contribute to a density driven gravitational circulation. This effect is a result of the density changing the vertical profile of the flow such that the ebb flows are strong at the surface whereas the flood flows are more evenly spread through depth. The tidally averaged currents tend, therefore, to be seawards in the surface waters and landwards in the waters closer to the bed.

In the Tees estuary, under many circumstances this effect becomes dominant such that continuous near-bed upstream (flooding) flows are observed. These effects are important in supplying sediment to the estuary from offshore (the main sediment supply).

During the metocean surveys in July 2020, CTD measurements were taken at the centre point of transect T8 on 26 occasions during each of the neap tide and spring tide surveys, and results show evidence of formation of both a halocline (**Figure 6.16**) and a thermocline (**Figure 6.17**).

The halocline was observed to occur over 2m to 4 m depth within the water column. Within this zone the waters are fresher than those at greater depths, and the halocline shows a variation in structure throughout the surveys. The homogenous layer beneath the halocline shows very little structural change throughout the surveys.

During the spring survey a tidal signature was observed in the halocline layer. Greatest stratification occurs at low water, whereas with progression towards high water the stratification reduces due to increasing tidal influence.

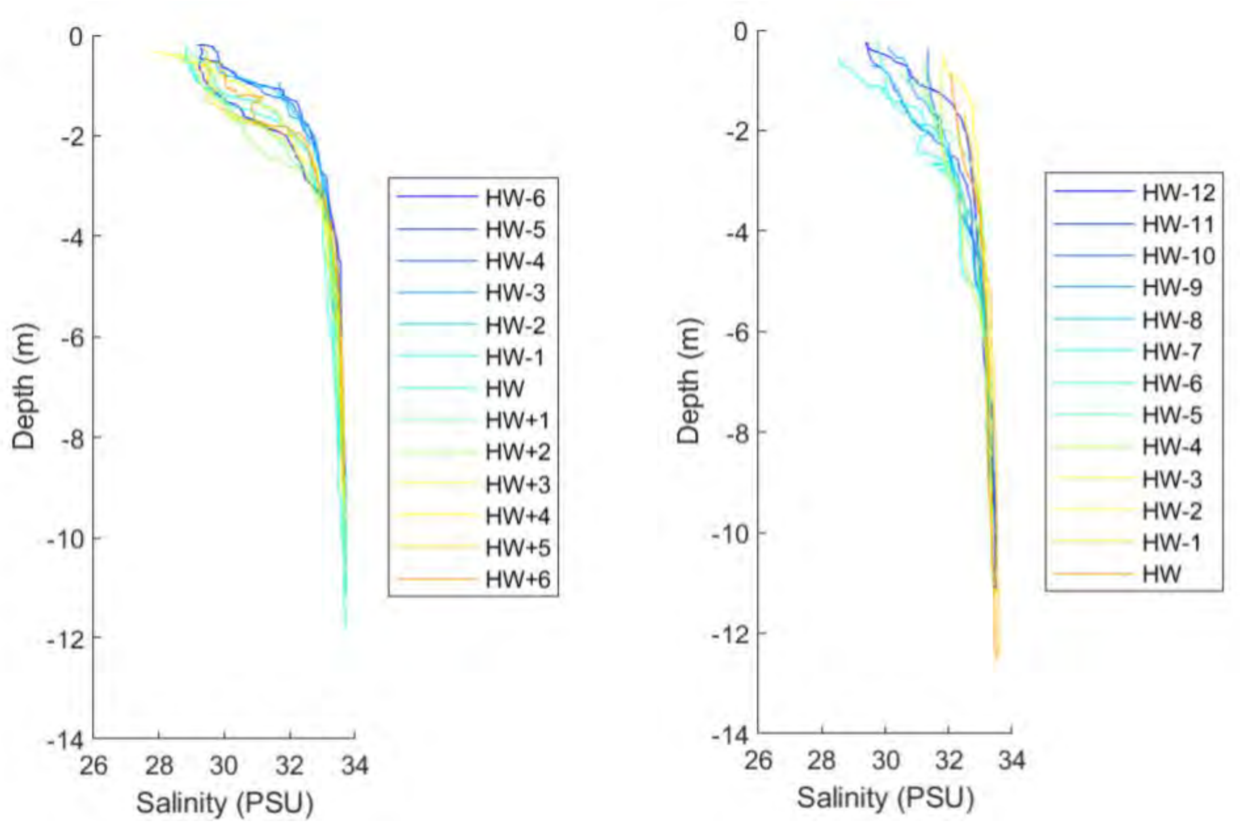

Figure 6.16 Measured hourly salinity profiles at the centre of transect T8 during neap (left) and spring (right) tides in July 2020

During both spring and neap surveys, it is evident that surface waters warm by around 1.5°C to reach temperatures close to 16°C.

During the neap survey, the thermocline between warmer near-surface waters and cooler deeper waters exists at 2m to 3 m depth. The bottom layer of the thermocline has a variation of ~1°C during the survey. This bottom water is warmest at low water before cooling as the tide floods and then warming again as the tide ebbs. The surface water continues to warm throughout the day until HW+4, with the HW+5 and HW+6 profiles showing some cooling occurring at the end of the day.

The spring survey profiles show a similar thermocline, although with greater variability in the depth and strength of the stratification throughout the survey.

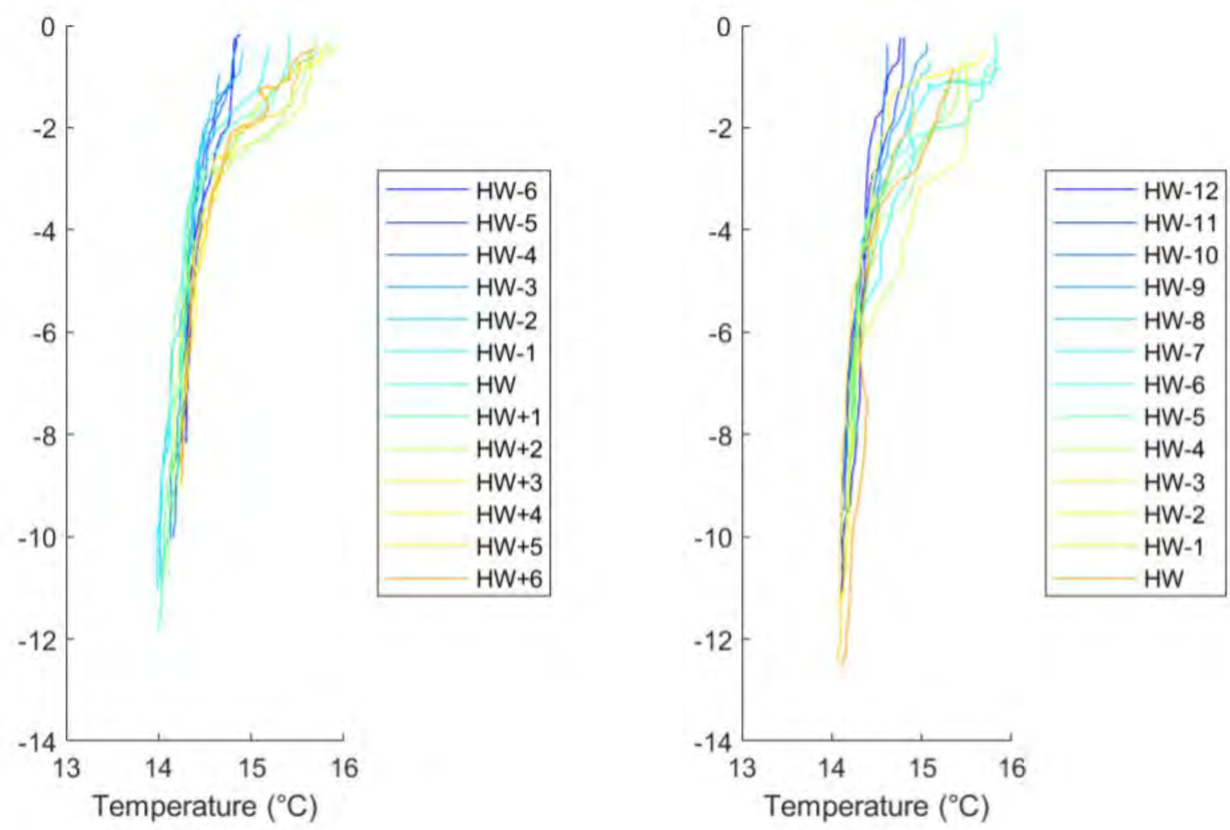

Figure 6.17 Measured hourly temperature profiles at the centre of transect T8 during neap (left) and spring (right) tides in July 2020

When river flows and tidal flows are combined and temperature and salinity effects are included, the modelled peak flow rates at the proposed scheme are around 728 m^3/s and 386 m^3/s for spring and neap tides respectively (**Figure 6.18**). At time of peak ebb flow the flows reduce to around 662 m^3/s and 368 m^3/s for spring and neap tides respectively. At the proposed scheme, the estuary reach is flood dominant (i.e. peak flood flow is stronger than peak ebb flow, but the duration of flood flow is shorter than that for ebb flow).

The modelled combined mean flood flow (over a tidal cycle) is about 410 m^3/s and 234 m^3/s and for spring and neap tides respectively and the modelled mean ebb flow (over a tidal cycle) is about 417 m^3/s and 252 m^3/s for spring and neap tides respectively. The mean ebb flow is larger than mean flood flow because of the effects of river flow from upstream, which is relatively more significant at times of mean tidal flow than at times of peak tidal flow.

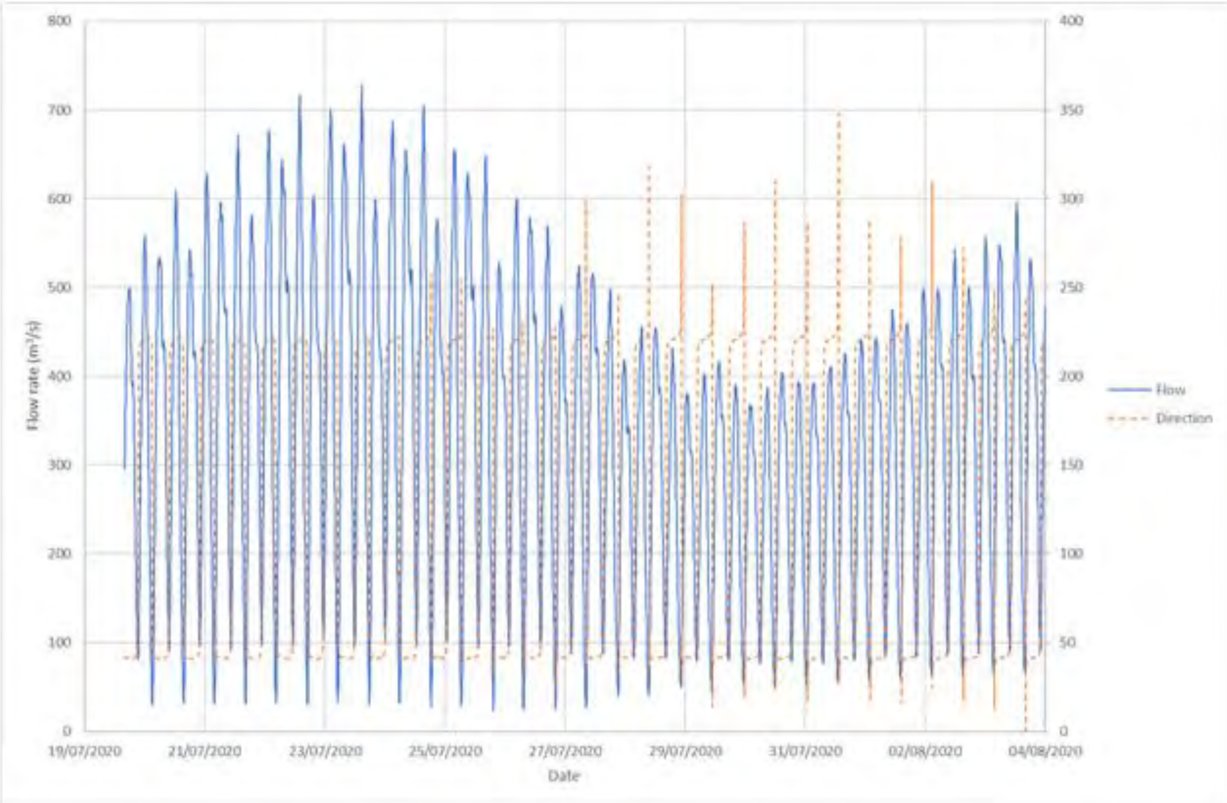

Figure 6.18 Modelled combined flow rates at the proposed scheme footprint

Wind

An analysis of wind speeds observed at South Gare between 1999 and 2005 was undertaken as part of the studies for the NGCT (HR Wallingford, 2006). This showed that the most frequent winds prevail from the south-west (210°N to 270°N), but the largest wind events (> 40 m/s) are from the north. This analysis was brought up to date with measured data from Tees Dock between October 2019 and July 2020, which confirmed the south-westerlies as the predominant winds (**Figure 6.19**).

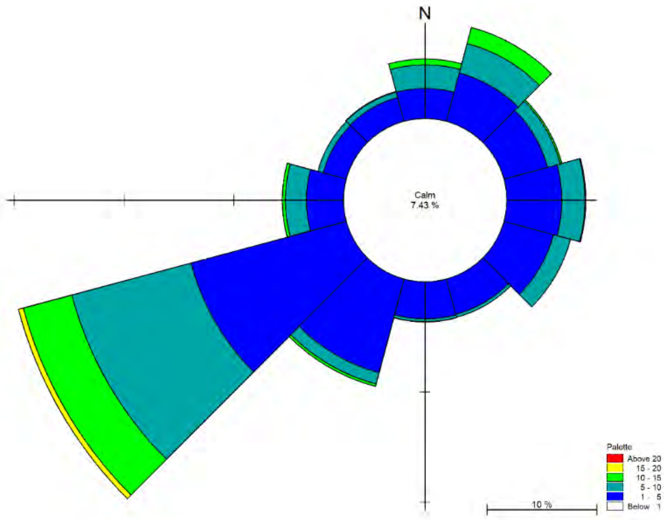

Figure 6.19 Wind rose based on recorded data at South Gare (October 2019 – July 2020)

This analysis further was brought up to date with long-term Met Office wind data from Loftus. From these data, extreme wind speeds from three separate directions were analysed, namely north (0 degrees), north-northeast (30 degrees) and south-southwest (210) (**Table 6.12**).

Table 6.12 Extreme wind speeds for the Tees estuary

Return Period (years)	Wind Speed (m/s)		
	0 degrees	**30 degrees**	**210 degrees**
1	20.12	18.88	20.08
100	31.68	30.69	30.25

During the metocean survey, recorded wind data were obtained from PDT for dates coinciding with the spring tide (24th July 2020) and neap tide (30th July 2020) surveys. As can be seen, relatively benign wind conditions were experienced over these two survey dates (**Table 6.13**).

Table 6.13 Wind speeds recorded at Tees Dock by PDT

Location	Tidal Condition	Wind Speed (m/s)		
		Minimum	Mean	Maximum
Tees Dock	Neap	0.05	1.28	3.29
	Spring	0.05	0.85	3.34

Waves

Wave conditions in outer parts of the Tees estuary are a combination of offshore swell and locally-generated wind waves, although only remnants of swell wave activity exist a short distance up-estuary from the mouth.

Offshore swell

The majority of offshore swell in the region has been found to come from a northerly direction (HR Wallingford, 2002), although the direction from which swell can enter the estuary is limited by the presence of the North Gare and South Gare Breakwaters.

The Tyne Tees WaveNet buoy, deployed by Cefas in 2006, is located 35km offshore from Tees Bay in around 65m water depth and provides a suitable baseline of offshore wave conditions. Wave heights recorded at the Tyne Tees buoy for 2019-20 are shown in **Figure 6.20**. The largest storms recorded during the period April 2019 to March 2020 were in December 2019 and March 2020, with significant wave heights (Hs) of 5.2m, however there were also notable storms in May and November 2019 (both Hs <5m) (Royal HaskoningDHV, 2020c).

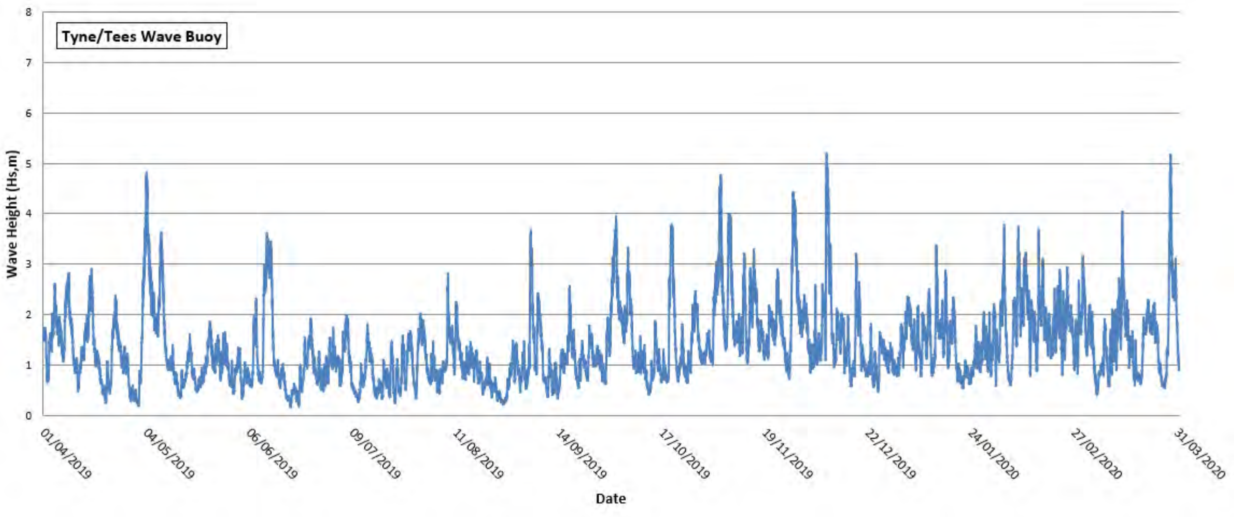

Figure 6.20 Offshore wave heights recorded at the Tyne/Tees wave buoy for 2019-2020

An offshore wave rose for the Tyne Tees buoy (**Figure 6.21**; Royal HaskoningDHV, 2020c) shows that the majority of the waves approach from the north to north-northeast sector (0-30 degrees). There is a small secondary peak in approach direction for waves from the south east sector (120-150 degrees). Other waves approach from easterly directions (30-120 degrees) located between the primary and secondary peaks. Due to the offshore location of this buoy there are also small peaks from the southwest and northwest that would represent calm periods along most of the inshore sections of the north-east coast.

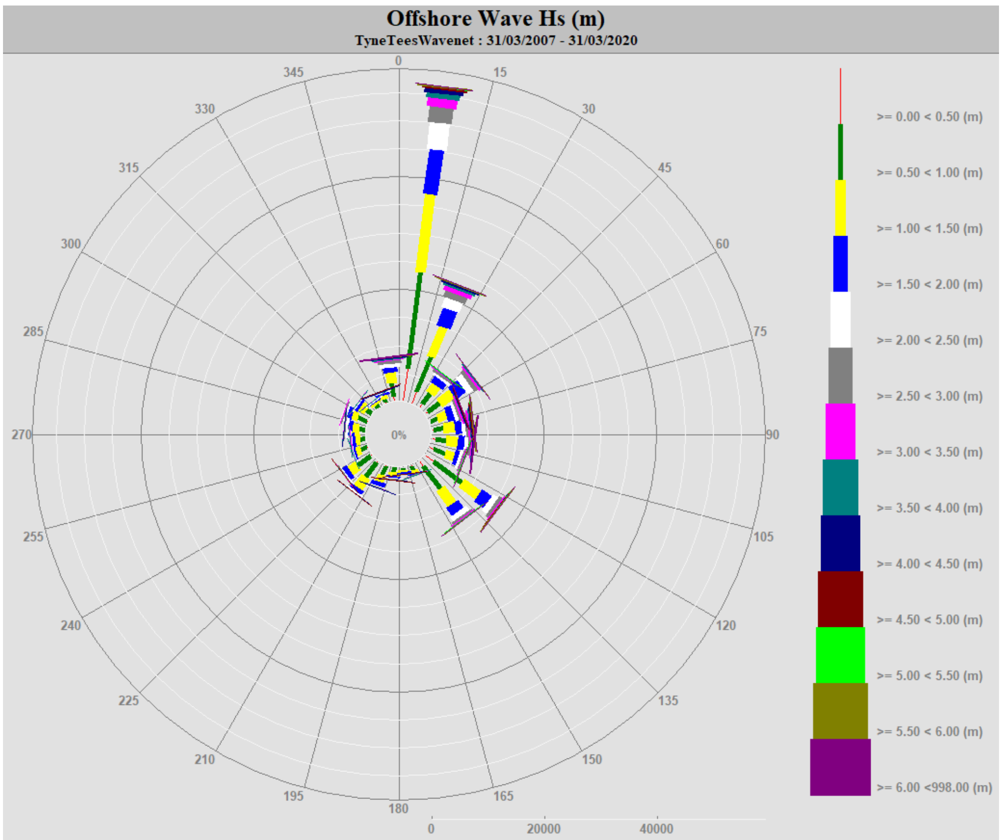

Figure 6.21 Offshore Wave Rose at Tyne Tees wave buoy site (WMO ID 62293)

Further inshore, the Environment Agency has a modelled swell wave data point in Tees Bay as part of its Coastal Flood Boundary Conditions (CFB) project, the location of which is shown in **Figure 6.22**. The 1 in 100 year extreme significant wave height at this nearshore location is 4.13m, with a corresponding period of 12 seconds and direction from north (0 degrees).

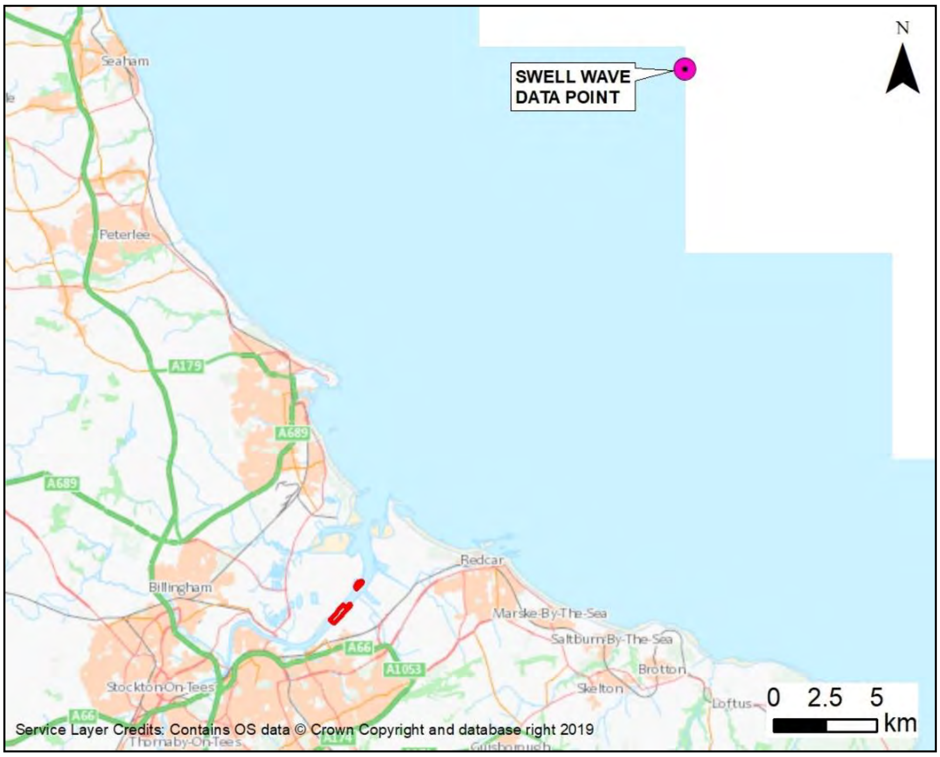

Figure 6.22 Location of Environment Agency's CFB swell wave data point

Numerical modelling of waves was undertaken using MIKE-SW to transform the offshore swell conditions from the Environment Agency CFB swell wave data point inshore and into the Tees estuary (**Figure 6.23**). Even under a scenario with a 1 in 100 year return period wave height coinciding with a Highest Astronomical Tide, swell waves would not propagate sufficiently far up-estuary to reach the proposed scheme (**Figure 6.24**). Even when the nearshore wave heights are increased by +0.2m as a sensitivity test, the swell waves would not propagate to the proposed scheme.

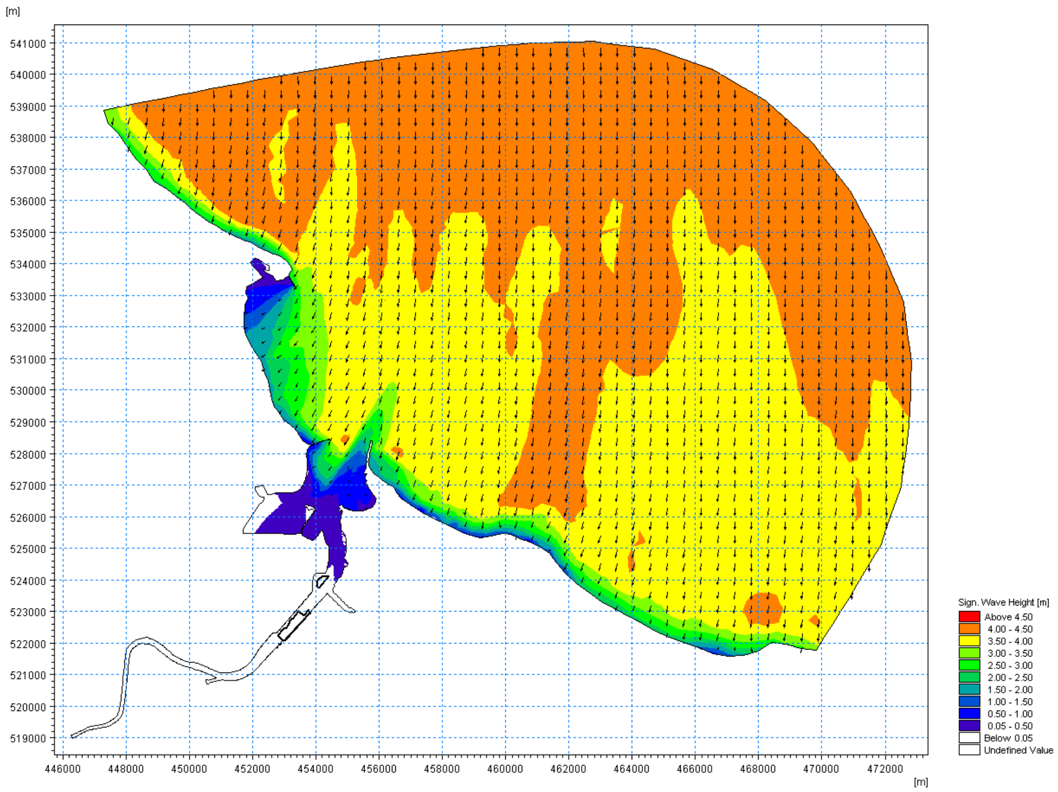

Figure 6.23 Swell Waves for 1 in 100 year return period coming from North (Tees Bay)

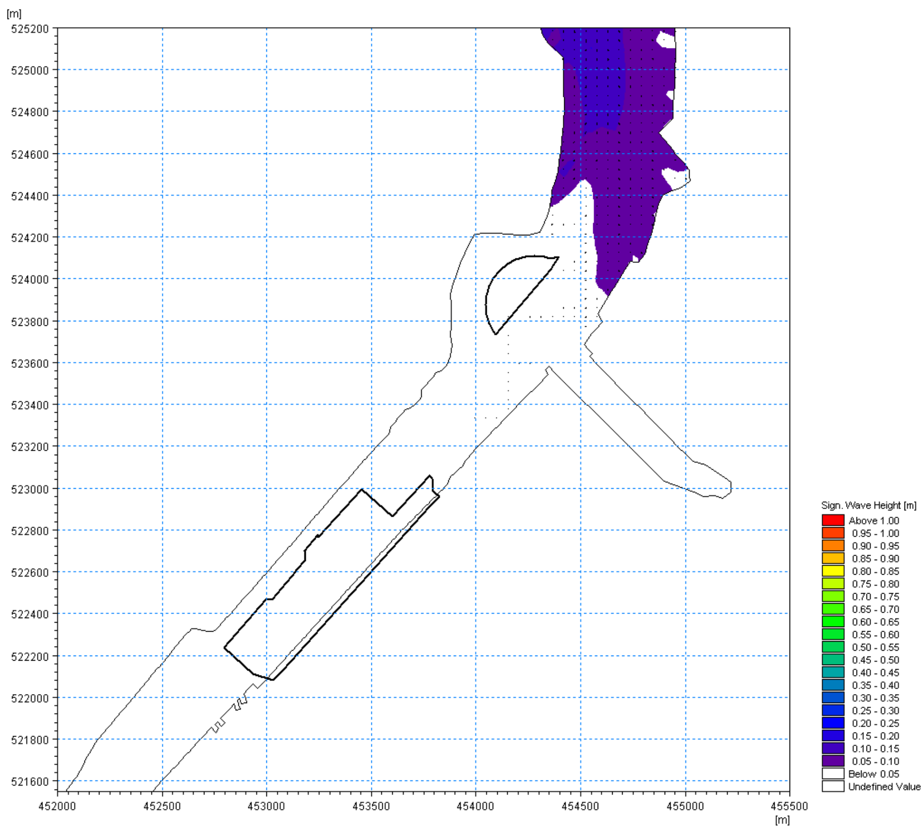

Figure 6.24 Swell Waves for 1 in 100 year return period coming from North (proposed scheme)

Local wind-generated waves
The local wind-generated waves for 1 in 1 year and 1 in 100 year return period events, with waves coming from north (0 degrees), north-northeast (30 degrees) and south-southwest (210 degrees), were modelled using MIKE-21 for the River Tees (**Figure 6.25**). These conditions were run coincident with a Highest Astronomical Tide for a worst case effect.

The wave model results show that at the proposed scheme the local wind-generated waves can reach a height of 0.3m to 0.4m for a 1 in 1 year return period wind event and 0.5m to 0.7m for a 1 in 100 year return period wind event.

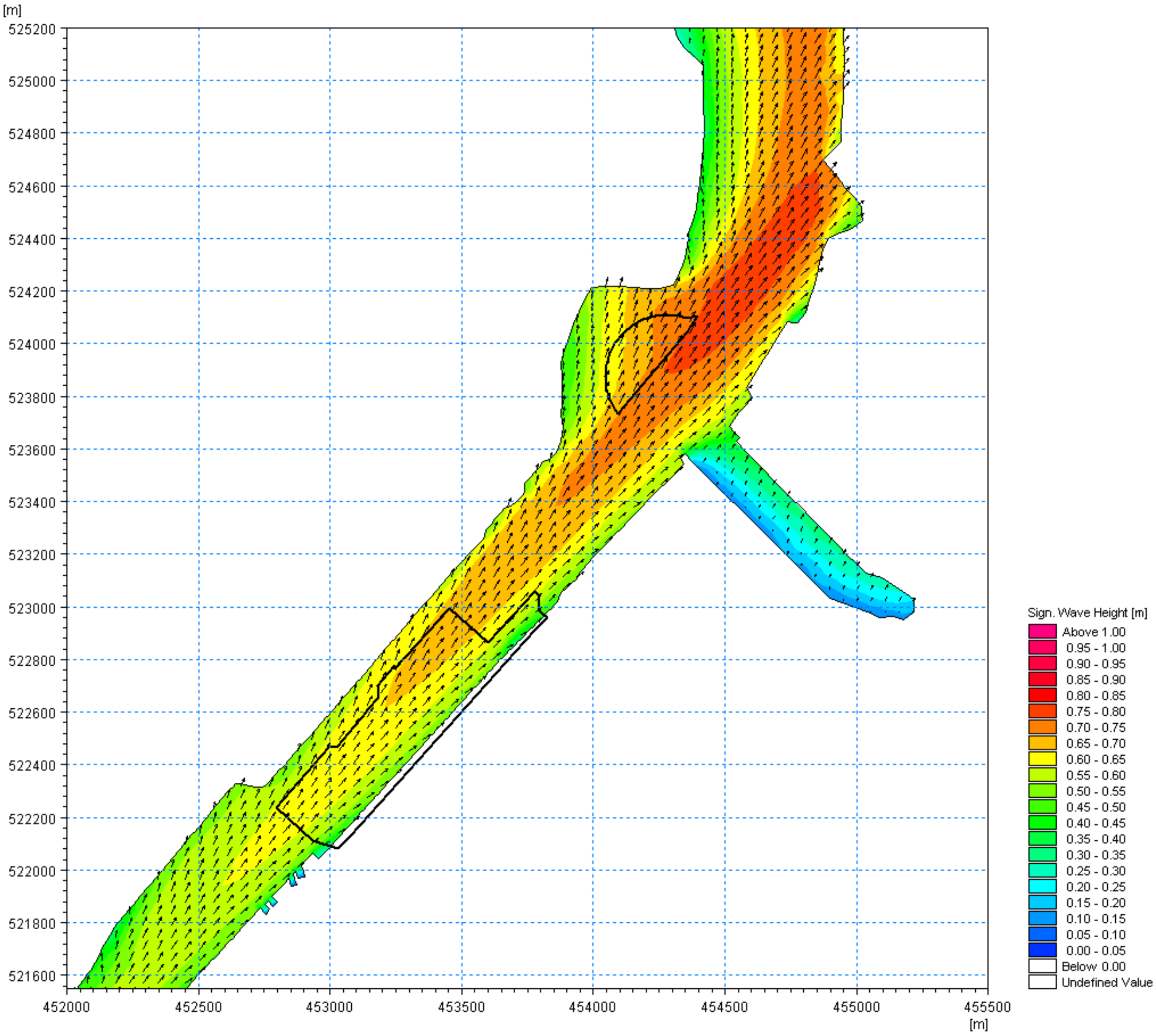

Figure 6.25 Local wind-generated saves for 1 in 100 year return period coming from south-southwest (210 degrees) (proposed scheme)

Climate change
The Environment Agency produced updated guidance on climate change allowances in July 2020 within two documents, namely for:

- Flood and coastal risk projects, schemes and strategies:

https://www.gov.uk/guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances

- Flood risk assessments: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

These documents include revised sea level rise allowances based on the latest UK Climate Projections (UKCP18). The 'Flood and coastal risk projects' guidance now recommends that a range of sea level rise values should be considered in assessing the impacts of climate change, instead of a single value. The purpose of this is to provide a range of scenarios for risk management authorities in the consideration of projects, schemes and scenarios. This guidance encourages the use of the UKCP18 'User Interface' to yield allowances that are specific to individual project sites. In contrast, the 'Flood risk assessment' guidance is coarser, providing allowances for different epochs across whole river catchment basins.

The extreme sea level values presented in the earlier **Table 6.8** from the Environment Agency (2018) are based upon a baseline date of 2017. Between this baseline and 2070, by way of example, the sea level rise allowances under the two guidance documents is as follows:

- 'Flood and coastal risk projects' guidance:
    - Design value for the Tees Estuary, based on the Representative Concentration Pathway (RCP) 8.5 at the 70th percentile value is 0.380m sea level rise.
    - Sensitivity test value for the Tees Estuary, based on RCP 8.5 at the 95th percentile value is 0.499m sea level rise.

- 'Flood risk assessment' guidance:
    - Higher central allowance for the Northumbria river basin district, based on RCP 8.5 at the 70th percentile value is 0.358m sea level rise.
    - Upper end allowance for the Northumbria river basin district, based on RCP 8.5 at the 95th percentile value is 0.476m sea level rise.
    - There is also suggestion that a 'catastrophic' scenario called H++ is considered. This involves a sea level rise of 1.9m by 2100 plus 2mm/year surge (from 2017). i.e. 1.900m + 0.166m = 2.066m.

The assessment of climate change, and in particular sea level rise, has been incorporated into the design of the quay wall crest level and adjacent land levels and also in **Section 20** of this report.

It is recognised that the baseline hydrodynamic and sedimentary regime, as characterised within this section, is dynamic; it changes over timescales of seconds, minutes and hours (during storms), through days, weeks and months (through tidal cycles) to years and decades (through sea level rise). However, the *relative* effect of the proposed scheme upon the baseline hydrodynamic and sedimentary regime will be constant throughout such changes.

Whilst it is acknowledged that the effect of climate change on physical processes may lead to increased risk of adverse impacts such submergence or erosion of intertidal habitats due to sea level rise, these changes are not due to the proposed scheme; they are natural ongoing processes that would occur with or without the proposed scheme in place. The proposed scheme itself will not exacerbate (or alleviate) these ongoing natural processes. It therefore remains valid to assess the potential impacts of the proposed scheme upon the baseline hydrodynamic and sedimentary regime in a relative manner, using the baseline understanding presented in this section.

6.4.4 Sedimentary regime

Suspended sediment concentrations

In general, suspended sediment concentrations (SSCs) are low within the estuary and within Tees Bay. The highest observed values tend to occur on spring tides. This relationship is not strong, but the extreme values are also attributed to either high rainfall or storm events. In general, the SSCs appear to be dominated by freshwater inputs in the reaches above Middlesbrough and marine influences in reaches located further downstream.

In the vicinity of the proposed scheme (i.e. in the Tees Dock area) SSCs are, for the most part, less than 20mg/l with short-term peaks from 40 to 80mg/l (Royal Haskoning, 2006). In terms of the tidal sequence, the highest suspended sediment levels occur close to high water. After storm periods, higher concentrations of suspended sediment have been noted around the Shell Jetty, but with little penetration further up the estuary. On other occasions the reverse has been true, thus the effect of storm events is not consistent within the estuary.

During the metocean survey in July 2020, 26 water samples were taken at regular time intervals from the centre point of transect T8 during both the spring tide (24th July 2020) and neap tide (30th July 2020) surveys. In total therefore, 52 samples were collected and subsequently analysed in the laboratory for SSCs. The minimum detection level of the laboratory is 3mg/l, so anything lower than this threshold has been given a zero reading for the purposes of analysis. Results are summarised in **Table 6.14** and indicate very low SSCs in the estuary channel. It should be noted that the weather conditions during the metocean survey were very dry and calm and therefore the results are considered to only be reflective of potential spring/summer conditions.

Table 6.14 SSCs recorded at Transect T8 in July 2020

Location	Tidal Condition	Suspended sediment concentrations (mg/l)		
		Minimum	Mean	Maximum
Transect T8	Neap	0.0	3.9	7.5
	Spring	0.0	2.5	8.5

Figures 6.26 and **6.27** plot a timeseries of SSCs from the water sampling for the neap tide and spring tide surveys, respectively, alongside the corresponding water levels, current speeds and wind speeds during each survey. There is no particularly strong correlation between SSC and forcing conditions, although there is clearly a peak in concentration when both wind speed and current speed are greatest.

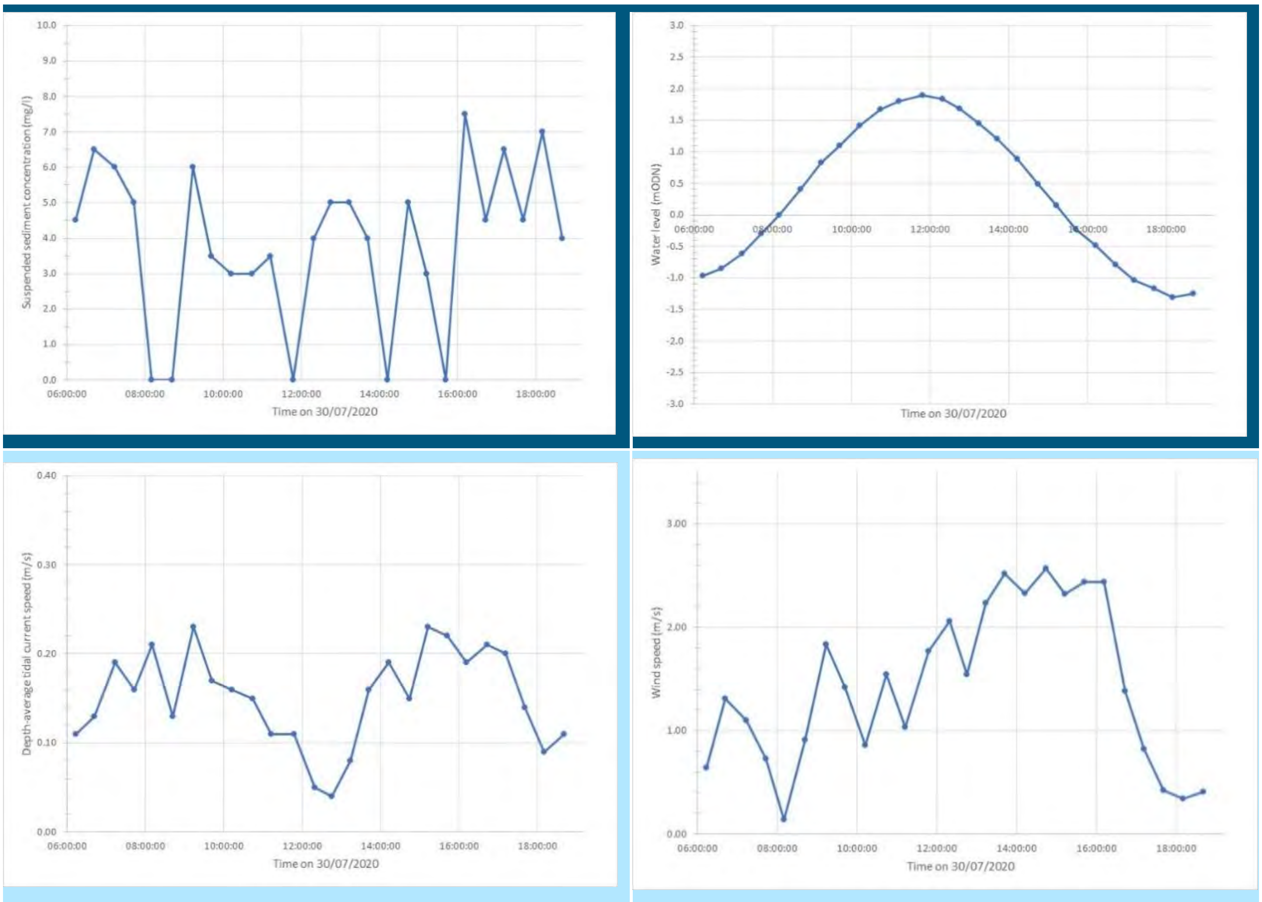

Figure 6.26 Timeseries of SSC (top left), water level (top right), current speed (bottom left) and wind speed (bottom right) during neap tide surveys on 30th July 2020

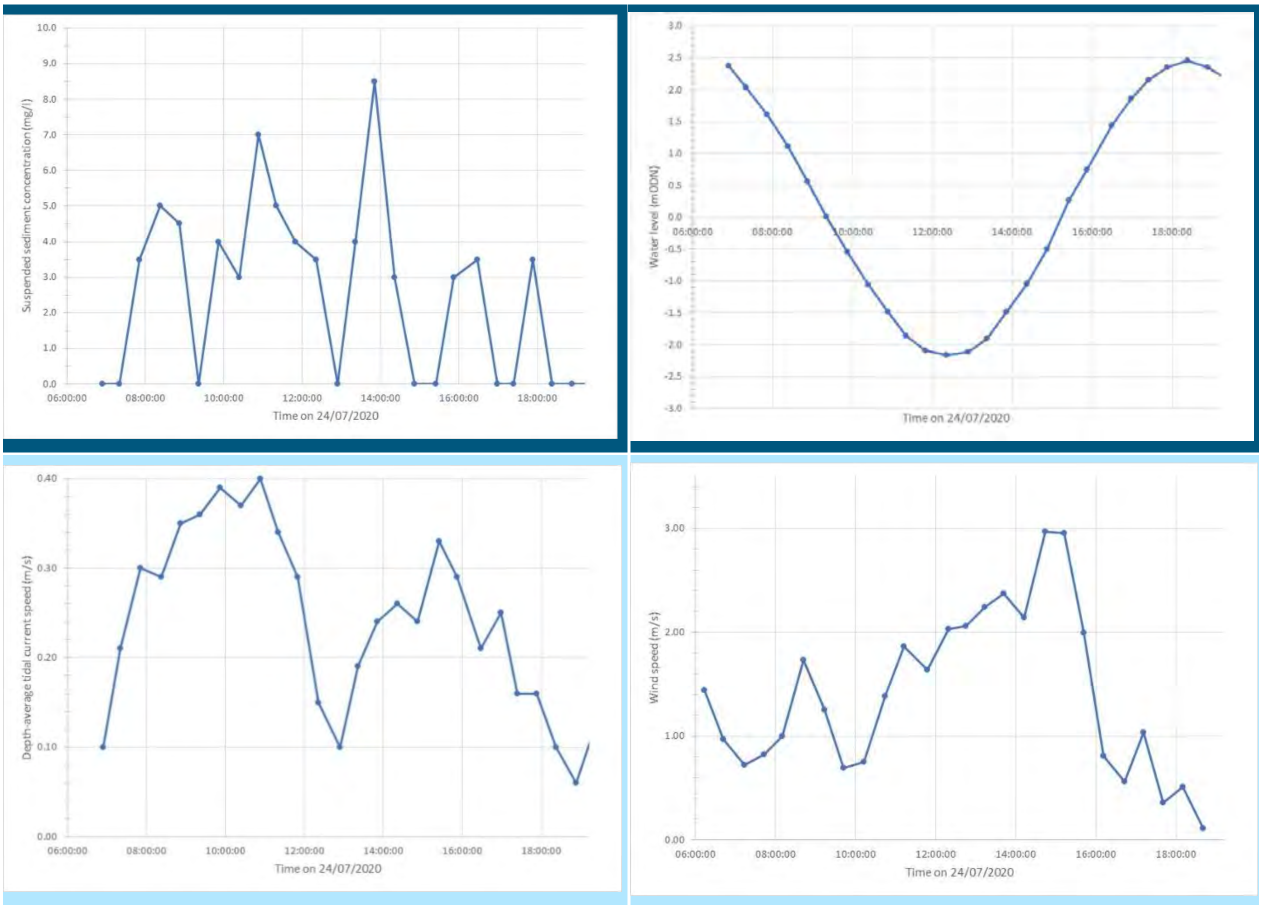

Figure 6.27 Timeseries of SSC (top left), water level (top right), current speed (bottom left) and wind speed (bottom right) during spring tide surveys on 24h July 2020

During the metocean surveys in July 2020, a turbidity sonde was deployed from the survey vessel. Two summary plots of measured turbidity through the depth of the water column at hourly time intervals are presented in **Figure 6.28**. A low turbidity water column was present during both surveys. The lowest turbidity values of <5 Formazin Turbidity Units (FTU) were found at the water surface, with increasing turbidity nearer to the bed (5 to 10 FTU).

Following analysis of the collected water samples and the low turbidity environment found during the surveys, it was decided that a conversion of FTUs into units of milligrams per litre would not have sufficient accuracy to be beneficial and was therefore not undertaken. The FTU measurements do, however, give a good indication of the turbidity in the water column throughout the duration of the surveys and it is noted that some variation between spring and neap tides is evident in the collected data. During the neap survey, less variation is found in the turbidity values (all data <6 FTU), when compared to the spring survey (all data <10 FTU).

During the spring cycle the surface 4 m layer shows very little variation, within 1-4 FTU, whilst the deeper sections of the water column show clear temporal variation. The highest turbidity values are found over low water, whereas over high water the water column has the lowest turbidity and shows very little change in turbidity with depth.

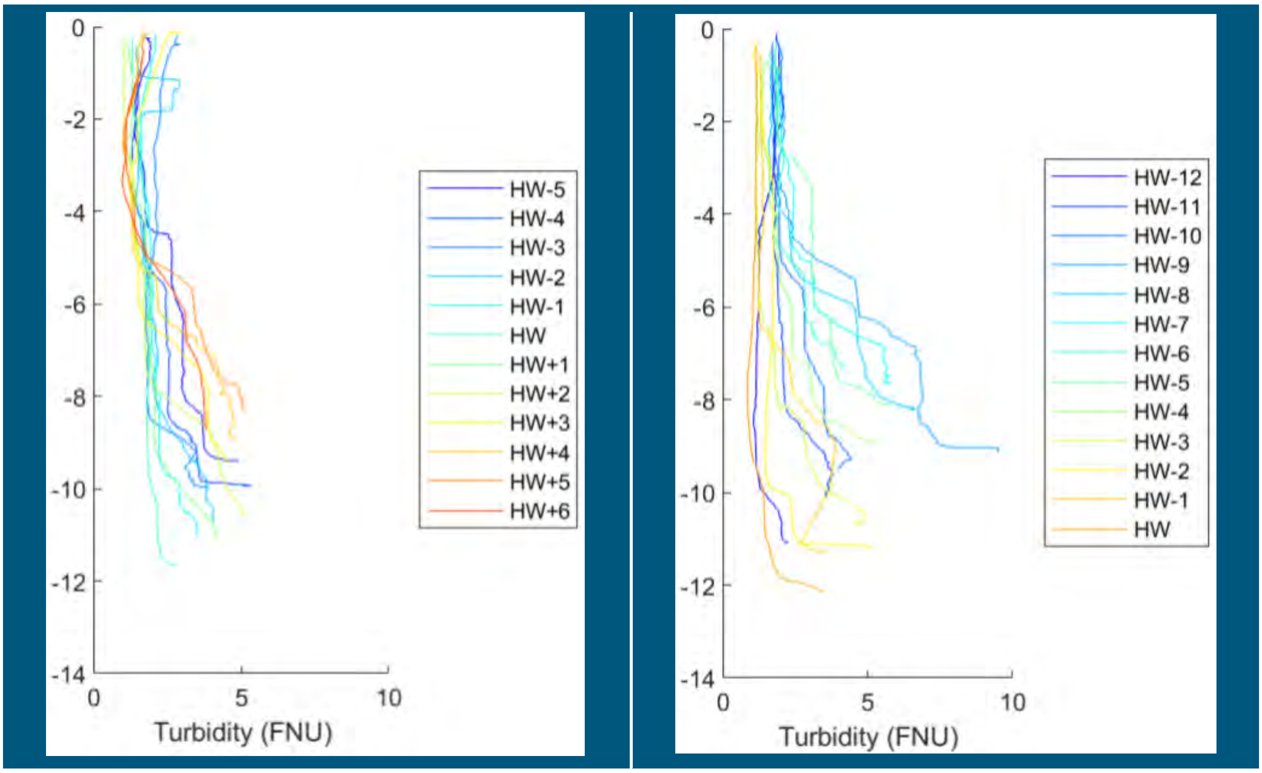

Figure 6.28 Measured hourly turbidity profiles at the centre of transect T8 during neap (left) and spring (right) tides in July 2020

Sediment sources and transport

Historic bed sampling results in the vicinity of the proposed scheme show bed sediments in the area to comprise predominantly (65% to 70%) silt, with some (20%) clay and the remainder sand and gravel (Halcrow, 1991). These observations match the particle size distribution results from bed grabs undertaken in this vicinity for previous studies (Royal Haskoning, 2009).

The sources of material into the Tees estuary system are fluvial inputs coming through the Tees Barrage, material entering from Tees Bay and any industrial inputs. These inputs are in addition to material eroded from the estuary bed. Of these sources, the main source of material is the marine component entering the estuary from Tees Bay. This material comes in on the flood tide, particularly during times when concentrations in Tees Bay are raised by the re-suspension of material from the seabed during storm events. The coarser material, mostly sand, is then able to settle out in the lower estuary, whereas the finer material is drawn further up the estuary by the gravitational circulation.

Within the system the driving forces for sediment transport are the tidal flows, density driven currents, wave induced currents, vessel induced forces and re-suspension by dredging operations. These last two were postulated by HR Wallingford (1989a) as a means by which material entering the system from offshore can be re-suspended and moved further upstream into the estuary. Inputs to the system can be summarised as follows (from HR Wallingford in Royal Haskoning, 2006):

- **Fluvial input:** HR Wallingford (1989a) outlined the pre-barrage conditions for fluvial input with general very low concentrations (<10 mg/l) which rose to about 200 mg/l during occasional floods. The inputs were suggested to be closely linked to large fluvial events with about 8,000 dry tonnes entering the estuary during the 1:1 year flood (300 cumecs at Low Moor, 44km up estuary of South Gare). The average total inputs were estimated at 40,000 dry tonnes per year; however the close link to high fluvial events would suggest that this could vary considerably from year to year. Most of this material is assumed to be trapped in the estuary.

Since construction of the Tees Barrage, considerable siltation has occurred upstream of the barrage with the implication that fluvial sediment input to the estuary has reduced (ABPmer, 2005). However, even the pre-barrage fluvial input is small when compared to marine inputs (see below).

- **Industrial input:** Up to 22,000 dry tonnes per year has been discharged under license from ICI Wilton at Redcar (ABPmer, 2002). This industrial material is discharged in the Dabholm Gut (directly downstream of the proposed scheme). This is the remaining major industrial source of material to the Tees estuary.

- **Marine input:** Comparison of the above figures with the present knowledge of the dredging requirements in the area (presently approximately 0.9 million m^3 per year within the Tees estuary) shows that the remaining source of material, i.e. that from Tees Bay, is the predominant source of sediment into the estuary system. This material comes in on the flood tide, particularly during times when concentrations in Tees Bay are raised by the resuspension of material from the seabed during storm events. The coarser material, mostly sand, is then able to settle out in the lower estuary, whereas the finer material is drawn further up the estuary by the gravitational circulation.

Dredging activities

PDT has a statutory duty to maintain navigation within the Tees estuary (and also into the Hartlepool docks). As part of this responsibility, PDT must maintain the advertised dredge depths within the defined areas (hereafter referred to as “the maintained areas”). In order to achieve this, PDT carries out maintenance dredging in the thirteen reaches of the river shown in **Figure 6.29** (as well as in berths within the Tees and Hartlepool’s Victoria Harbour, in the Seaton Channel and occasionally in other areas within their jurisdiction within Tees Bay). Maintenance dredging practices have remained unchanged since 2005.

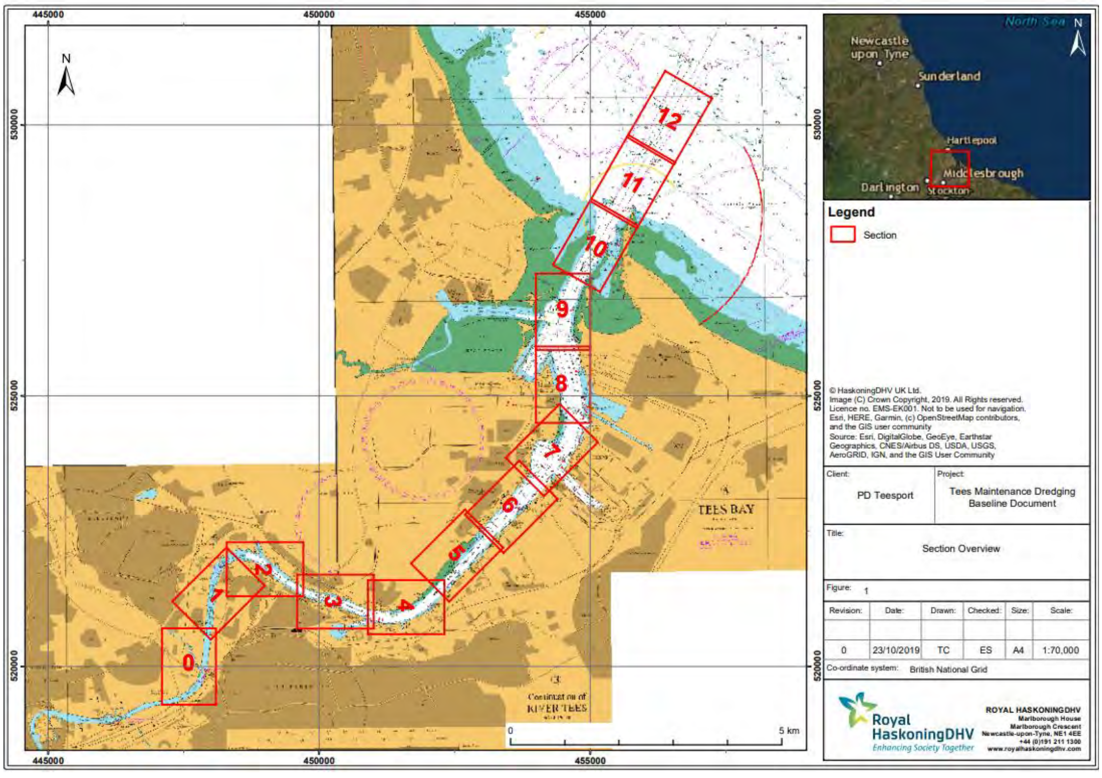

Figure 6.29 Maintenance dredging reaches within the River Tees

Most dredging within the Tees occurs in the approach channel and low-middle estuary in order to maintain access to berth pockets and impounded docks. TSHDs are currently used for the majority of the dredging and are supported by ploughing where required. PDT employs two TSHDs of 1,500m³ hopper volume to maintain depths within the navigable channel and berths within the Tees estuary and Hartlepool. Both dredgers have active bottom door offloading systems.

PDT also operates its own 11m plough to supplement ongoing suction dredging operations through the removal of isolated high spots on the riverbed, primarily in frontages or confined areas. Plough dredging has also been utilised to move recently deposited accumulations of sediment to adjacent scour spots within the river, thus maintaining sediment within the estuarine system and reducing the overall volumes of dredgings requiring disposal to sea.

A summary of the maintenance dredged volumes (m³) by each reach from 2001 to 2019 is provided in **Table 6.15** and shown in **Figure 6.30**. Data on dredging was obtained from PDT and extends the time series originally presented in Royal Haskoning (2008) from 2001 to 2019. No dredging has been required within Reach 0 during the reporting period. Note that these data also include maintenance dredging volumes from berths within the Tees and Hartlepool's Victoria Harbour, from within the Seaton Channel and from occasional other areas within Tees Bay as well as the thirteen reaches within the Tees estuary.

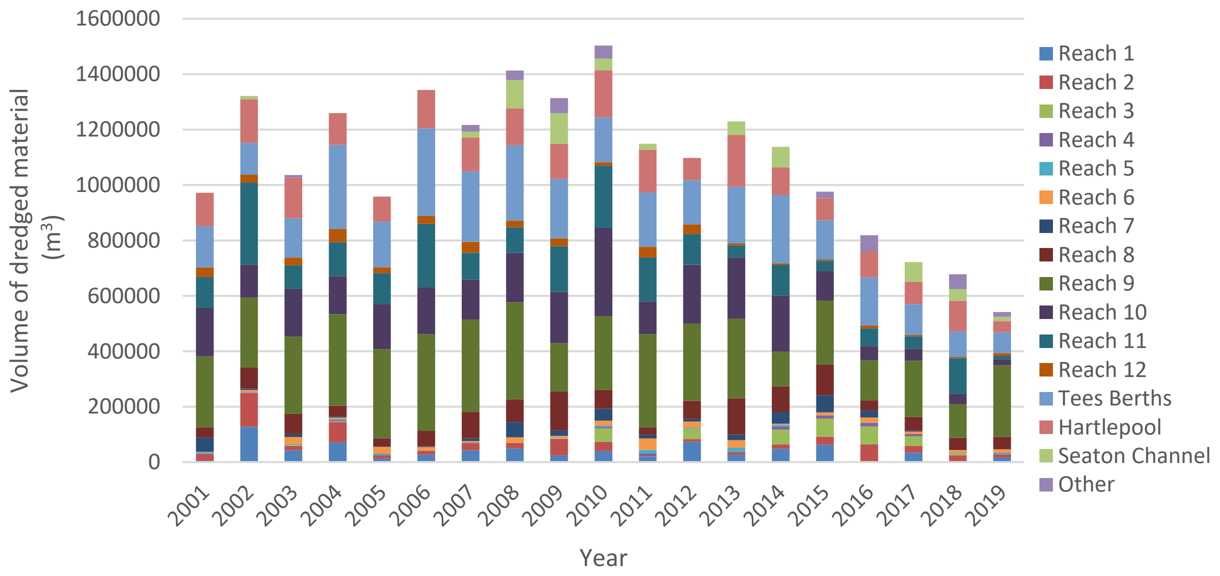

Figure 6.30 Summary of volumes (m^3) dredged and deposited offshore during the period 2001 to 2019

The total volume of maintenance dredged material has decreased below the average annual volume for the period 2001 to 2019 in recent years. Contributing factors to this reduction are weather conditions and varied deposition rates within maintained areas.

Over the 19-year period, the average volume maintenance dredged from the Tees reaches is 740,266m^3, with an average of 183,980m^3 from the Tees berths making an average of 924,247m^3 for the Tees as a whole. When considering all 'other' areas outside of the Tees estuary but elsewhere within Tees Bay, the average over this period is 1.1Mm^3.

Royal HaskoningDHV

Table 6.15 Summary of the total volumes of dredged material disposal (m^3) from 2001 to 2019

Reach	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	5,911	127,827	42,384	70,856	12,361	27,075	42,701	49,701	24,159	40,237	19,066	73,544	25,674	48,268	62,094	1,500	33,972	2,165	16,509
2	21,768	122,381	16,470	73,210	11,649	12,982	26,028	19,805	60,118	32,817	371	9,814	8,863	15,894	29,830	61,722	25,133	22,508	11,379
3	0	1,366	4,176	3,205	412	412	1,925	735	1,772	48,532	0	37,429	0	52,857	64,998	65,468	33,698	8,501	1,693
4	3,131	1,666	127	4,468	676	282	1,514	0	274	6,056	11,386	1,500	2,996	12,504	11,770	12,884	8,771	1,879	2,605
5	4,621	1,634	2,751	3,815	5,997	1,339	764	0	1,336	4,745	13,496	2,541	15,018	5,370	471	951	0	0	3,270
6	1,625	5,282	24,645	4,859	23,640	12,092	3,088	18,906	7,037	17,009	41,303	21,755	26,210	3,630	10,534	18,383	8,242	8,624	10,618
7	51,303	4,804	10,765	3,297	1,243	2,642	9,841	55,084	19,322	43,157	12,502	10,160	19,746	42,200	61,866	25,041	3,339	0	0
8	37,075	76,297	72,261	39,251	30,172	56,926	96,160	82,531	140,839	68,357	27,102	64,468	131,948	93,188	111,145	37,485	50,317	44,138	44,965
9	256,158	252,715	279,054	330,835	321,316	347,365	332,679	349,982	174,009	266,187	336,050	278,883	286,441	124,821	230,316	143,677	202,051	121,796	258,315
10	174,248	118,613	171,950	137,022	161,349	168,733	143,089	178,819	186,336	317,961	117,635	211,799	221,176	201,953	106,326	51,239	44,053	36,072	21,132
11	112,437	296,471	85,385	121,807	113,304	230,099	97,682	92,427	163,910	225,143	159,529	110,787	43,032	110,777	36,893	64,146	44,546	129,283	12,204
12	34,747	28,437	28,156	48,707	21,307	28,262	39,441	23,548	27,937	12,133	38,877	35,415	7,662	5,954	4898	11,168	4,796	4,471	10,170
Sub-total Reaches	**703,024**	**1,037,493**	**738,124**	**841,332**	**703,426**	**888,209**	**794,912**	**871,538**	**807,049**	**1,082,334**	**777,317**	**858,095**	**788,766**	**717,416**	**731,141**	**493,664**	**458,918**	**379,437**	**392,860**
Tees berths	148,837	115,219	141,880	303,869	164,664	316,696	254,458	272,520	215,702	162,053	195,482	159,067	205,141	246,486	141,160	173,396	111,221	92,351	75,427
Sub-total Tees Reaches & Berths	**851,861**	**1,152,712**	**880,004**	**1,145,201**	**868,090**	**1,204,905**	**1,049,370**	**1,144,058**	**1,022,751**	**1,244,387**	**972,799**	**1,017,162**	**993,907**	**963,902**	**872,301**	**667,060**	**570,139**	**471,788**	**468,287**

Reach	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Hartlepool	119,847	157,329	146,457	114,104	89,811	137,606	121,605	132,041	125,032	170,170	154,025	80,410	186,229	99,068	79,818	92,781	79,936	110,448	39,943
Seaton Channel	0	10,900	0	0	0	0	22,279	102,463	111,424	42,110	21,060	0	49,598	74,652	0	0	71,803	41,712	15,951
Other	0	245	9,809	0	0	312	23,366	34,605	54,610	46,725	461	0	0	0	23,972	58,842	0	53,880	17,183
Total ($x 10^6$)	**0.972**	**1.321**	**1.036**	**1.259**	**0.958**	**1.343**	**1.217**	**1.413**	**1.314**	**1.503**	**1.148**	**1.098**	**1.230**	**1.138**	**0.976**	**0.819**	**0.722**	**0.678**	**0.541**

Maintenance dredge material (between 2001 and 2018) comprised around 180,000m^3 of mud, mostly found in the upstream reaches beyond the Transporter Bridge. Of the remainder, 80% typically is clean, fine sand (approximately 650,000m^3) and 20% typically is silty sand (approximately 170,000m^3) (Royal HaskoningDHV, 2020b).

A review of the dredged sediment quality data is presented in **Section 7.**

The active disposal sites present in Tees Bay are summarised in **Table 6.16** and shown in **Figure 6.31**. In general, Tees Bay A (TY160) is used for the disposal of maintenance dredge arisings while Tees Bay C (TY150) is used for capital dredge arisings. Tees Bay B (TY110) and Tees Bay Foreshore (TY170) are closed.

Table 6.16 Active disposal sites present in Tees Bay (Royal HaskoningDHV, 2018)

Disposal site	Status	Description	Comment
Tees Bay A (TY160) Within the area bounded by joining the points: 54 40.800 N 01 03.500 W 54 41.500 N 01 02.200 W 54 41.000 N 01 00.300 W 54 40.200 N 01 01.500 W 54 40.800 N 01 03.500 W	Active	Active site for soft non-cohesive maintenance material	DEFRA records show volume fluctuating from 0.3 million to 2.4 million wet tonnes over a 15 year period. Volumes drop off post 1996. Largest volume deposited since 1996 was 1.8 million wet tonnes.
Tees Bay C (TY150) Within the area bounded by joining the points: 54 42.600N 00 58.600W 54 41.900N 00 57.400W 54 41.400N 00 58.700W 54 42.300N 00 59.900W 54 42.600N 00 58.600W	Active	Predominantly used for capital dredged material. Some maintenance dredging has been disposed of at this site.	DEFRA records show small scale usage. Peak volume deposited was 1.9 million wet tonnes in 1999, associated with the construction of the downstream Ro-Ro berths. Typical annual volume is 0.1 million wet tonnes. Some years show no usage at all.

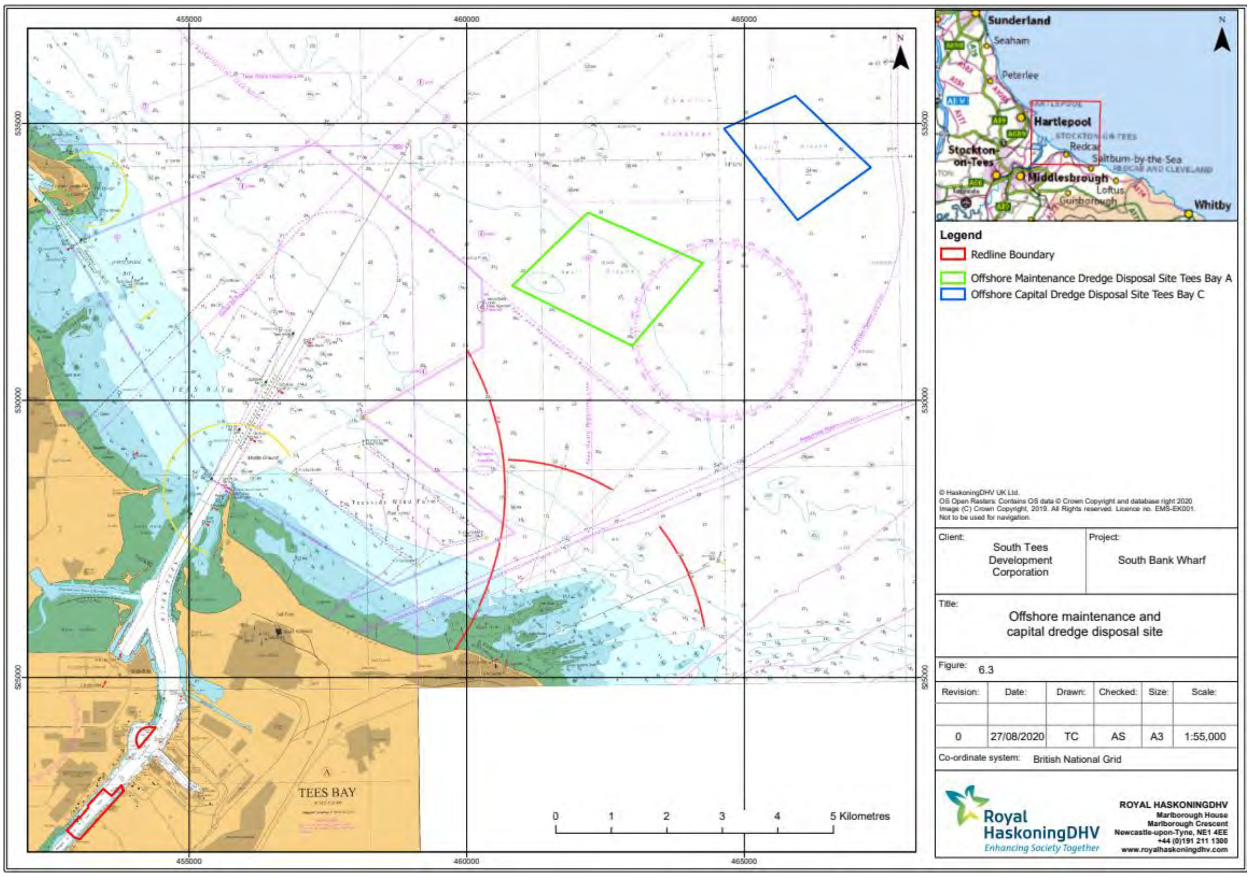

Figure 6.31 Location of offshore maintenance and capital dredge disposal sites

6.5 Potential impacts during the construction phase

6.5.1 Demolition of the existing wharf and jetties

A jack-up barge with a crawler crane, a slave barge and a safety vessel/workboat are likely to be used for the demolition of the existing wharf and jetties. It is envisaged that the demolition works will take approximately 12 months. Whilst the spud legs of the jack-up barge, anchors of the vessels and bow thrusters of the vessels as well as the pile removal activities themselves will result in some disturbance to the existing estuary bed, this will be minor and highly localised and thus is not of significant concern. The works also will be temporary in duration and the baseline conditions will be restored once the vessels have been demobilised from site. Given these findings, the magnitude of effect on baseline hydrodynamic and sedimentary regime arising from the demolition works is **very low**.

6.5.2 Capital dredging and offshore disposal of dredged sediments

Capital dredging is required to: (i) create a berth pocket adjacent to the new quay; (ii) deepen the river channel in the reach containing the new quay; and (iii) deepen part of Tees Dock turning circle.

Part of the Tees Dock turning circle will be deepened from 8.8m below CD to 11.0m below CD, yielding 170,000m^3 of material. Part of the existing navigation channel in the river will be deepened from between 5.7 – 8.5m below CD to 11.0m below CD and a new berthing pocket will be constructed adjacent to the new quay, deepening parts of the existing estuary from 2m below CD to 15.6m below CD and creating new areas of estuary to this depth from existing land areas. A 2m high rock blanket will be placed into the berthing pocket, creating a finished depth of 13.6m below CD. Dredging of the channel and berthing pocket will yield 1,620,000m^3 of material.

In total, approximately 1,800,000m^3 of material will be dredged from the areas described over an approximately four-month period. This material comprises Tidal Flat Deposits and Glacial Till (both classed as ‘soft’ material) and Mercia Mudstone (classed as ‘hard’ material). Dredging will be undertaken using a combination of TSHD (for some of the soft material below -5m CD) and BHD (for all of the soft material above -5m CD, some of the soft material below -5m CD, and all of the hard material). A safety vessel/workboat will be present throughout the operations.

Each year, between 25 – 30 million tonnes (wet weight) of dredged marine sediments from ports, harbours and marinas, and their approach channels, are disposed at sea within licensed disposal sites off the UK coast. This activity is highly regulated through international and regional-sea agreements between governments to control disposal at sea (e.g. the OSPAR and London Conventions). In England, the MMO is the regulator for the disposal of material to sea at licensed disposal sites, and these sites are routinely monitored as part of a national programme. In keeping with this principle, all non-contaminated material dredged from the proposed scheme will be taken to the Tees Bay C licensed offshore disposal site, some 18km from the proposed scheme footprint.

The capital dredging within the river, using TSHD and BHD, and the disposal activities at the licensed offshore site will both result in sediment plumes. These effects have been investigated using numerical modelling of the sediment dispersion associated with the dredging and disposal activities, as well as the changes in bed thickness when the suspended sediment falls from the plume to become deposited on the river or seabed.

A MIKE3-MT sediment dispersion model has been coupled with the 3D hydrodynamic model (MIKE3-HD) and run for the entire four month duration covering all proposed dredging and disposal activities. Wave disturbance effects have been included. The dredging methods, schedule and sediment release settings have been described in the Numerical Modelling Report (see **Appendix 5**). The simulations account for the movement of dredgers and transport barges (including dredging, sailing, disposal and downtime) such that sediment releases have been made near continuously throughout the dredging operations (except for allowed periods of downtime) from along the centre line of the dredged areas, running along the axis of the river channel, and also on a periodic basis from a single point in the centre of the offshore disposal site. The overall dredging and disposal operations may be considered as four stages in the following sequence:

- Stage 1: BHD working to dredge the upper soft material (above -5m CD) in the berthing pocket and river channel
- Stage 2: BHD and TSHD working in parallel to dredge the middle soft material (below -5m CD) in the berthing pocket and river channel
- Stage 3: BHD working to dredge the bottom hard material in the berthing pocket and river channel
- Stage 4: BHD and TSHD working in parallel to dredge the material in the Tees Dock turning circle

Results from the sediment dispersion modelling are discussed in turn for the dredging and disposal activities. Note that all the modelling plots in the following sections show the elevations in SSC or sediment deposition due to these activities above baseline levels.

For SSC, two types of plot are presented:

- SSC ‘timestep’ plots present values in units of kg/m^3, which can be translated into units of mg/l by multiplying the values by a factor of 1,000. It should be noted that the interpretation provided in the following sections is based on an animation of plots created at 5-minute timesteps (intervals) throughout the entire four-month period covered by the dredging and disposal simulations, but only representative examples from selected timesteps are presented in these plots to illustrate key points of discussion.

- Maximum 'zone of influence' plots present values in mg/l and show the maximum values and spatial extents of enhancement in SSC from any stage of the dredging or disposal operations during the relevant stage of the dredging programme. It is important to note that this type of figure does not represent a plume that would occur at any one point in time (such plumes are shown in the timestep plots). Rather, this type of figure shows the areas of the river channel or offshore area that will become affected by a plume at some point during the dredging or disposal activities (in some areas this will be on a single occasion, in other areas it will be on multiple occasions) and the maximum magnitude of change that will be experienced at that point.

Unless otherwise stated, all SSC plots show values within the near-bed layer of the 3D model. This is taken as the worst case in terms of SSC enhancement, but the effects described below generally exist throughout the water column but are of lesser magnitude with progression from the near-bed to the water surface.

Dredging

During Stage 1 of dredging (with the BHD working to dredge the upper soft material (above -5m CD) in the berthing pocket and river channel), the model simulates releases over time, moving from the south-western end of the dredging transect to the north-eastern end.

Peak concentrations from dredging are always local to the point of disturbance from dredging at the riverbed, typically reaching around 100 to 200mg/l, but sometimes up to 350mg/l for a very short duration (depending on timing of release with respect to the phase of the tide and location of dredging within the berthing pocket or river channel). To illustrate this, **Figures 6.32 – 6.35** shows the maximum extent of the plume during a release from the south-western corner of the dredging transect during the ebb phase (Plot A) and flood phase (Plot B) of the tide. Similar results are also shown for releases on the ebb phase (Plot C) and flood phase (Plot D) of the tide when the release is towards the north-eastern end of the dredging transect.

When the dredger is at the south-western end of the transect, the maximum spatial extent of the plume on the ebbing tide is as far north-east as Tees Dock and on the flooding tide is as far south-west as Middlesbrough Dock. When the dredger is at the north-eastern end of the transect, the extent of the plume correspondingly shifts towards the north-east such that during the ebbing tide it extends northwards beyond Tees Dock but during the flooding tide it extends only around 300m south-west of the upstream end of the new quay. However, in all cases considered, the lateral extent of the plume across the river channel is very narrow and the magnitude of the SSC within the plume beyond a few hundred metres from the point of release is of the order of 10 to 20mg/l and in the extremities of the plume reduces further to the same order as the background concentrations that were measured during the metocean survey.

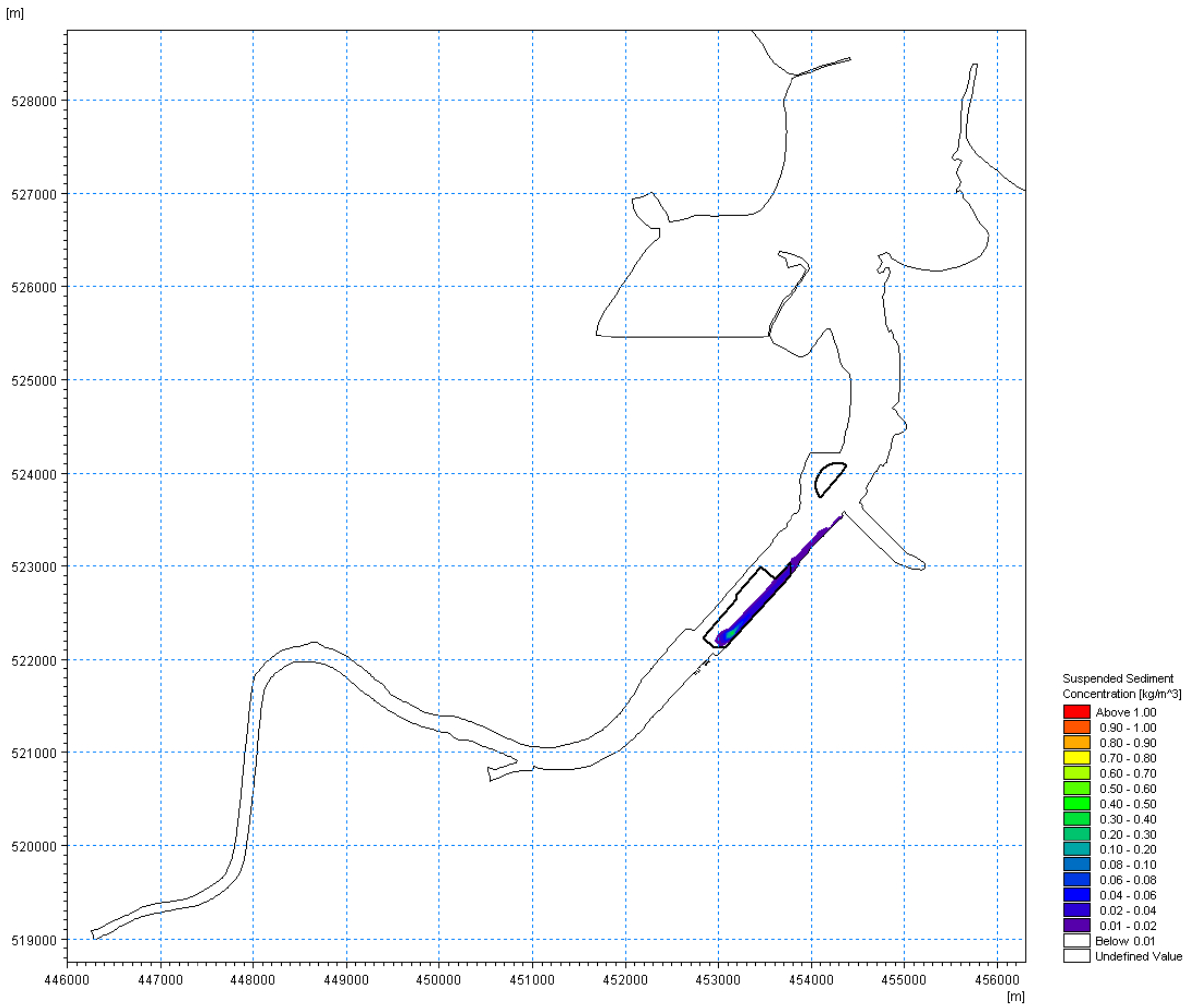

Figure 6.32 (Plot A) – Plume of enhanced SSCs arising from dredging activities during Stage 1 of the capital dredging programme

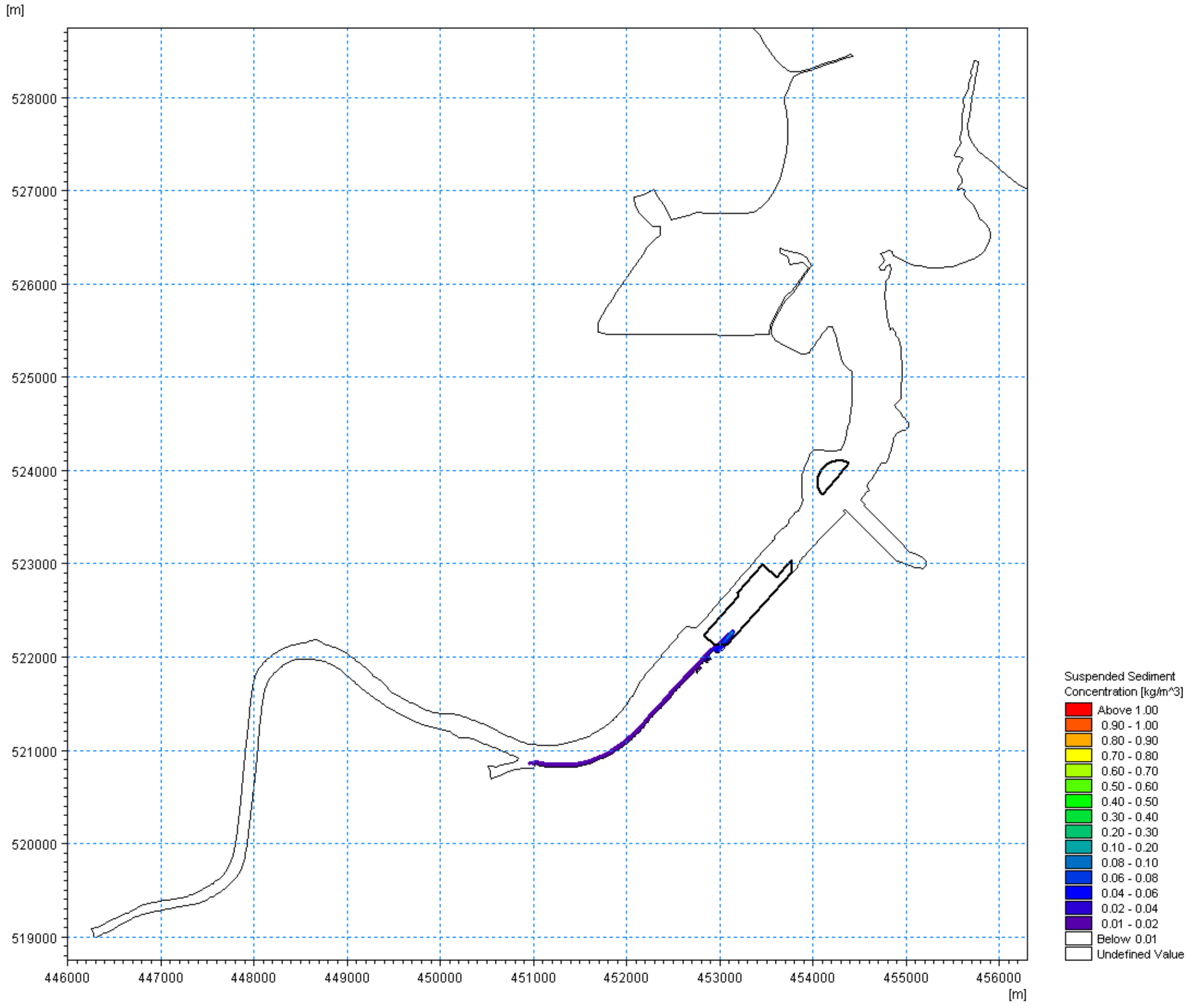

Figure 6.33 (Plot B) – Plume of enhanced SSCs arising from dredging activities during Stage 1 of the capital dredging programme

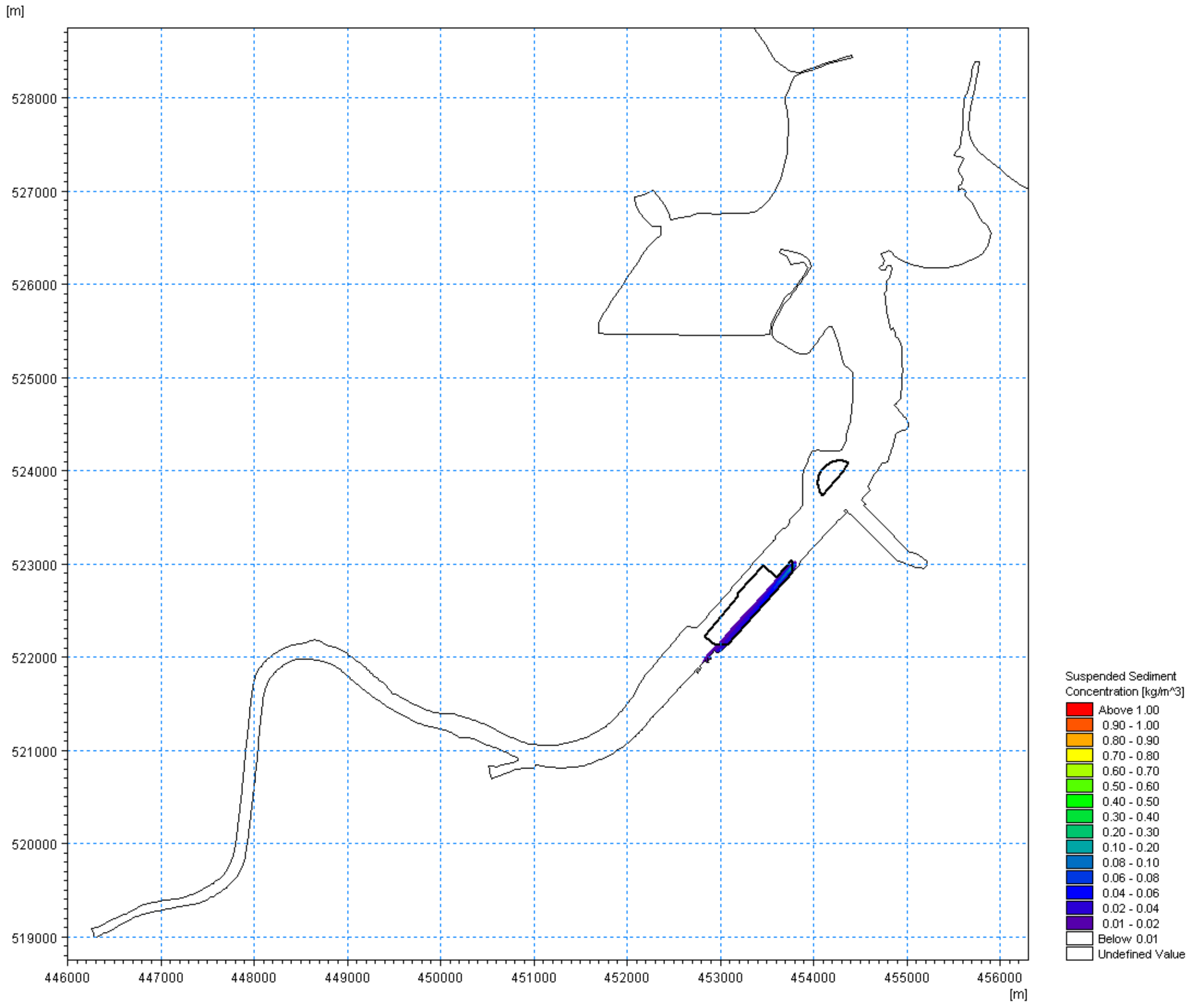

Figure 6.34 (Plot C) – Plume of enhanced SSCs arising from dredging activities during Stage 1 of the capital dredging programme

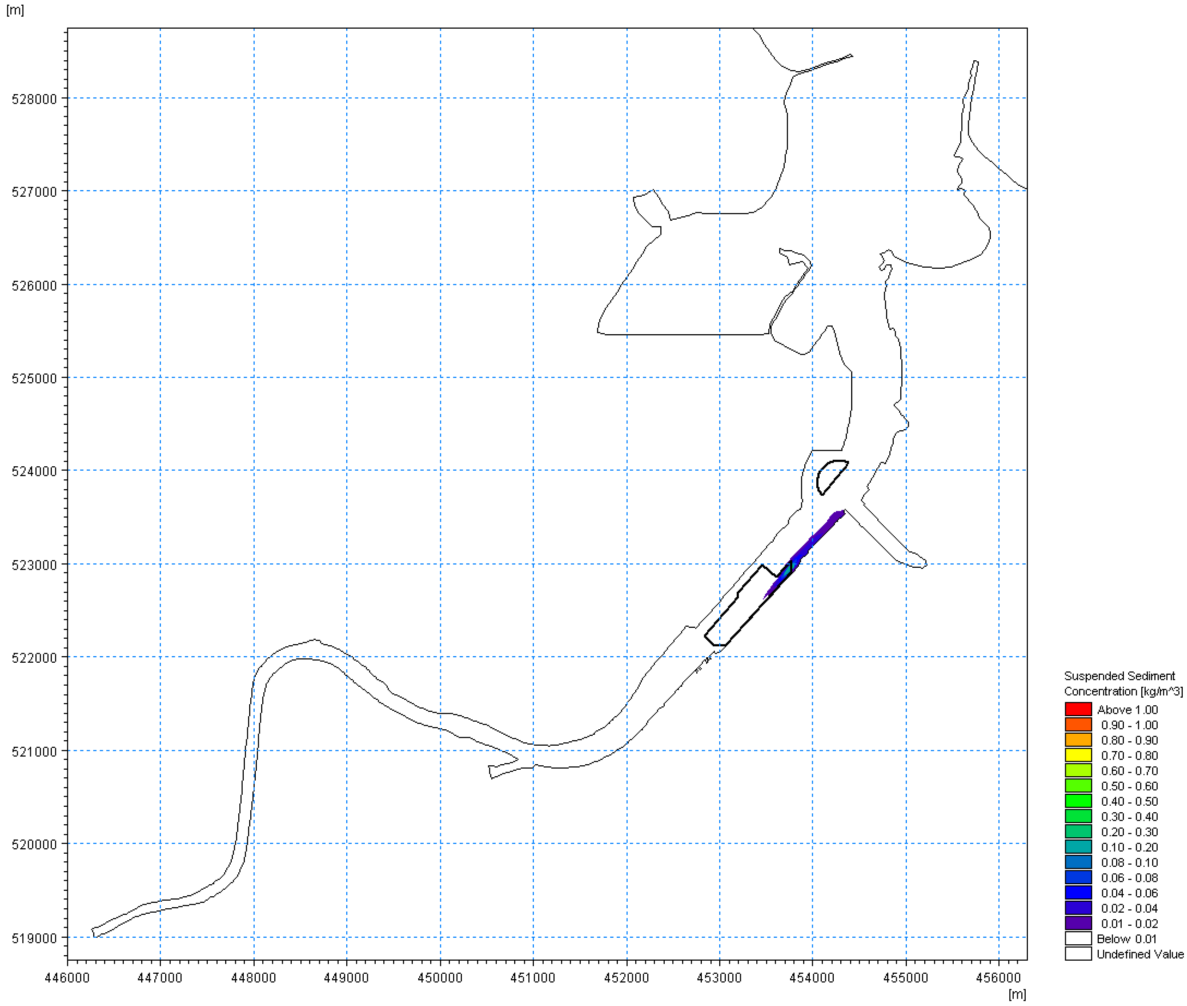

Figure 6.35 (Plot D) – Plume of enhanced SSCs arising from dredging activities during Stage 1 of the capital dredging programme

In order to determine a maximum 'zone of influence' from Stage 1 of the dredging activities, the maximum values of enhancement in SSC from any phase of the dredging operations during Stage 1 have been plotted in **Figure 6.36** (please note the earlier caution in interpreting this type of figure).

This figure shows that the maximum concentrations of SSC (up to a few hundred mg/l) are confined to the release points along the dredging transect at the proposed scheme site. Further upstream and downstream of the areas directly dredged, the SSC enhancement drops markedly (typically below 50mg/l a short distance from the point of dredging, and at the peripheries below 20mg/l) before merging with low background concentrations that characterise the baseline conditions.

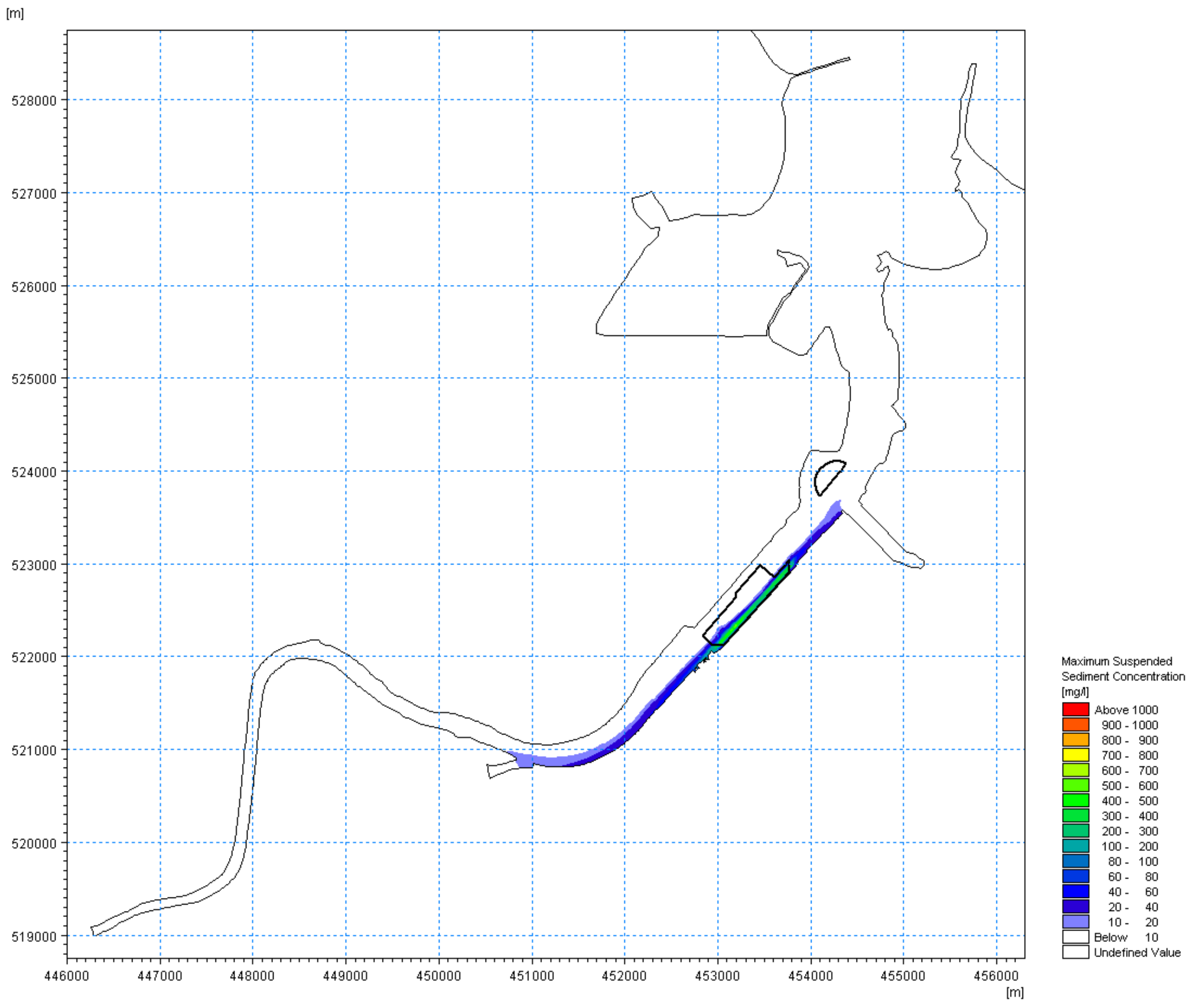

Figure 6.36 Maximum enhanced SSCs arising from dredging activities during Stage 1 of the capital dredging programme

During Stage 2 of the dredging activity (with the BHD and TSHD working in parallel to dredge the middle soft material (below -5m CD) in the berthing pocket and river channel), the model simulates releases over time, moving from the south-western end of each of two parallel dredging transects to the north-eastern end.

Results from this scenario are broadly similar to those from Stage 1, but now separate plumes are created from the two dredger types, as show in **Figures 6.37** and **6.38** (Plot A and Plot B show releases from the south-western and north-eastern ends of the two parallel dredging transects respectively). However, the principal difference to Stage 1 is that, at some points in the cycle, all or some parts of these initially separate plumes can coalesce and collectively occupy around half the width of the river channel as they move upstream and downstream according to the tidal phase, albeit at relatively low (typically <30mg/l and often <10 mg/l) SSC concentrations once a few hundred metres away from the point of initial release.

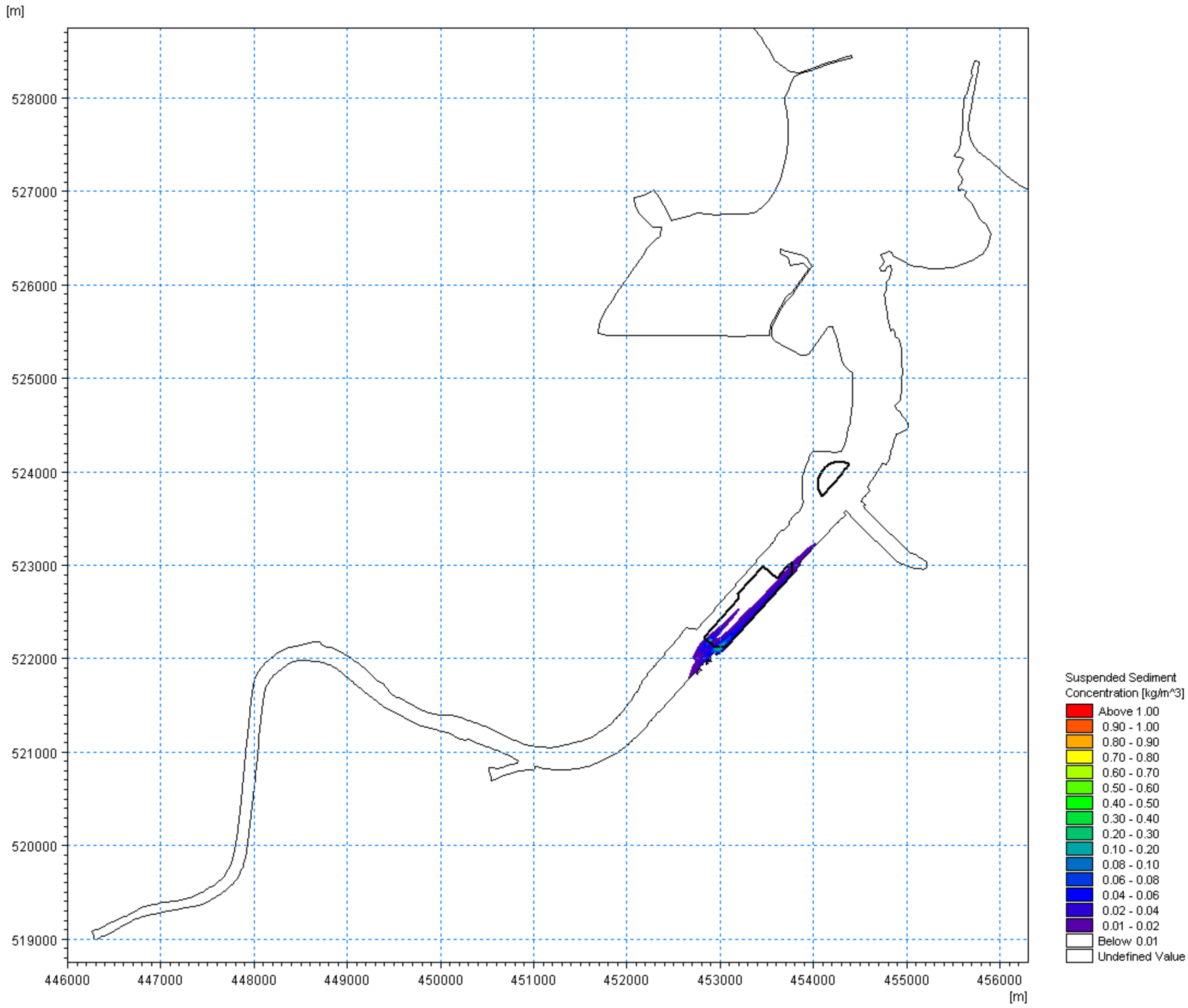

Figure 6.37 (Plot A) – Plume of enhanced SSCs arising from dredging activities during Stage 2 of the capital dredging programme

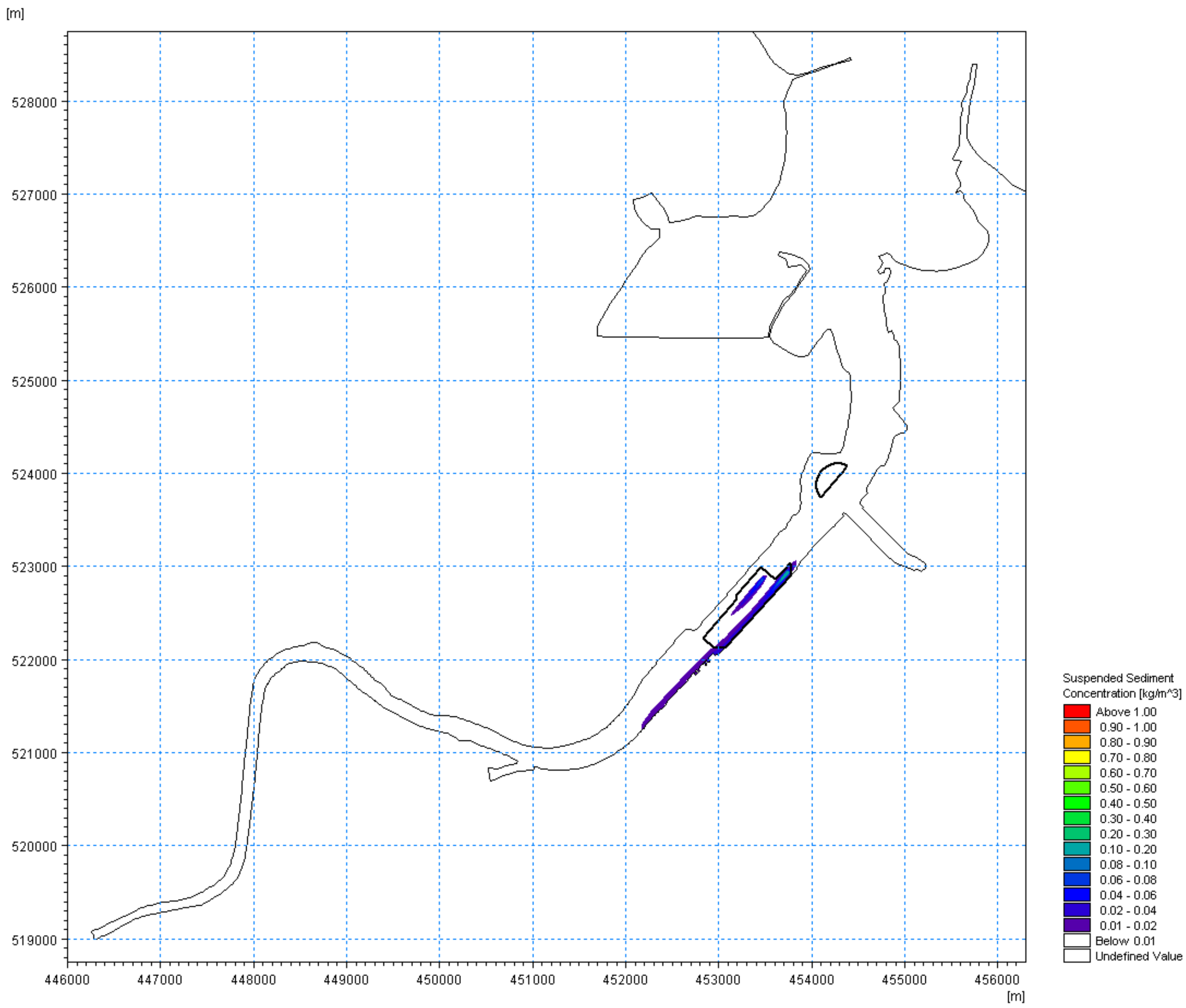

Figure 6.38 (Plot B) – Plume of enhanced SSCs arising from dredging activities during Stage 2 of the capital dredging programme

The maximum 'zone of influence' from Stage 2 of the dredging activities is shown in **Figure 6.39** (please note the earlier caution in interpreting this type of figure). This shows that during Stage 2 of the dredging, broadly similar patterns to those observed in Stage 1 are anticipated, although: (i) the lateral extent of the plume (at low concentrations) becomes slightly greater; (ii) the extent of the plume across the river channel becomes wider; and (iii) at times two plumes are created by the in-parallel dredging activities. Despite these subtle differences, maximum concentrations of SSC (up to a few hundred mg/l) remain confined to the release points along the dredging transects at the proposed scheme site. Further upstream and downstream of the areas directly dredged, the SSC enhancement drops markedly (typically below 50mg/l a short distance from the point of dredging, and at the peripheries below 20mg/l) before merging with low background concentrations that characterise the baseline conditions.

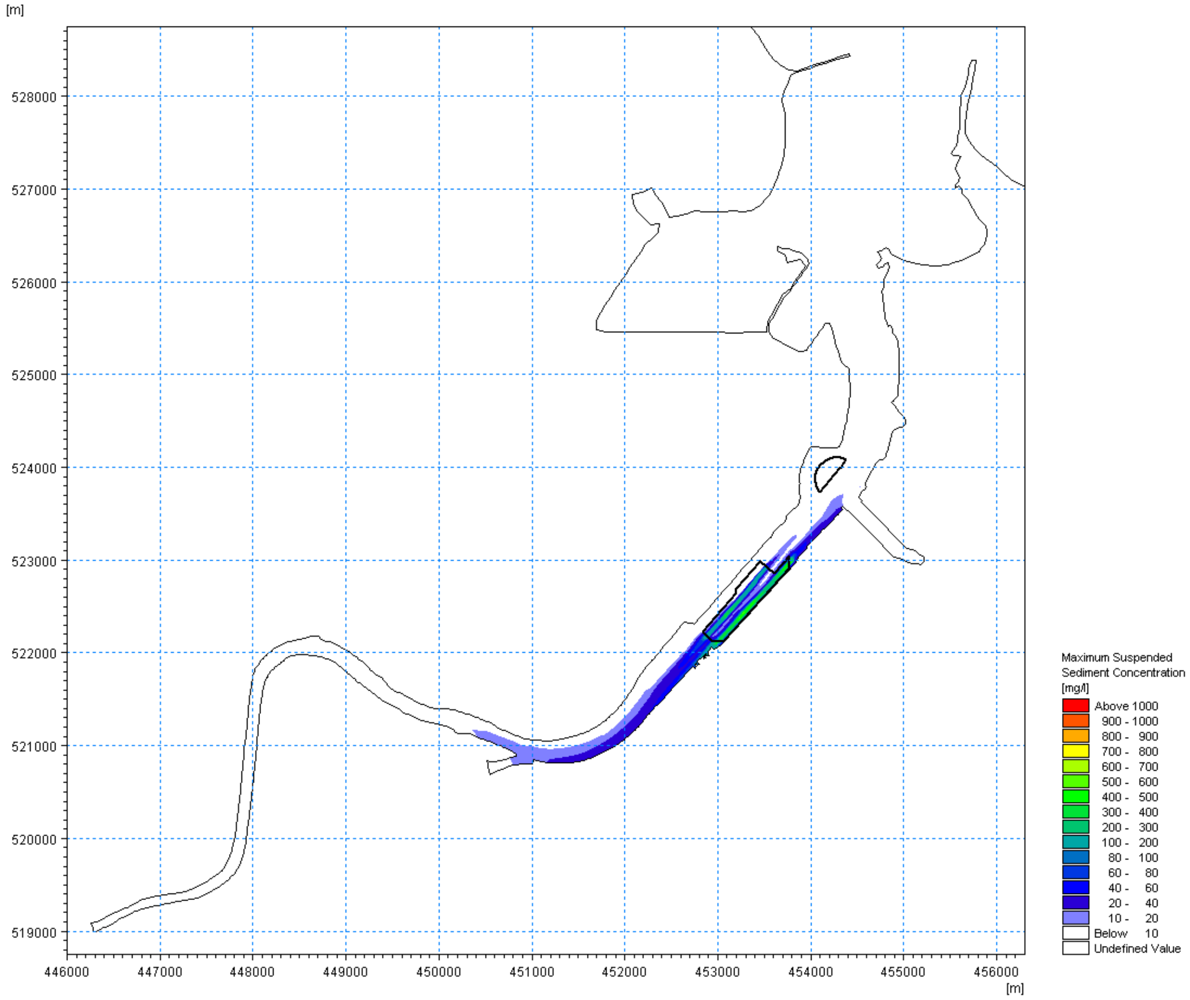

Figure 6.2 Maximum enhanced SSCs arising from dredging activities during Stage 2 of the capital dredging programme

During Stage 3 of the dredging activity (with the BHD working to dredge the bottom hard material in the berthing pocket and river channel), the model simulates releases over time, moving from the south-western end of the dredging transect to the north-eastern end.

Figures 6.40 – 6.43 shows the maximum extent of the plume during a release from the south-western corner of the dredging transect during the ebb phase (Plot A) and flood phase (Plot B) of the tide. Similar results are also shown for releases on the ebb phase (Plot C) and flood phase (Plot D) of the tide when the release is towards the north-eastern end of the dredging transect. It can be seen that the maximum SSC values and the spatial extents of the plume arising from Stage 3 of the dredging are much lower than those experienced during Stage 1, largely because the material being released is coarser and the production rate of dredging is notably lower.

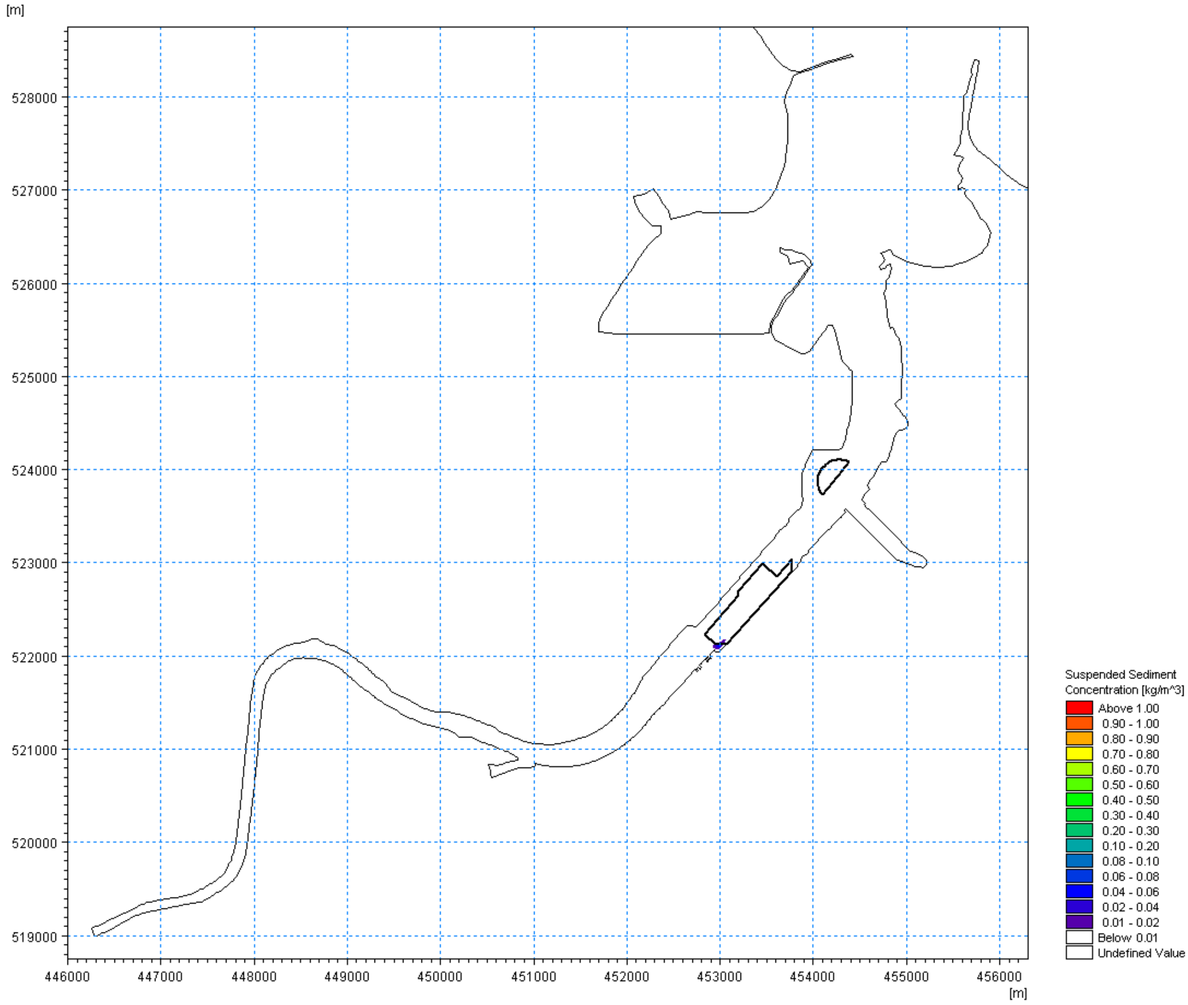

Figure 6.40 (Plot A) – Plume of enhanced SSCs arising from dredging activities during Stage 3 of the capital dredging programme

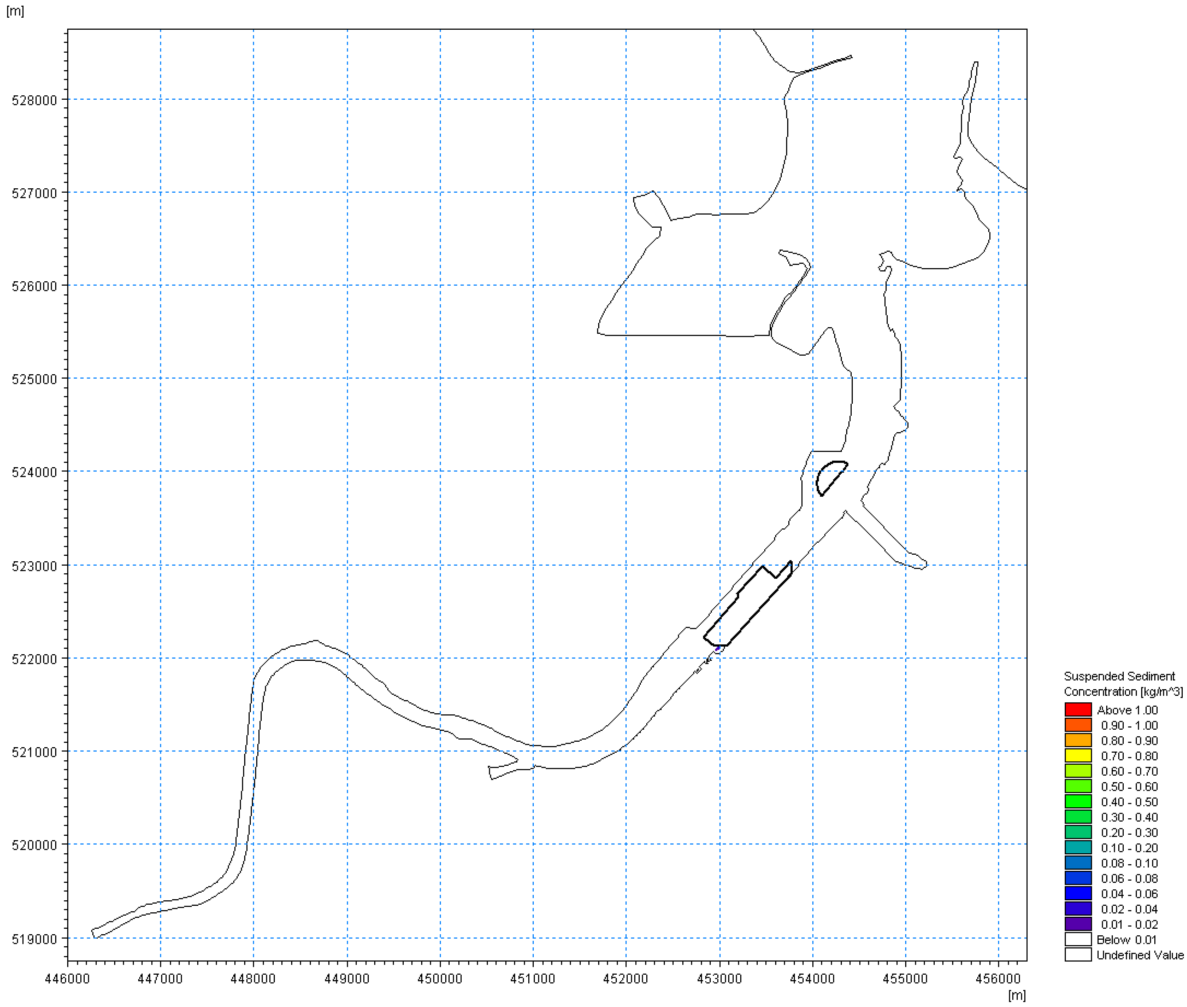

Figure 6.41 (Plot B) – Plume of enhanced SSCs arising from dredging activities during Stage 3 of the capital dredging programme

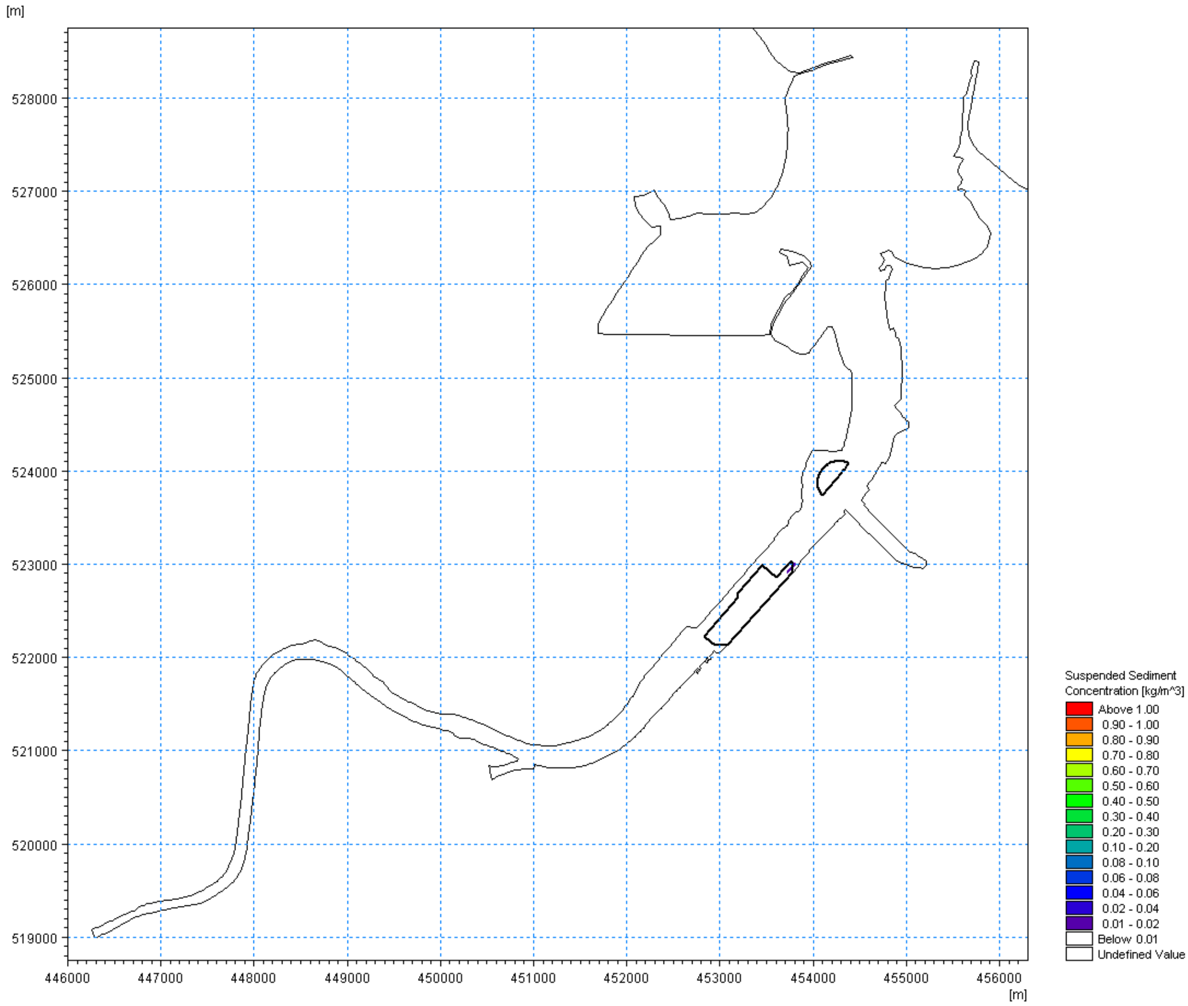

Figure 6.42 (Plot C) – Plume of enhanced SSCs arising from dredging activities during Stage 3 of the capital dredging programme

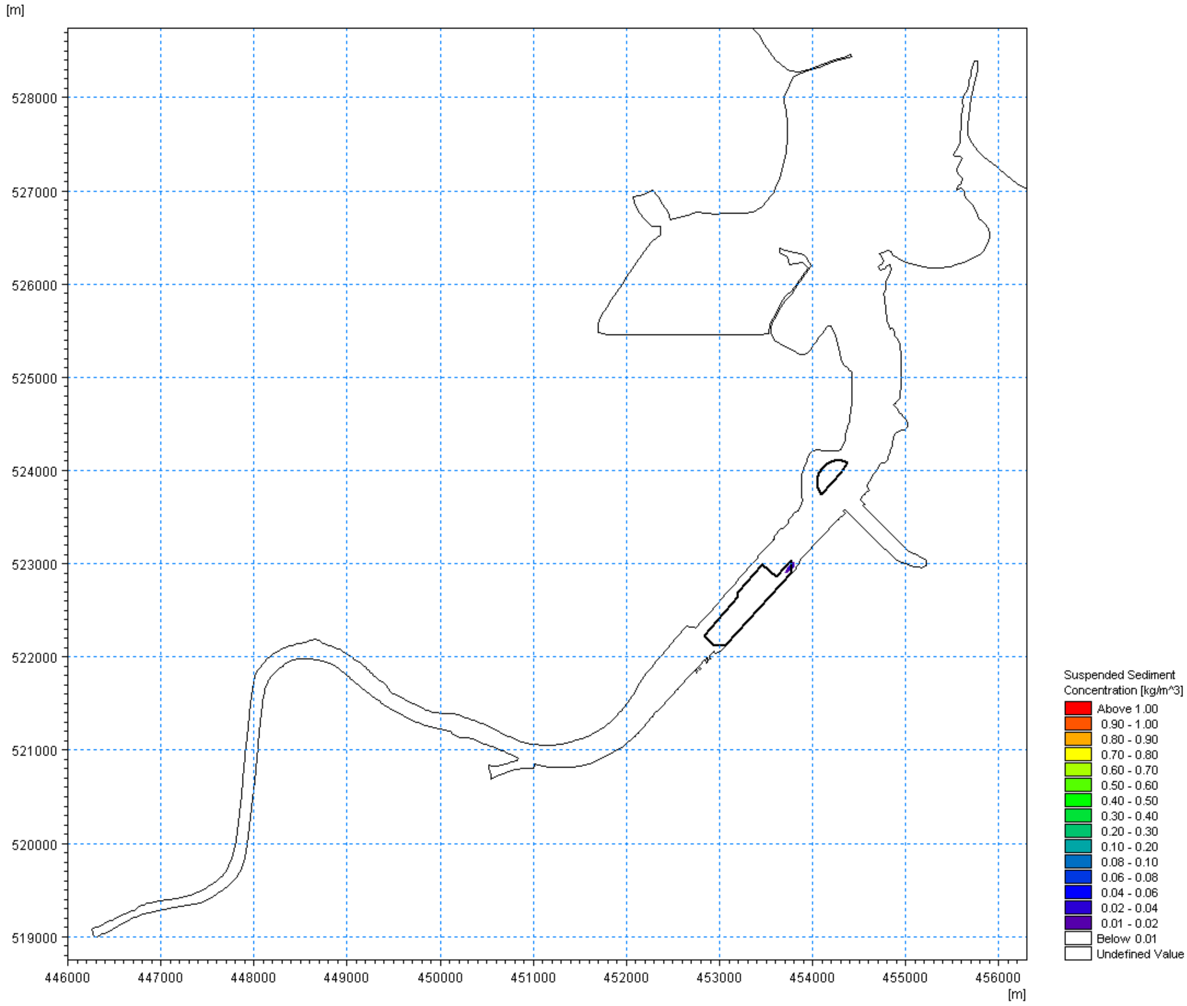

Figure 6.43 (Plot D) – Plume of enhanced SSCs arising from dredging activities during Stage 3 of the capital dredging programme

The maximum 'zone of influence' from Stage 3 of the dredging activities is shown in **Figure 6.44** (please note the earlier caution in interpreting this type of figure). This shows that during Stage 3 of the dredging, the maximum plume extent and maximum SSC values within the plume are much lower than experienced during both Stages 1 and 2 of the dredging (note the slight plume shown in the mid channel is a remnant of the Stage 2 dredging, which has not fully dissipated before Stage 3 commences). During Stage 3, the maximum extent of the plume is confined to within the length of the proposed quay and covers only a very narrow width of the channel, at very low peak concentrations.

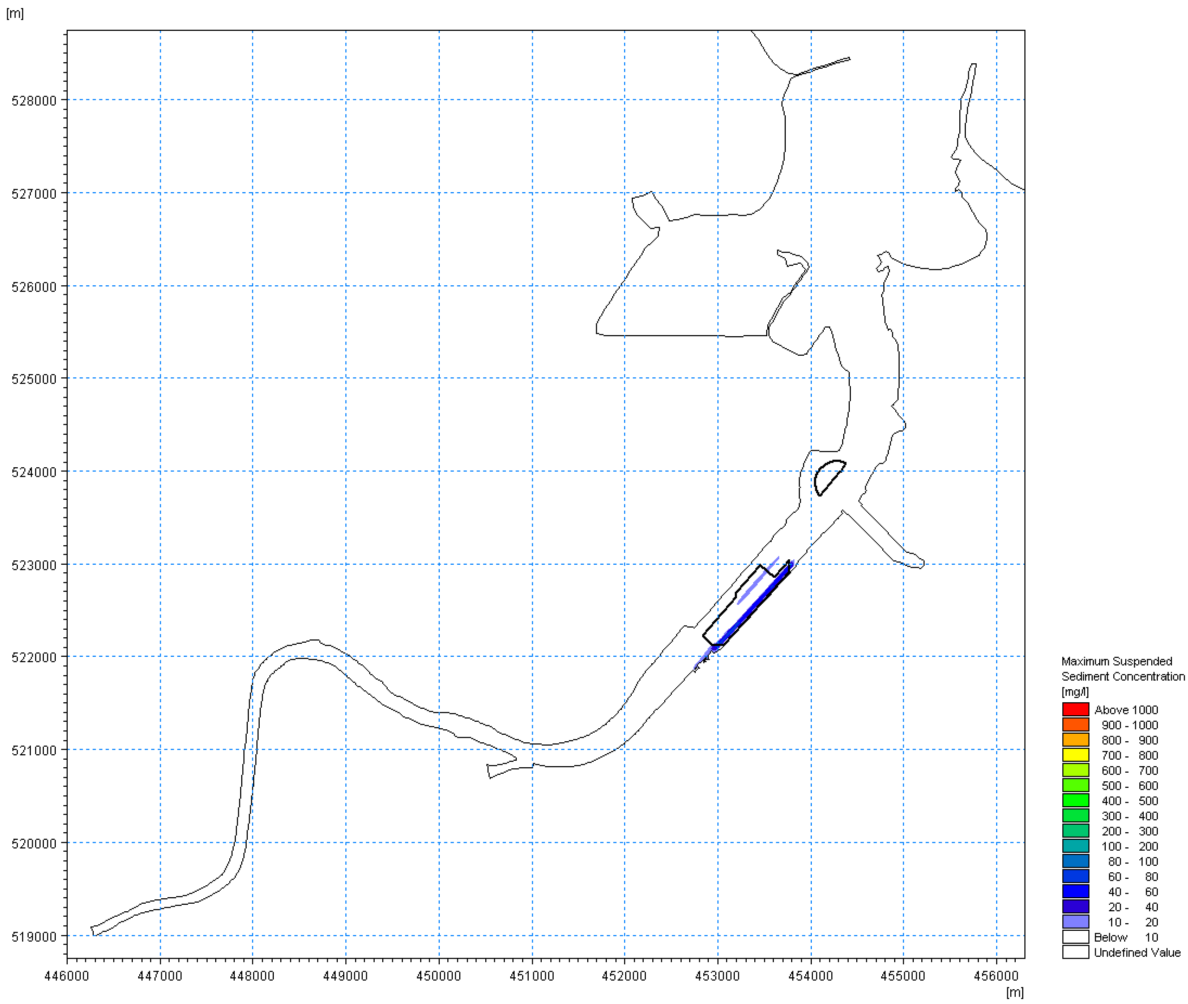

Figure 6.44 Maximum enhanced SSCs arising from dredging activities during Stage 3 of the capital dredging programme

During Stage 4 of the dredging activity (with the BHD and TSHD working in parallel to dredge the material in the Tees Dock turning circle), the model simulates releases over time, moving from the south-western end of each of two parallel dredging transects to the north-eastern end.

Peak concentrations from dredging are always local to the point of disturbance from dredging at the riverbed, typically less than 300mg/l for a very short duration (depending on timing of release with respect to the phase of the tide). **Figure 6.45** and **6.46** shows the maximum extent of the plume during a release from the turning circle during the ebb phase (Plot A) and flood phase (Plot B) of the tide.

On the ebb phase, the plume can extend at low (<30mg/l) concentrations along the jetties of the Oil Terminal towards (but not entering) the Conoco Phillips Inset Dock, whilst on the flood phase it tends to remain close to the northern bank over a narrow channel width extending along the North Tees Works jetties. At certain times in the dredging cycle, SSC values can become enhanced by typically 10 to 20mg/l between the point of release in the turning circle and the closest north bank within the embayment occupied by the Storage Depot. Under no conditions does the plume enter Tees Dock at any significant concentration.

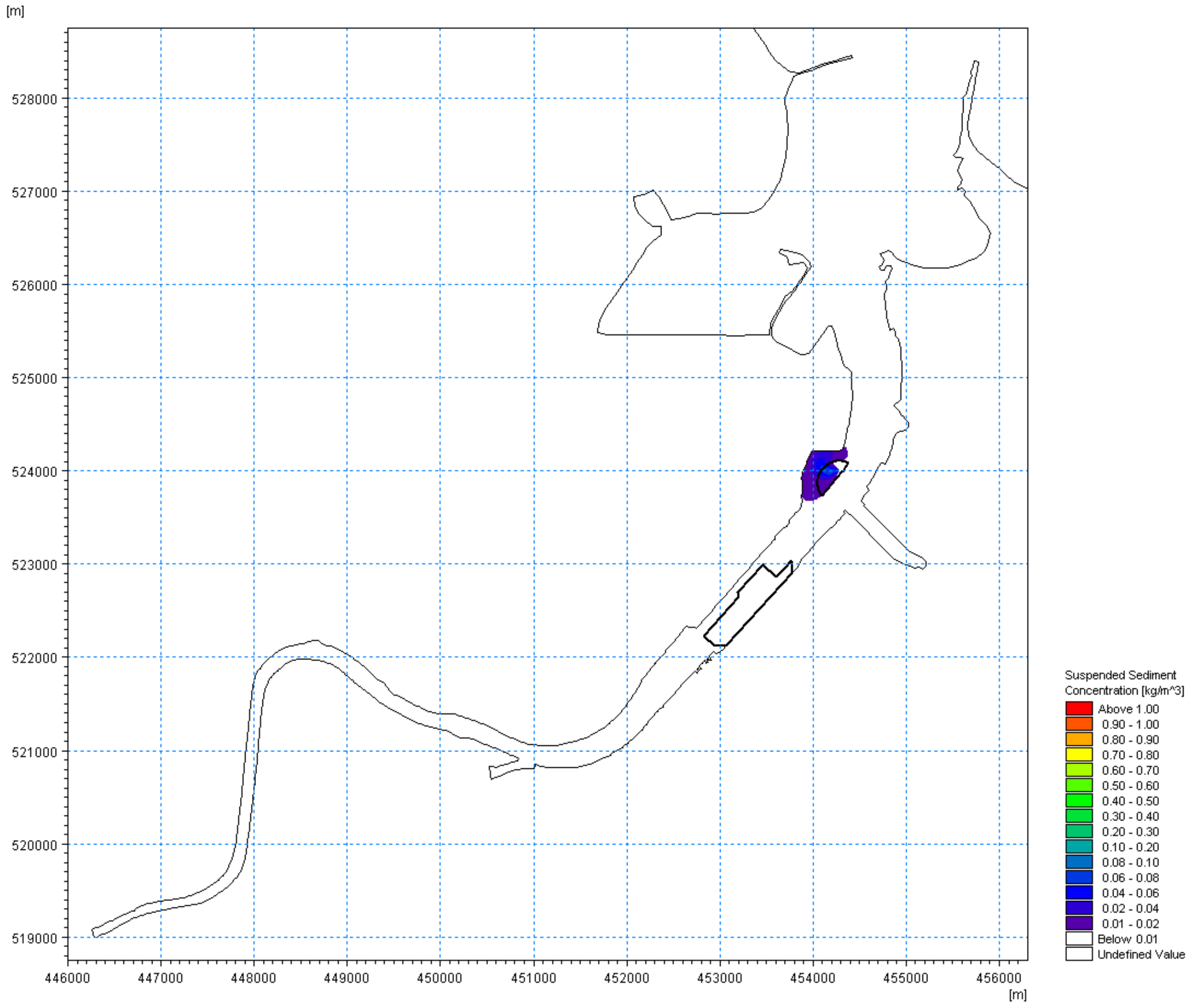

Figure 6.45 (Plot A) – Plume of enhanced SSCs arising from dredging activities during Stage 4 of the capital dredging programme

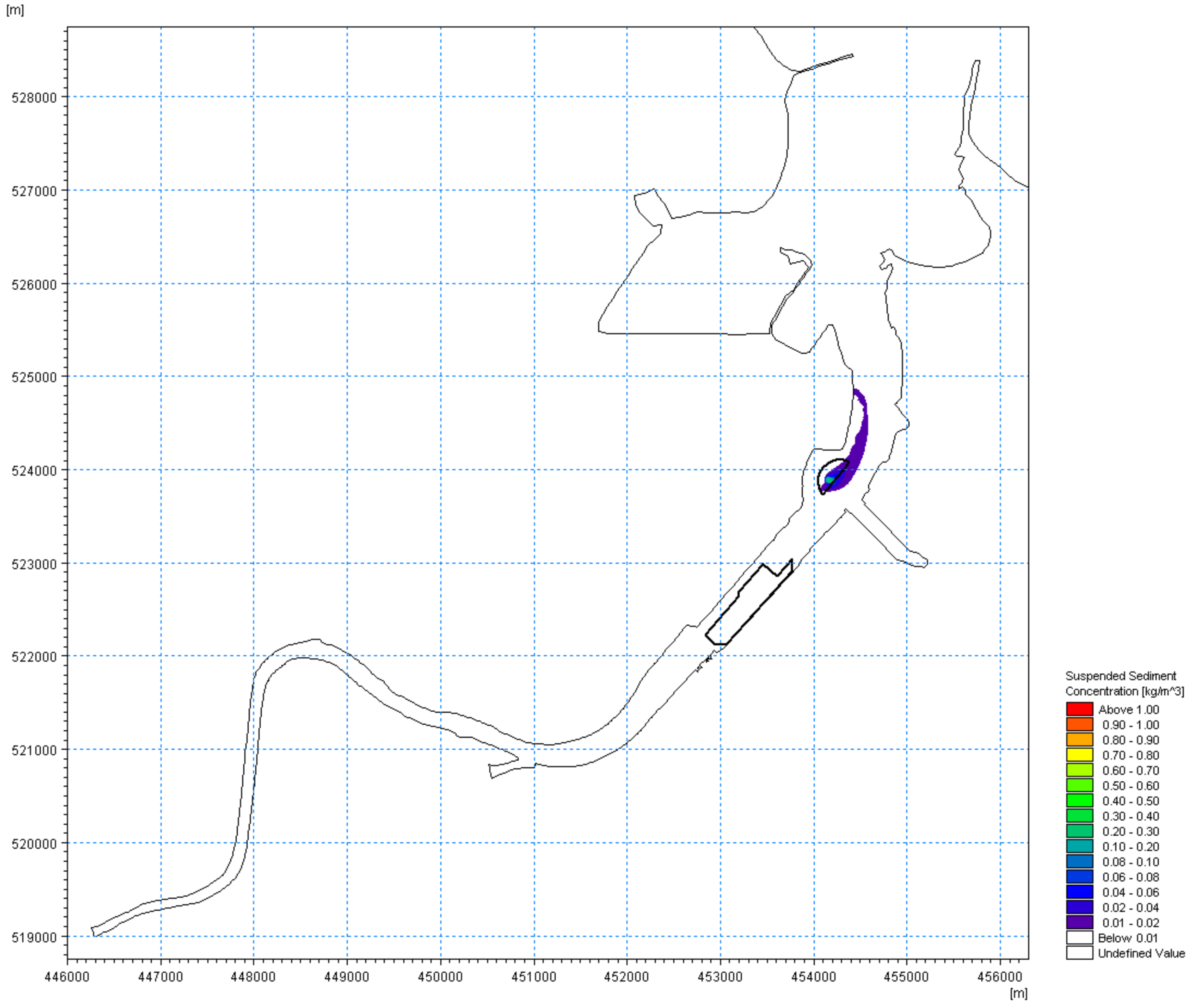

Figure 6.46 (Plot B) – Plume of enhanced SSCs arising from dredging activities during Stage 4 of the capital dredging programme

The maximum 'zone of influence' from Stage 4 of the dredging activities is shown in **Figure 6.47** (please note the earlier caution in interpreting this type of figure). This shows that during Stage 4 of the dredging, the plume is created at the turning circle and along parts of the north bank of the river. As with previous stages, the maximum SSC concentrations remain local to the point of dredging within the turning circle (up to a few hundred mg/l). Further upstream and downstream of the areas directly dredged, the SSC enhancement drops markedly (typically below 50mg/l a short distance from the point of dredging, and at the peripheries below 20mg/l) before merging with low background concentrations that characterise the baseline conditions.

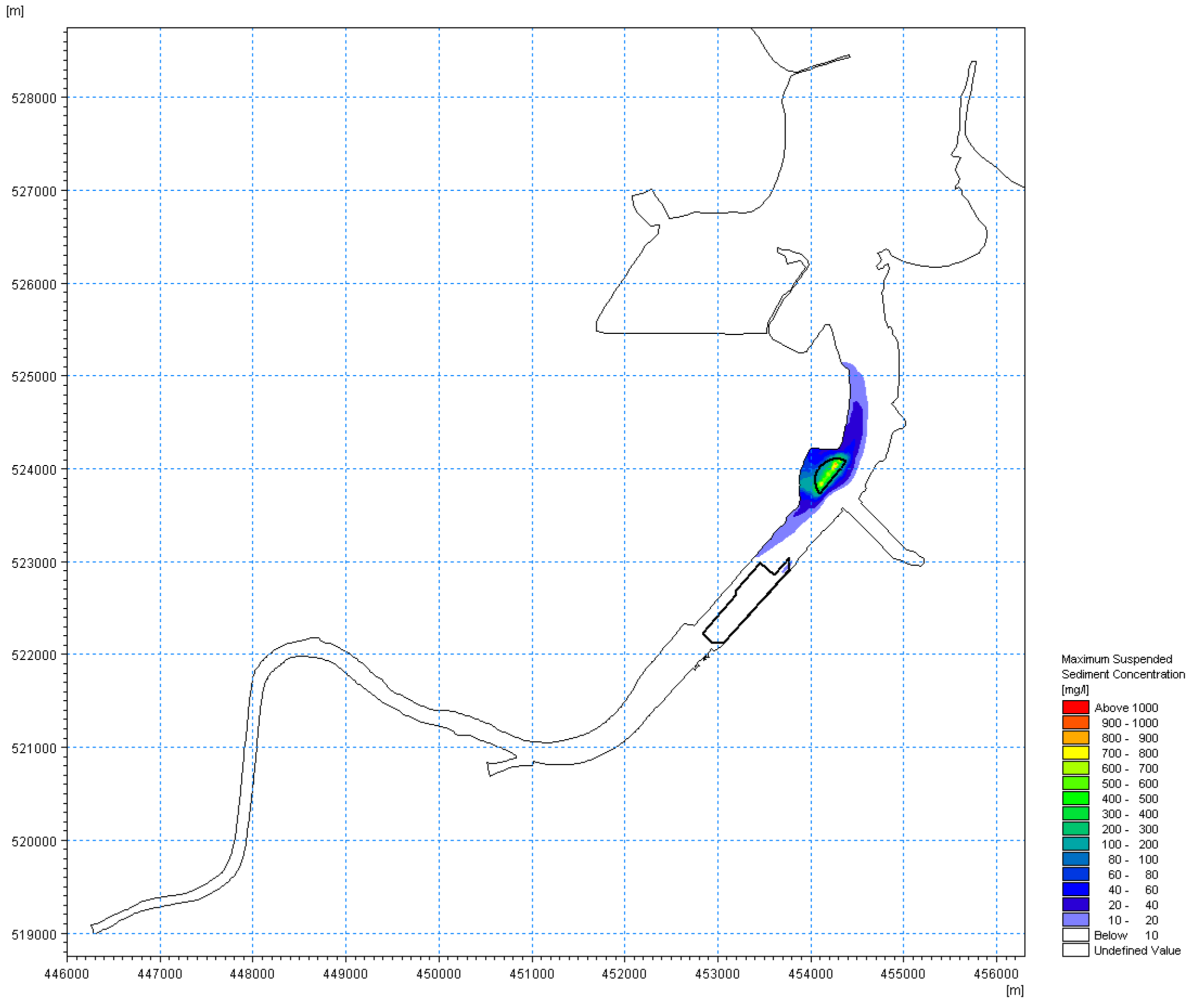

Figure 6.47 Maximum enhanced SSCs arising from dredging activities during Stage 4 of the capital dredging programme

The sediment plumes that arise from the four stages of the dredging could potentially affect areas of riverbed or seabed that are remote from the point of sediment release in terms of either increases in SSC or increases in sediment deposition. This could affect water quality (in terms of increased turbidity) or aquatic ecology (by 'smothering' of interest features) in the river. To further investigate this, the combined maximum 'zone of influence' from Stages 1 - 4 inclusive of the dredging activities has been plotted in **Figure 6.48** for the near-bed layer of the water column and in **Figure 6.49** for the near-surface layer (please note the earlier caution in interpreting this type of figure).

These figures demonstrate that near-surface effects are generally slightly lower than near-bed effects, and that during the predicted four months of dredging, all individual or coalesced plume effects are confined to within the river reaches that extend between Middleborough Dock/Transporter Bridge at the upstream end and the Oil Terminal on the north bank at the downstream end.

Furthermore, all plumes associated with dredging of the berthing pocket and river channel in the vicinity of the proposed new quay are confined to the right bank (south of centre line) portion of the channel's width, whilst all plumes associated with dredging of the turning circle are confined to the left bank (north of centre line) portion of the channel's width in the reaches that they respectively affect.

No plume effects (and by implication no deposition effects) of a significant level above background values will occur beyond these reaches (i.e. areas such as Tees Dock, Seal Sands, Bran Sands, North Gare Sands and the adjacent coastlines of Seaton Sands (west of the river mouth) and Coatham Sands (east of the river mouth) will not be affected).

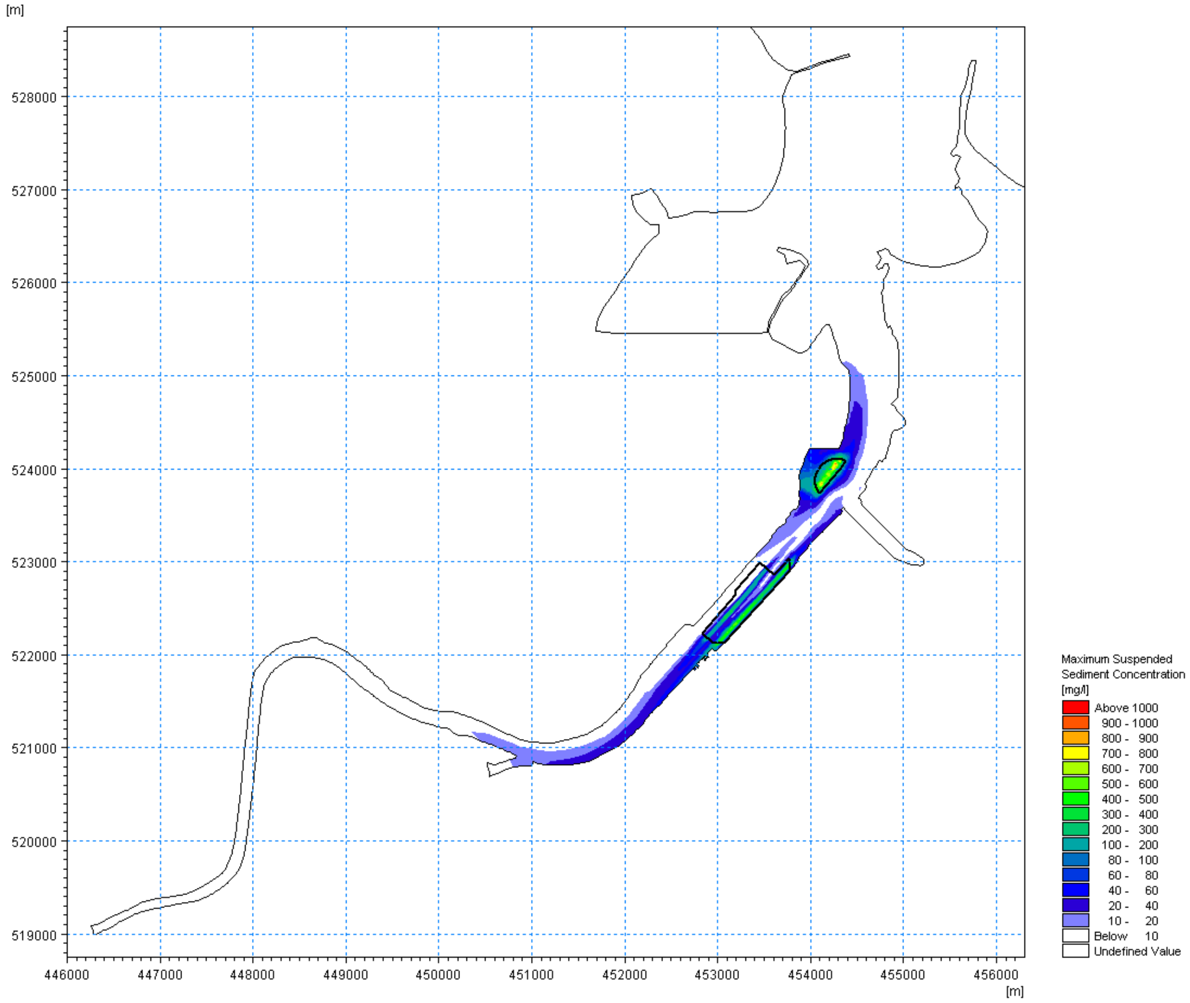

Figure 6.3 Maximum enhanced SSCs (near-bed layer) arising from dredging activities during Stages 1 - 4 inclusive of the capital dredging programme

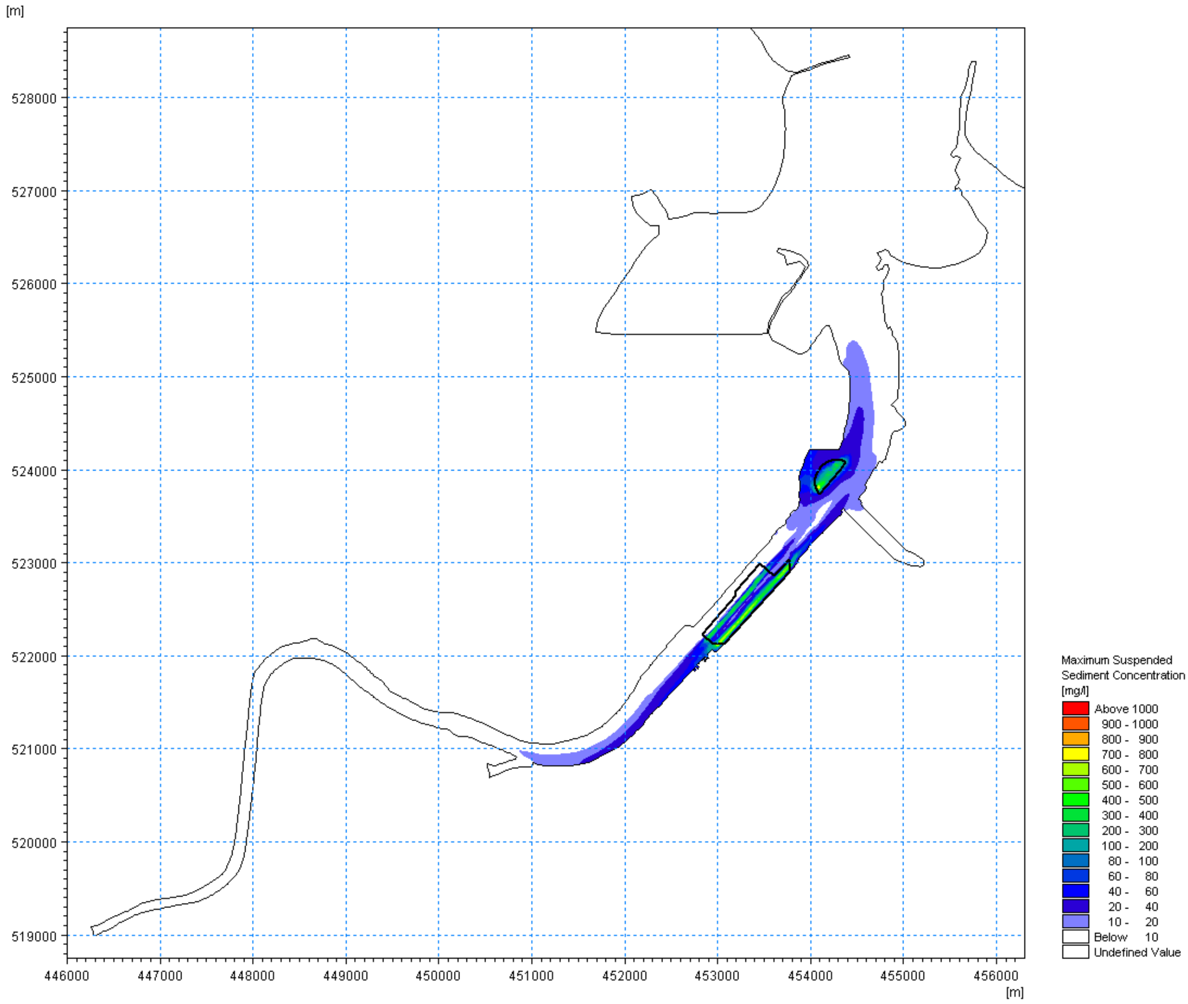

Figure 6.49 Maximum enhanced SSCs (near-surface layer) arising from dredging activities during Stages 1 - 4 inclusive of the capital dredging programme

Sediment suspended within the dredging plumes will fall to the riverbed, either soon after disturbance or spillage 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). **Figure 6.50** shows the maximum changes in riverbed thickness caused by this deposition. It can be seen that much of the sediment falls to the bed within the dredged areas (from where it will be re-dredged to achieve the necessary bed depths), 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.

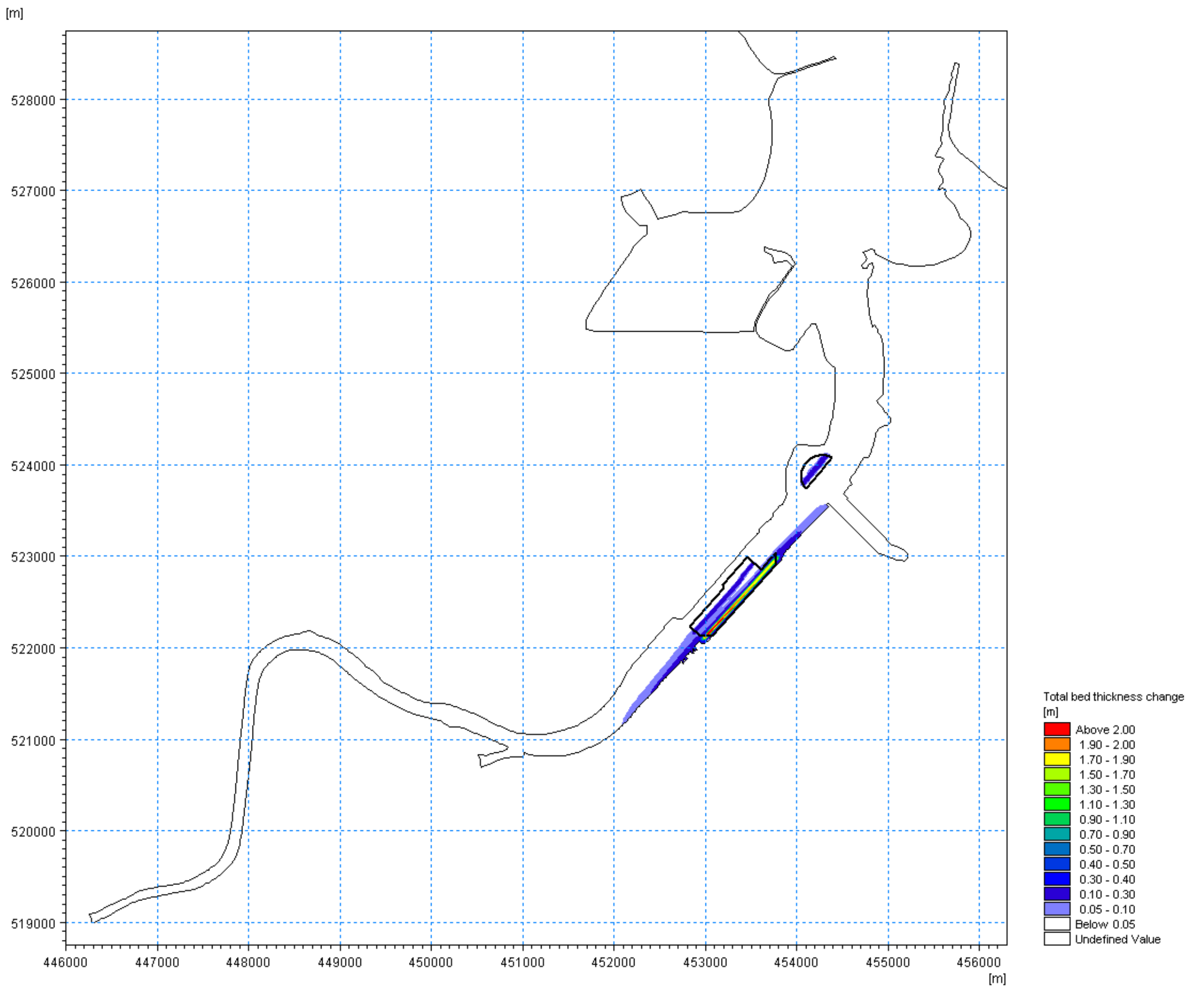

Figure 6.50 Maximum riverbed thickness change due to sediment deposition arising from dredging activities during Stages 1 - 4 inclusive of the capital dredging programme

Within this maximum zone of influence from sediment plumes and bed deposition, the following receptors could potentially be adversely affected by increases in SSC or increases in sediment deposition (or both factors occurring in combination):

- **Water quality** (the river reach, as represented by the water quality monitoring points located throughout the river - see **Section 28**).
- **Marine ecology** (the three areas of inter-tidal mudflat identified as Priority Habitats – see **Section 11**). [Note: None of the other significant areas of Priority Habitat in the river or adjacent coasts would be affected by the zone of influence of the dredging operations].
- **Navigation** (the main navigation channel of the river, parts of the Tees Dock turning circle, the jetties along North Tees Works Oil Refinery, the Storage Depot and the Oil Terminal on the north bank, the jetties along Cargo Fleet Wharf and Teesport on the south bank and parts of Middlesbrough Dock up to its lock gates).

To further investigate these effects, timeseries plots of changes in SSC and changes in riverbed thickness have been extracted from the model at a series of points within the affected river reaches (locations are shown in **Figure 6.51**). The points are:

- WQ1 – Water quality monitoring point (Tees at the Gares);
- WQ2 – Water quality monitoring point (Tees at Redcar Jetty);
- WQ3 – Water quality monitoring point (Tess at Smiths Dock);
- WQ4 – Water quality monitoring point (Tees at Haverton Hill Shipyard);
- WQ5 – Water quality monitoring point (Tees at the Barrage);

- M1 – Mudflat (north);
- M2 – Mudflat (centre);
- M3 – Mudflat (south);

- NV1 – Oil Terminal (north bank);
- NV2 – Storage Depot (north bank);
- NV3 – North Tees Works Oil Refinery (north bank);
- NV4 – Teesport (south bank);
- NV5 – Cargo Fleet Wharf (south bank); and
- NV6 – Middlesbrough Dock (south bank).

At the water quality monitoring points, it is only at point 3 (Smiths Dock) where SSC is elevated by any appreciable extent, with peak enhancements of between 15 and 85 mg/l during Stage 2 of the dredging programme (**Figure 6.52**). Whilst Stage 1 of the dredging also causes some enhancement in SSC at point 3, the values are so low (<5mg/l) as to be negligible compared with background levels and, in all cases, the elevations in SSC drop rapidly after each dredging plume has dispersed, and return to baseline levels at points of downtime or between successive dredging stages. There are no significant effects noted at the water quality sampling points during Stage 3 of the dredging and only negligible effects for a short duration during Stage 4. Similarly it is only point 3 where any appreciable sediment deposition occurs, and this is at a very low value (6mm) throughout the entire dredging programme (**Figure 6.53**) and in reality some of this material will become re-suspended by tidal currents or dredged during maintenance campaigns of the river channel.

At the mudflat monitoring points, it is only during Stage 4 of the dredging that any discernible effects are noted, when at Mudflat 1 SSC increases by a peak of 22mg/l, at Mudflat 2 it increases by a peak of 10mg/l and at Mudflat 3 it increases by a peak of 8mg/l (**Figure 6.54**). Sediment deposition on the mudflats is predicted to be immeasurable (**Figure 6.55**).

At the navigation monitoring points on the north bank, it is only during Stage 4 of the dredging that any discernible effects are noted, when at Location 1 (Oil Terminal) SSC increases by a peak of 8mg/l, at Location 2 (Storage Depot) it increases by a single peak of 75mg/l (but with maximum values mostly being less than 50mg/l), and at Location 3 (North Tees Works Oil Refinery) it increases by a peak of 8mg/l (**Figure 6.56**). Sediment deposition at these locations is predicted to be immeasurable (**Figure 6.57**).

At the navigation monitoring points on the south bank, it is throughout Stages 1 and 2 of the dredging that discernible effects are most noted, when at Location 4 (Teesport) SSC increases by a peak of around 30mg/l, at Location 5 (Cargo Fleet Wharf) it increases by a peaks of between 15 and 48mg/l, and at Location 6 (Middlesbrough Dock) peaks occur on fewer occasions and reach a maximum value of 7mg/l. During Stages 3 and 4 of the dredging, only negligible effects are noted, equivalent to variations within the background levels of concentrations (**Figure 6.58**). Sediment deposition at Location 6 (Middlesbrough Dock) is predicted to be immeasurable, but up to 10mm of deposition is predicted at Location 5 (Cargo Fleet

Wharf) and up to 9mm at Location 4 (Teesport) (**Figure 6.59**). Some of this deposited material will become re-suspended by tidal currents or will be removed during maintenance dredging campaigns of the river channel and berths.

Overall changes of these magnitudes in SSC and sediment deposition are unlikely to cause significant effects on water quality, marine ecology or navigation in the river, but these matters are assessed more fully in **Sections 7**, **9** and **14**, respectively.

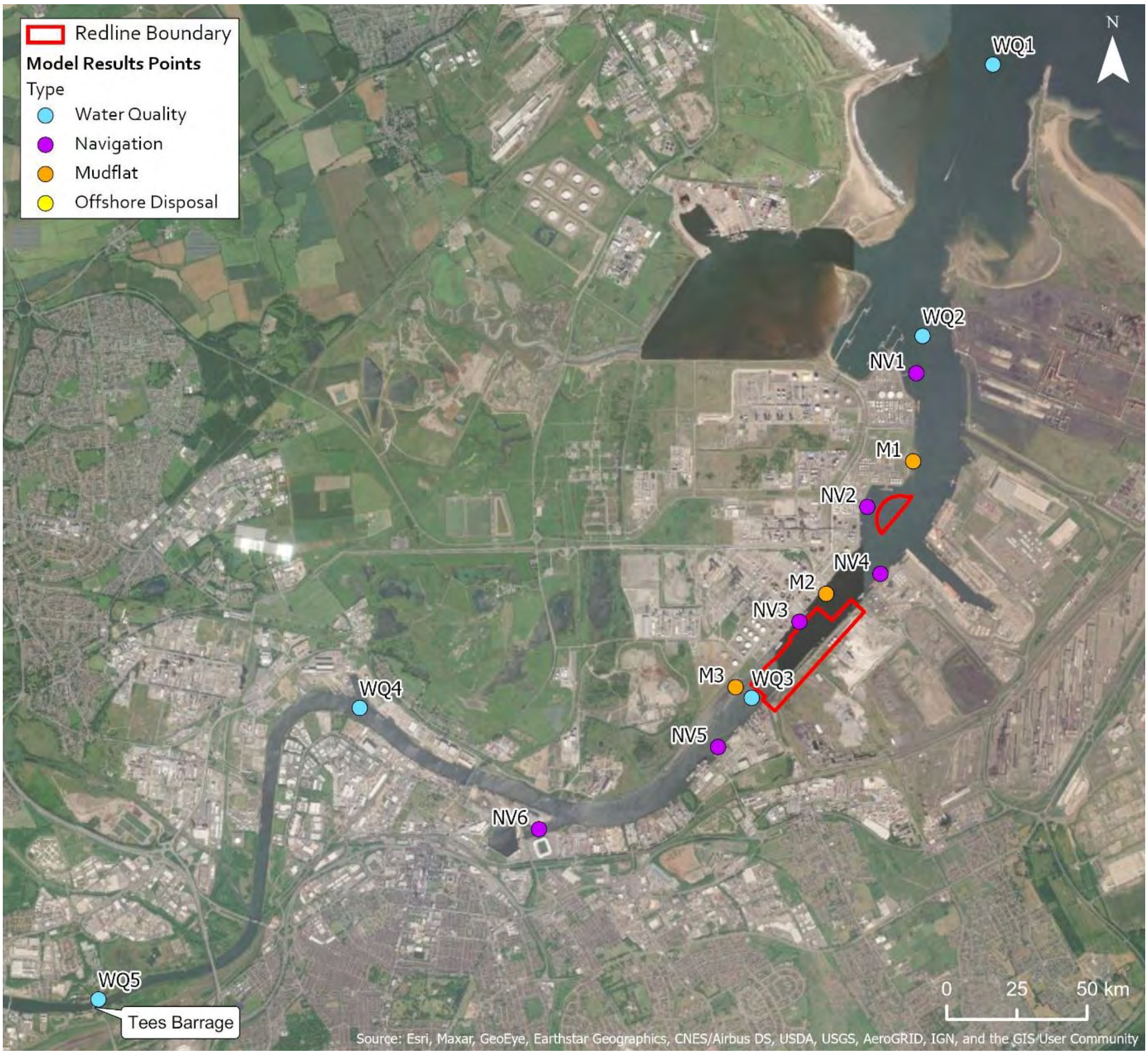

Figure 6.51 Location of points used for of timeseries analysis of changes in SSC and sediment deposition

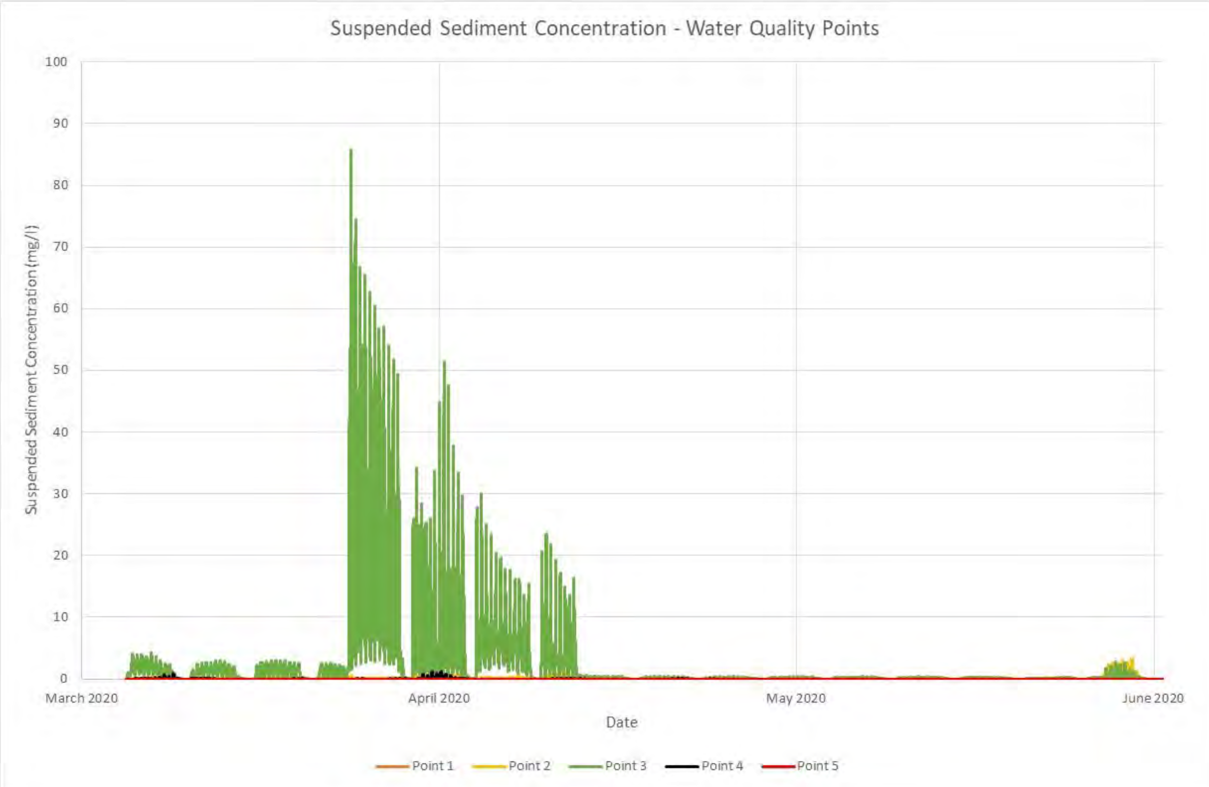

Figure 6.52 Timeseries of changes in SSC at the water quality monitoring points

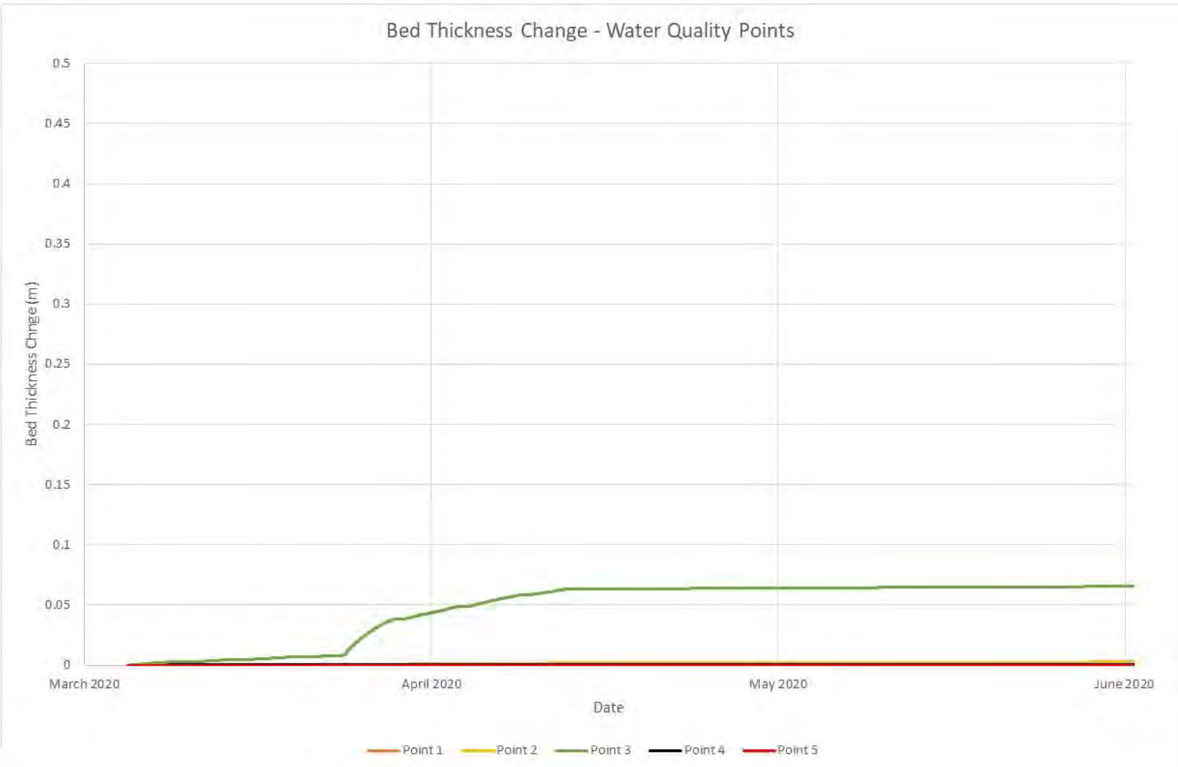

Figure 6.53 Timeseries of changes in sediment deposition at the water quality monitoring points

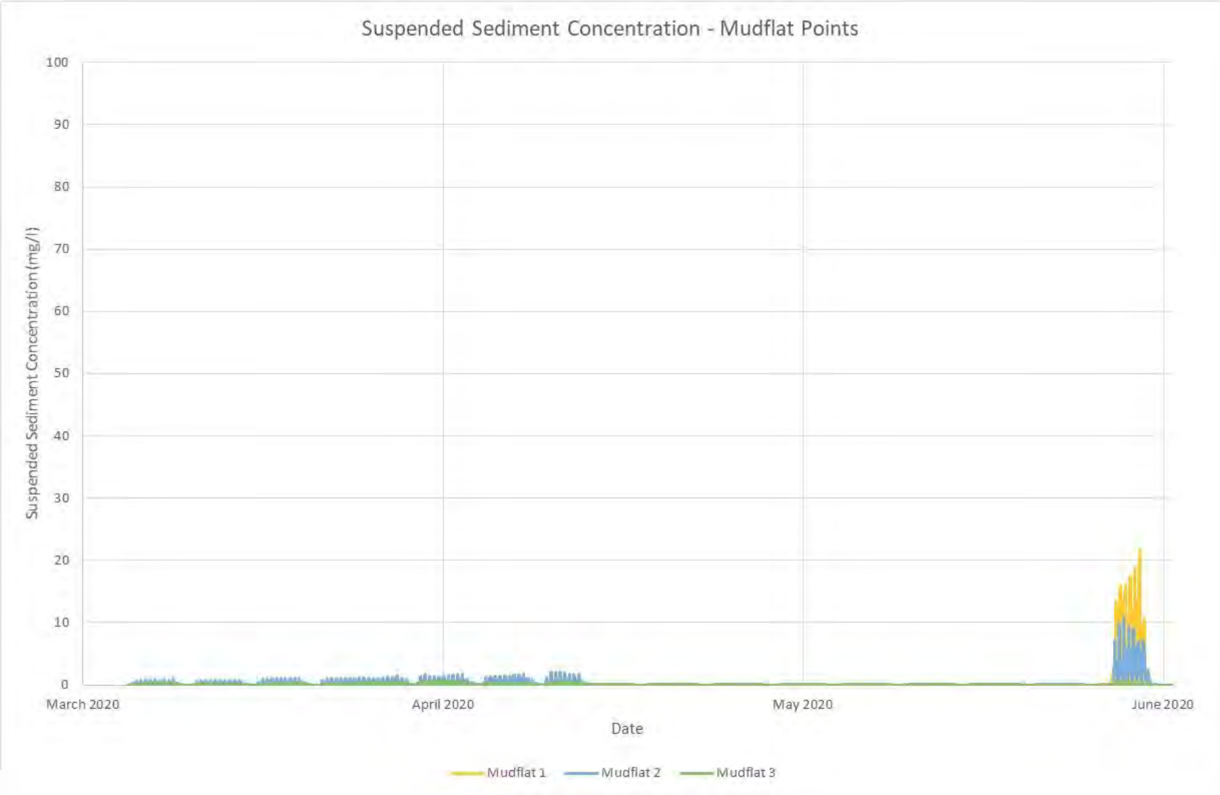

Figure 6.54 Timeseries of changes in SSC at the mudflat monitoring points

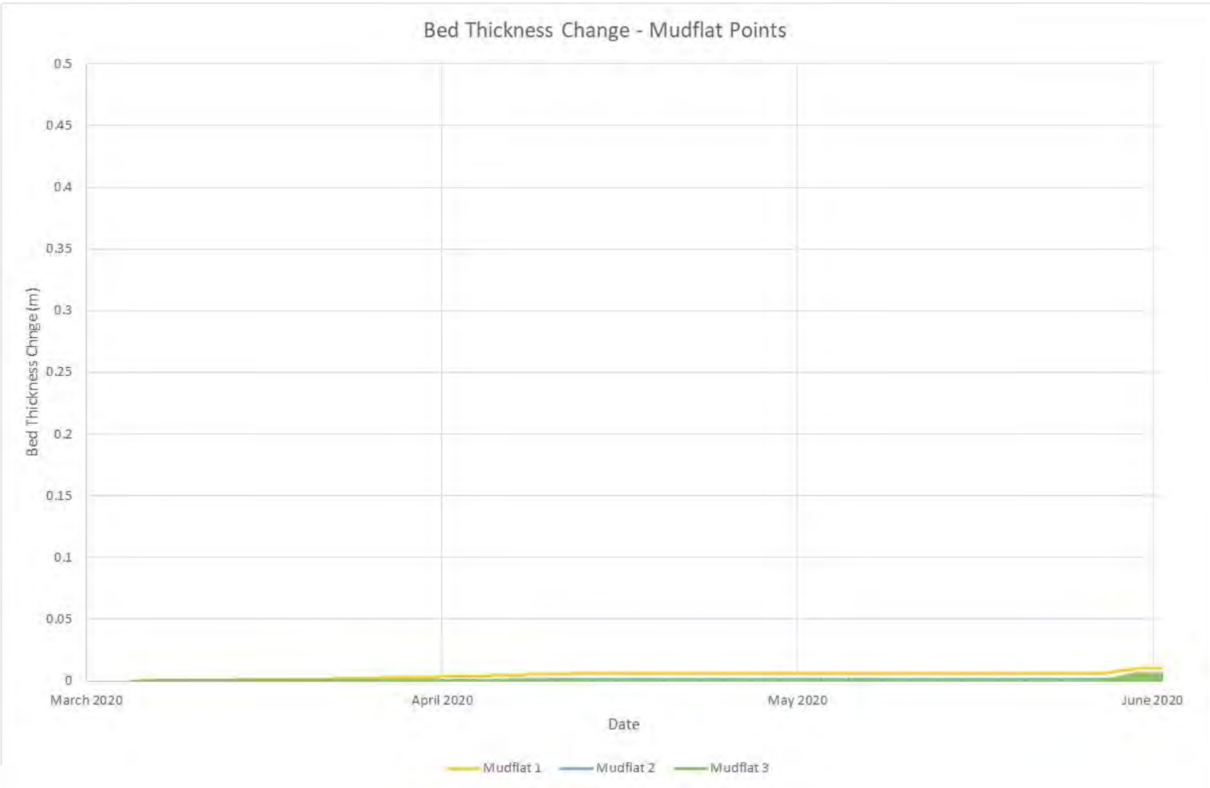

Figure 6.55 Timeseries of changes in sediment deposition at the mudflat monitoring points

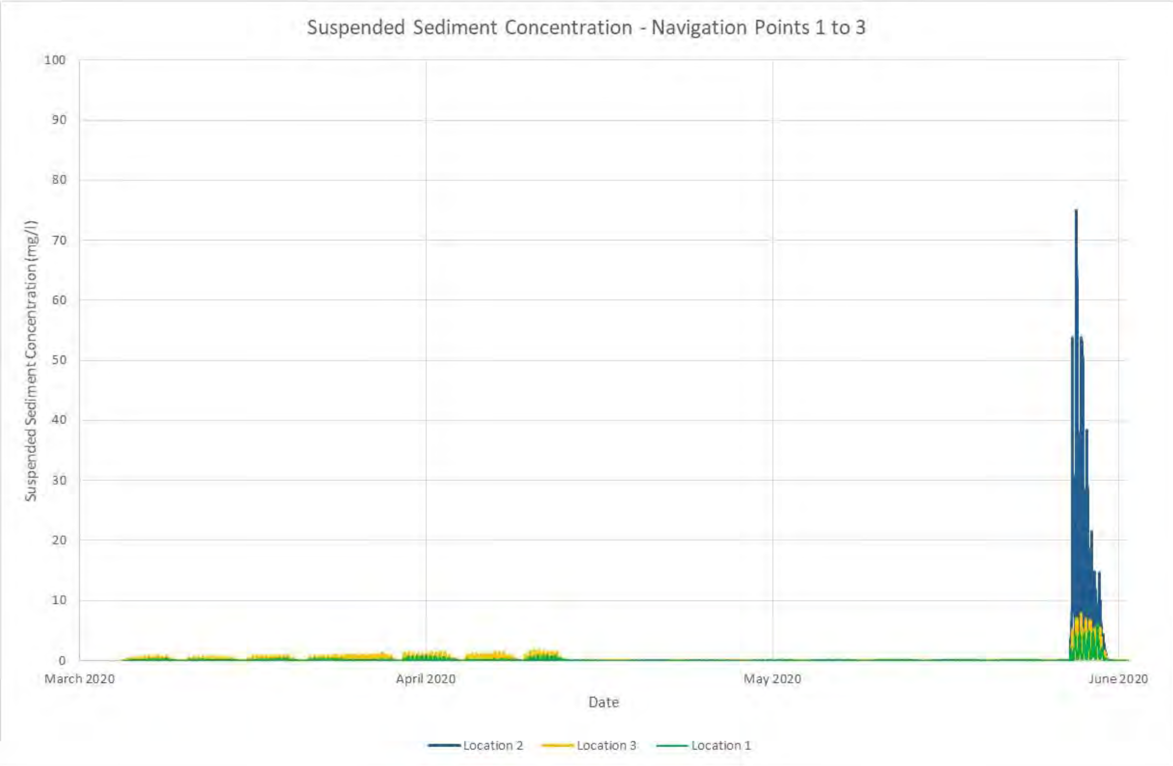

Figure 6.56 Timeseries of changes in SSC at the navigation (north bank) monitoring points

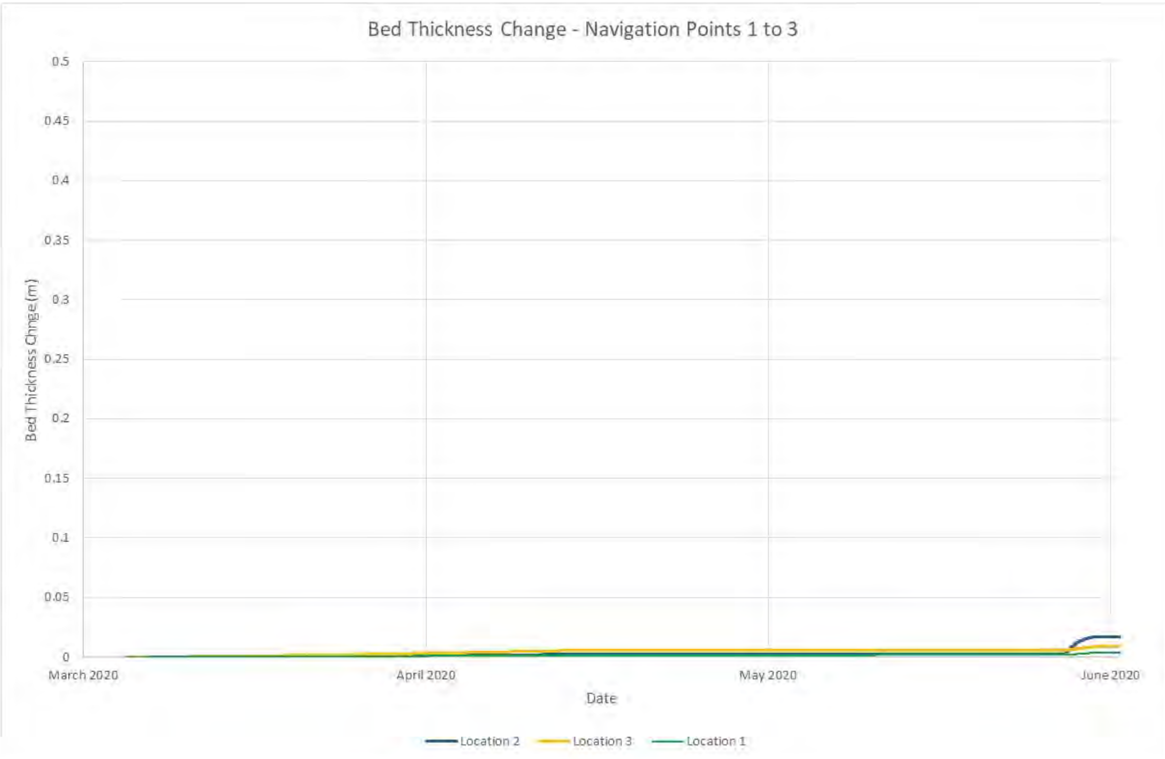

Figure 6.57 Timeseries of changes in sediment deposition at the navigation (north bank) monitoring points

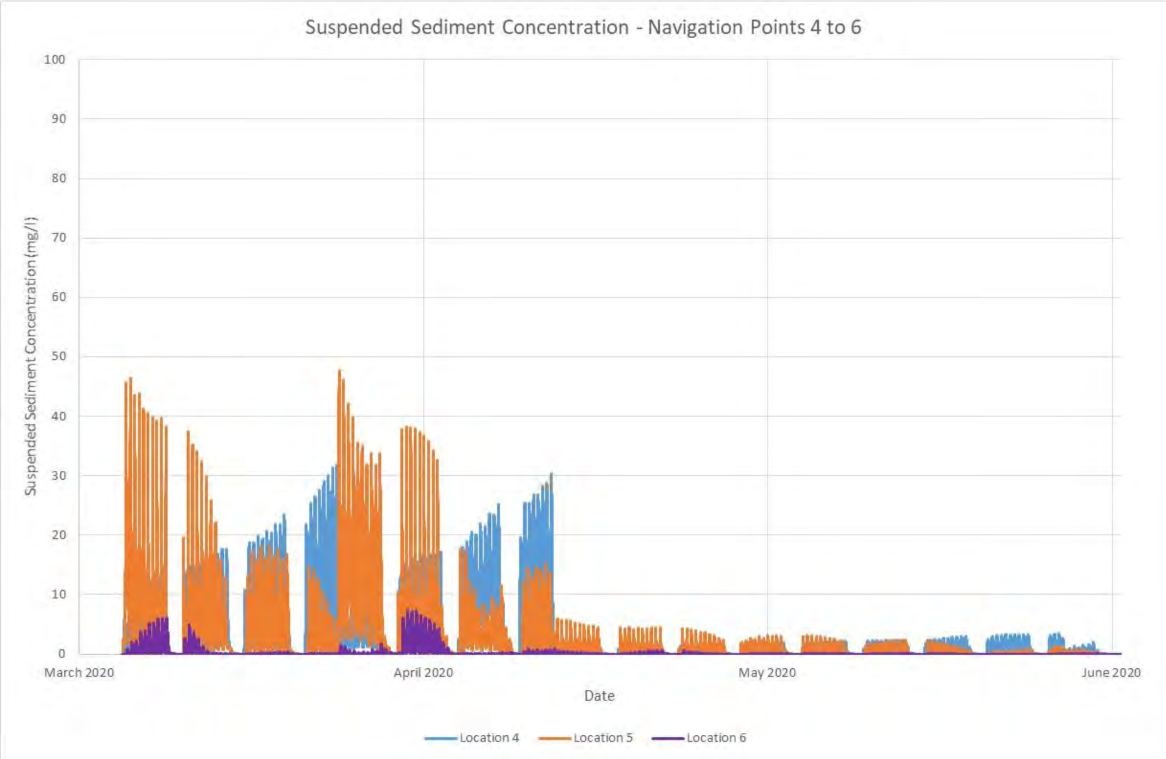

Figure 6.58 Timeseries of changes in SSC at the navigation (south bank) monitoring points

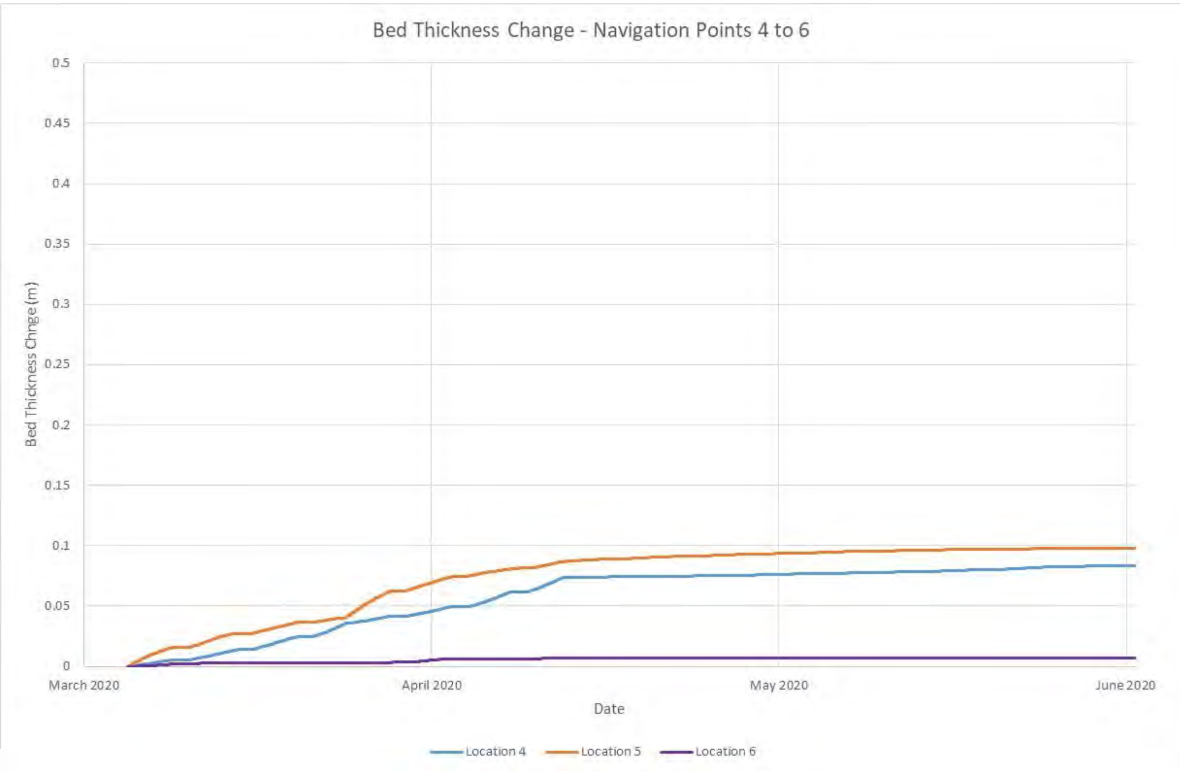

Figure 6.59 Timeseries of changes in sediment deposition at the navigation (south bank) monitoring points

Offshore disposal

The offshore disposal site is located within a water depth of approximately 43.5m, approximately 18km from the proposed scheme footprint and around 12km from the mouth of the river at its nearest point. The site is licensed for the disposal of dredged sediment and is routinely monitored as part of a national programme. Therefore, plumes arising from disposal activities and subsequent sediment deposition is unlikely to be of concern within the licensed area, or in immediately adjacent seabed areas.

During Stage 1 of dredging (with the BHD working to dredge the upper soft material (above -5m CD) in the berthing pocket and river channel), commencement of offshore disposal activities is repeated every 2 hours and 5 minutes. **Figure 6.60** shows one example disposal cycle, with material release shortly after high water on an ebbing tide. By way of illustration of key points in the following interpretation, plots are presented at the near-bed layer of the water column from: (i) immediately prior to disposal; (ii) at two stages through the 10-minute duration of disposal activity; and (iii) at selected intervals thereafter until the initial plume disappears.

Immediately prior to offshore disposal (Plot A) there is no enhancement to SSC in the offshore areas. As the offshore disposal commences (Plot B) a plume starts to be generated at the point of release. It can then be seen that the end of the discharge period coincides with the greatest enhancement in SSC at the offshore disposal site (Plot C), with values local to the point of material release exceeding 900mg/l (or 0.9 kg/m^3). This plume starts to increase in spatial extent shortly after cessation of discharge due to advection by tidal currents (Plot D), but then very rapidly reduces in concentration progressively over subsequent timesteps as some material falls relatively quickly to the sea bed whilst the material remaining in suspension starts to further disperse in spatial extent, moving in a north-westerly direction through advection by currents during the ebbing tide (Plot E).

At 30 minutes after cessation of discharge (Plot F), the plume is less than 250mg/l at its localised centre, reducing to less than 10mg/l at its peripheries and this trend of dispersion continues throughout the ebbing phase of the tide such that 1 hour after cessation of discharge (Plot G), the plume has a maximum SSC of less than 120mg/l at its centre reducing to less than 10mg/l towards its edges. By the time the next disposal activity commences and starts to form its own sediment plume (Plot H), the initial plume has moved sufficiently far from its point of release that it does not coalesce with the new plume and, by this time, is less than 40mg/l in SSC at its centre and mostly less than 20mg/l a short distance from the centre and thus is not visible in the plots at the magnitudes presented. The original plume continues to disperse such that after 4 hours and 25 minutes since cessation of discharge, there is absolutely no enhancement due to the initial event (and for a long period prior to this the enhancement is so small in magnitude and spatial extent as to be negligible in such a great depth of water in this deep water offshore area).

The above cycle is repeated throughout all disposal events associated with Stage 1 of the dredging, although when the discharge is made during the flooding tide, the plume moves in a south-easterly direction, along the axis of principal tidal flows. At times when the release is around slack water, the plume tends to reside closer to the point of release for longer, until the subsequent ebb or flood phase of the tide starts to transport it in suspension in the water column in the appropriate direction of dispersion (i.e. to the north-west or south-east, respectively). However, when this occurs the concentration in the plume reduces readily because more material falls to the seabed during the slack currents.

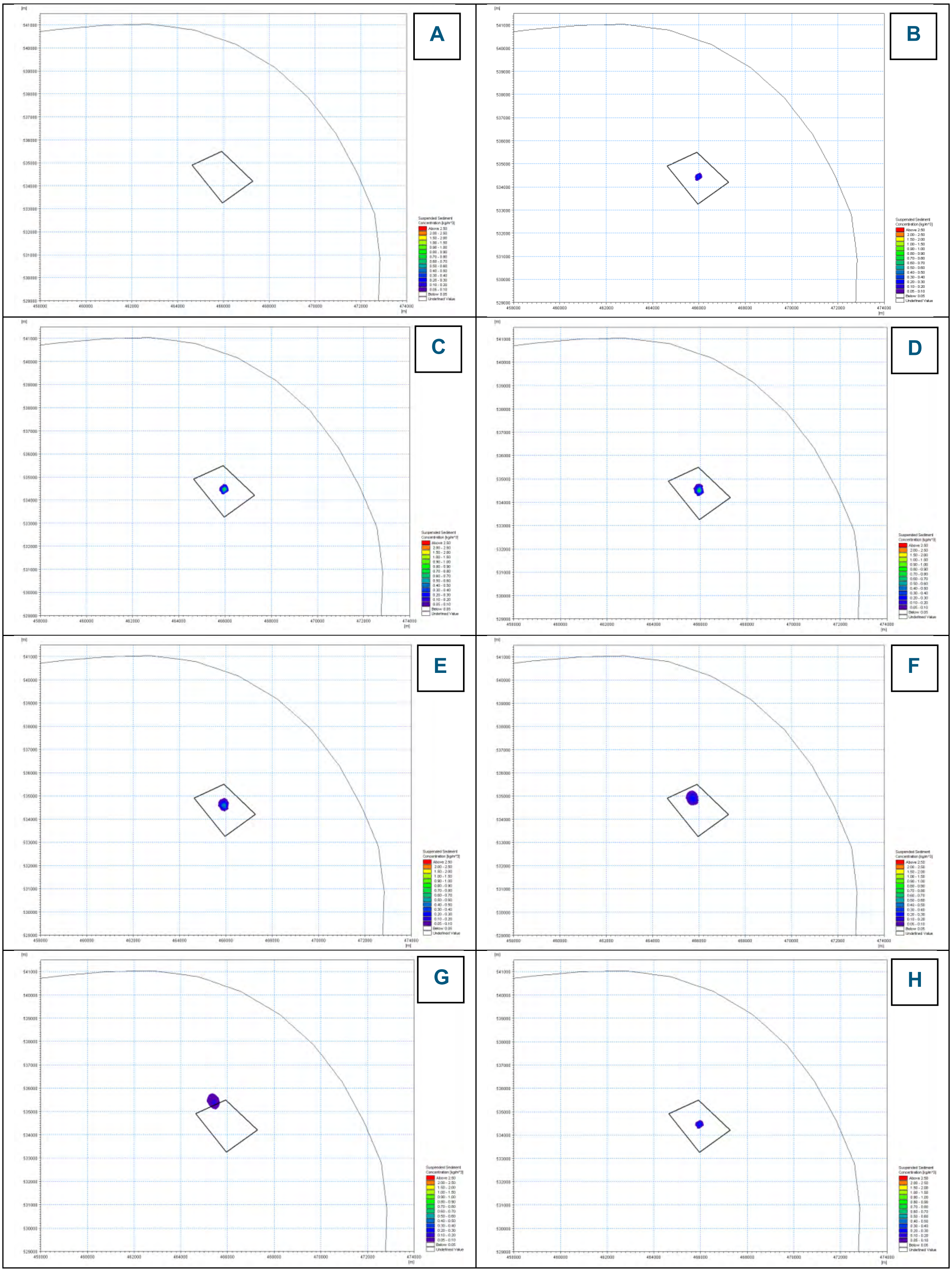

Figure 6.60 Plume of enhanced SSCs arising from disposal activities during Stage 1 of the capital dredging programme

Having described the pattern of dispersion thoroughly for disposal activities associated with Stage 1 of the dredging, the following descriptions focus on where particular aspects of subsequent stages differ from the general pattern described for Stage 1.

During Stage 2 of the dredging activity (with the BHD and TSHD working in parallel to dredge the middle soft material (below -5m CD in the berthing pocket and river channel), commencement of offshore disposal activities is repeated every 2 hours and 5 minutes for the BHD and every 3 hours and 10 minutes by the TSHD. The pattern of dispersion following discharge of the BHD-dredged material is as described for Stage 1, but this can now become further affected by coalescence with the TSHD discharges if, under a worst-case scenario, the subsequent discharges are all made at the same point in the centre of the disposal site. This coalescence does not occur on all discharges (from the same point) during Stage 2, but only when the timing of the respective discharges with respect to the phase of the tide allows or when the subsequent discharges are forced close to each other in time due to the different disposal intervals for each operation.

Figure 6.61 shows one example of where such coalescence occurs. Plot A shows the situation prior to the commencement of a TSHD disposal, which then occurs over the next two 5-minute timesteps (Plots B and C). Since the quantities of material being discharged from the TSHD are greater than those discharged from the BHD (although the time intervals are greater), the initial plume has greater SSC values at its centre, reaching close to 2,800mg/l. As the TSHD discharge occurred shortly before low water in this plot (a worst case for maximum SSC), the plume resides in spatial extent around the point of release during the slack phase of the tide, although the SSC values drop notably to a peak of around 1,200mg/l within 45 minutes of cessation of discharge (Plot D). After 1 hour and 30 minutes following cessation of discharge, the TSHD plume has started to move towards the south-east through advection by the flood tidal currents, and the peak concentration has reduced to around 350mg/l locally (Plot E). By 30 minutes later (some 2 hours after cessation of TSHD discharge) the subsequent BHD-dredged material disposal is commenced at a common release point (Plot F). At this point in time, the TSHD plume has further reduced in peak concentration to around 200mg/l. Some 30 minutes later, the TSHD plume and subsequent BHD plume have fully coalesced, with two peaks in concentration; the original TSHD plume has a peak now around 100mg/l locally at its centre whilst the more recently formed (but smaller) BHD plume has a peak SSC value at its centre of around 200mg/l (Plot G). Just before the next subsequent TSHD release, at 3 hours after cessation of the previous TSHD release, the now fully coalesced plume has a peak SSC of around 100mg/l very locally and this continues to disperse through the remainder of the flooding tide such that when the subsequent TSHD plume remains present a further 45 minutes later, the original coalesced plume is considerably smaller in magnitude and spatial extent (Plot H).

This shows that even if all discharges in the disposal site were made at exactly the same location on successive disposal events, any coalescence of subsequent plumes would continue to result in only temporary effects of a short duration, at relatively low magnitudes of SSC. In reality, successive disposal activities would not take place at the same location within the disposal site and so the likelihood of coalescence of successive plumes at significant concentrations or for long durations is very low even during this stage of the works, when disposal from both BHD and TSHD is being undertaken.

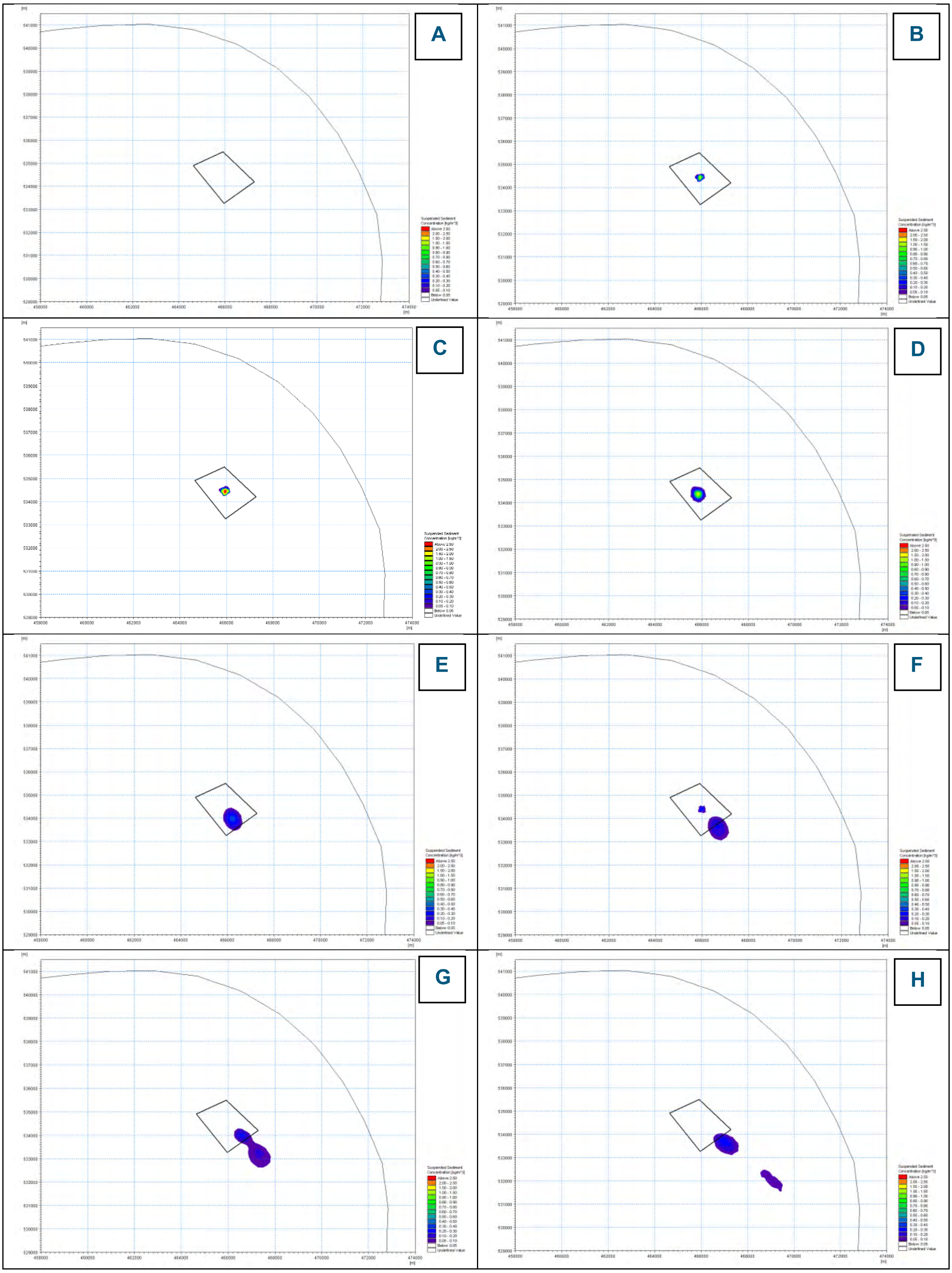

Figure 6.61 Plume of enhanced SSCs arising from disposal activities during Stage 2 of the capital dredging programme

During Stage 3 of the dredging activity (with the BHD working to dredge the bottom hard material in the berthing pocket and river channel), commencement of offshore disposal activities is repeated every 4 hours and 45 minutes. **Figure 6.62** shows one example disposal cycle, with material release shortly after high water on an ebbing tide. Results are very similar to those previously presented for Stage 1 but the frequency of disposals is lesser and the quantities involved in each disposal are greater and the material type is overall coarser.

Immediately prior to offshore disposal (Plot A) there is no enhancement to SSC in the offshore areas. As the offshore disposal commences (Plot B) a plume starts to be generated at the point of release. The greatest enhancement in SSC at the offshore disposal site occurs at the end of the discharge (Plot C), with values local to the point of material release up to 665mg/l. As observed during the Stage 1 discharges, this plume starts to increase in spatial extent shortly after cessation of discharge due to advection by tidal currents (Plot D), but then very rapidly progressively reduces in concentration as some material falls relatively quickly to the sea bed whilst the material remaining in suspension starts to further disperse in spatial extent, moving in a north-westerly direction through advection by currents during the ebbing tide (Plots E - F) and is significantly reduced at timesteps thereafter (Plots G and H).

The plumes associated with Stage 3 disposal activities are generally lower in concentration than those for Stage 1, despite the larger quantities being discharged at each event during Stage 3. This is likely to be due to the coarser nature of the material, which would lead to more falling to the bed sooner than during the Stage 1 discharges.

Indeed, the plume arising from Stage 3 disposal activities fully disperses before the next subsequent discharge activity, such that after 2 hours and 20 minutes following cessation of discharge, there is absolutely no enhancement due to the initial event (and for around 1 hour and 30 minutes prior to this the enhancement is so small in magnitude and spatial extent as to be negligible in such a great depth of water in this offshore area). Due to this, there is no possibility of plumes coalescing from Stage 3 disposal operations, even if all discharges are made from a common point.

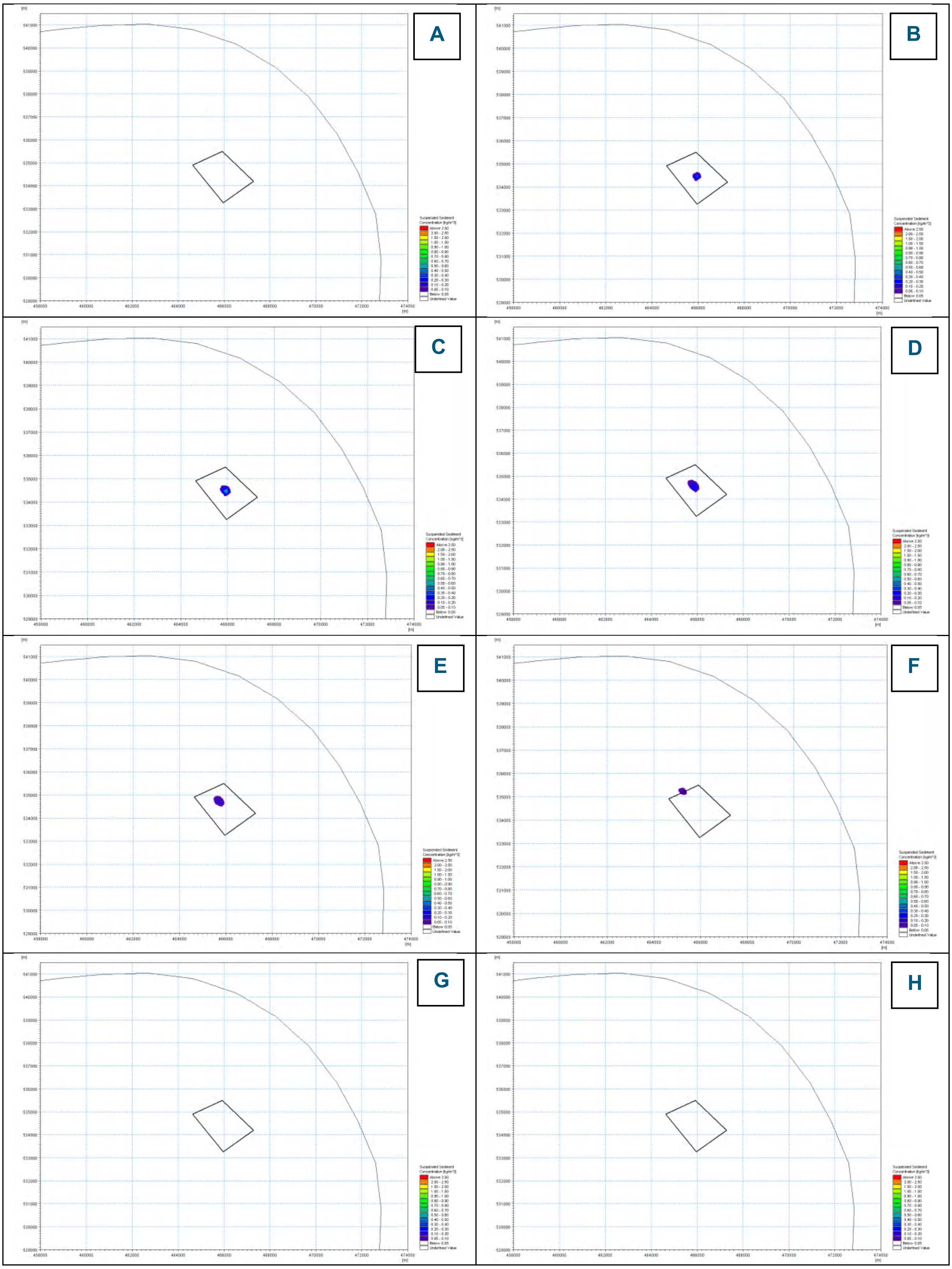

Figure 6.4 ***Plume of enhanced SSCs arising from disposal activities during Stage 3 of the capital dredging programme***

During Stage 4 of the dredging activity (with the BHD and TSHD working in parallel to dredge the material in the Tees Dock turning circle), commencement of offshore disposal activities is repeated every 2 hours and 5 minutes for the BHD and every 3 hours and 10 minutes by the TSHD. **Figure 6.63** shows one example disposal cycle, with material release shortly after high water on an ebbing tide.

Like during Stage 2, there is potential for the plume from a TSHD discharge to coalesce with a preceding or subsequent BHD-related discharge. **Figure 6.63** shows one example of where such coalescence occurs. Plot A shows the residual plume from a TSHD disposal some 5 minutes before the commencement of a BHD disposal, which then occurs over the next two 5-minute timesteps (Plots B and C). Plot D shows two separate plumes at 45 minutes after cessation of the BHD discharge. A further 30 minutes later, another TSHD discharge is released and since the previous BHD release was around slack water, it has not been notably dispersed spatially (although it has decreased in magnitude of elevation in SSC) and so the latest TSHD release occurs within the previous BHD plume extent (Plot E). Peak concentrations from the TSHD release elevate the SSC to over 1,000mg/l above background levels locally. Then, before this coalesced plume has widely dispersed, a further BHD release is made some 50 minutes later, again within the previous (now coalesced) plumes. Despite this coalesced plume now containing elements of three separate releases, the maximum SSC elevations are around 500mg/l (Plot F). One hour later still, the remnants of the residual plume shown in Plot A coalesce with the ‘three-release’ plume (Plot G), although the SSC values at the point of overlap are very low (~10mg/l). Around 55 minutes later, the plume is now mostly containing enhanced SSC values of 10-30mg/l over most of its extent, with local levels up to 70mg/l (Plot H).

Even in the unlikely situation where successive disposal activities take place at the same location within the disposal site, leading to coalescence of subsequent plumes, the resulting temporary, short duration effects are mostly of low magnitudes within a great depth of water and are confined to along the axis of the prevailing tidal flow.

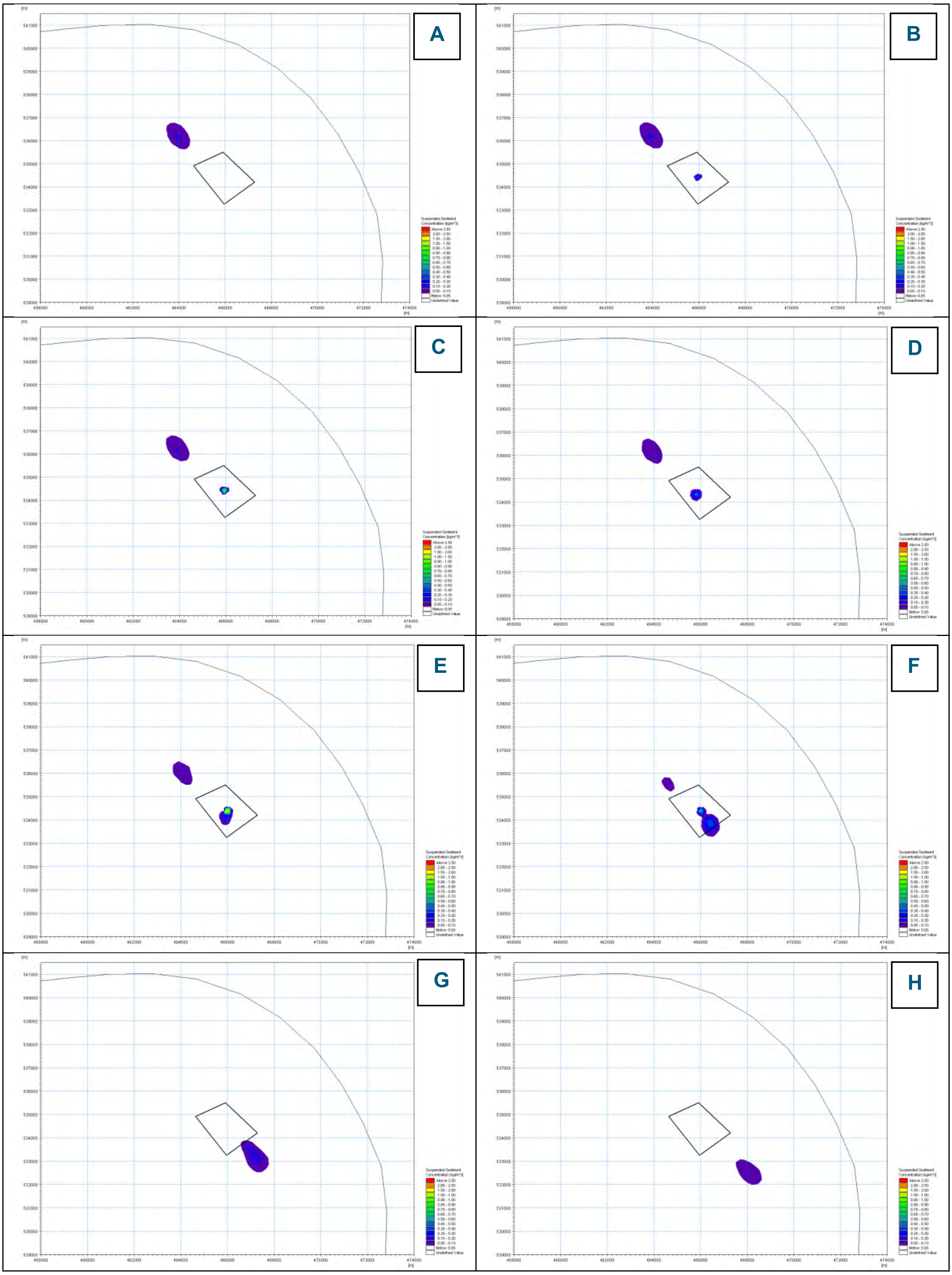

Figure 6.5 Plume of enhanced SSCs arising from disposal activities during Stage 4 of the capital dredging programme

The maximum 'zone of influence' from combined disposal activities during Stages 1 - 4 inclusive of the dredging programme has been plotted in **Figure 6.64** for the near-bed layer of the water column (please note the earlier caution in interpreting this type of figure). It should be noted that this represents a worst case whereby all disposal activities have occurred in the model at a single release point and the potential for coalescence of subsequent plumes is greatest. In reality, subsequent disposals will be at different parts of the release site and so the zone of influence is likely to be slightly broader in width and shorter in length, and certainly at lower maximum concentrations than shown in the worst case. Nonetheless, it can be seen that SSC values are elevated by the greatest amount at the release point (by up to several thousand mg/l), reducing to more typically a few hundred mg/l within a few km of the upstream and downstream boundaries. At the extremities of the plume extent, there are wide zones of relatively low SSC values (<100mg/l).

Figure 6.65 shows the maximum changes in seabed thickness caused by deposition of material from the sediment plume associated with one release event (this example being from Stage 1). It can be seen that much of the sediment falls to the bed within close proximity of the point of release, forming a small deposit locally on the seabed of up to around 6cm in elevation. Deposition to the west and east of the disposal point is negligible, whilst to the north it covers a similar zone to the sediment plume for this disposal event, which made the release during the ebb tide. Within 200m of the release point deposition thickness reduce to less than 1cm, whilst at the boundary of the licenced disposal area there is nowhere with deposition greater than 0.1cm. Clearly these magnitudes are extremely low within the licenced disposal site, and negligible beyond.

To provide spatial context, **Figure 6.66** shows the same deposition effects from this single disposal event plotted at a wider scale. Similar results would be obtained for deposits made during the flood tide, but with the zone of deposition extending south-eastwards from the release point. In practice, releases will be made from different points within the licenced disposal site over time, and at different states of the tidal cycle, so the resulting seabed deposition will occur at different locations across the disposal site, at relatively low magnitudes, with negligible changes anticipated beyond the boundaries of the site.

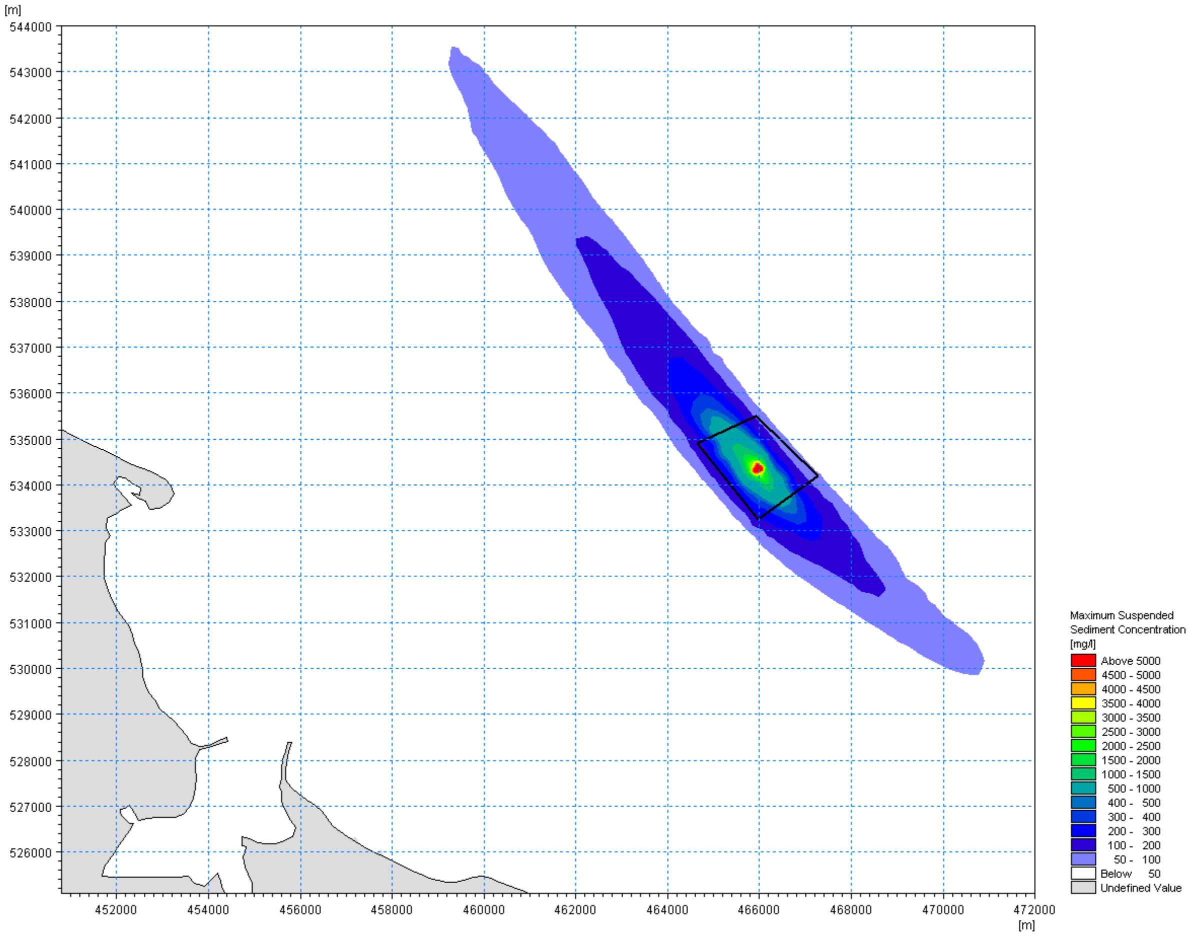

Figure 6.64 Maximum enhanced SSCs (near-bed layer) arising from disposal activities during Stages 1 - 4 inclusive of the capital dredging programme

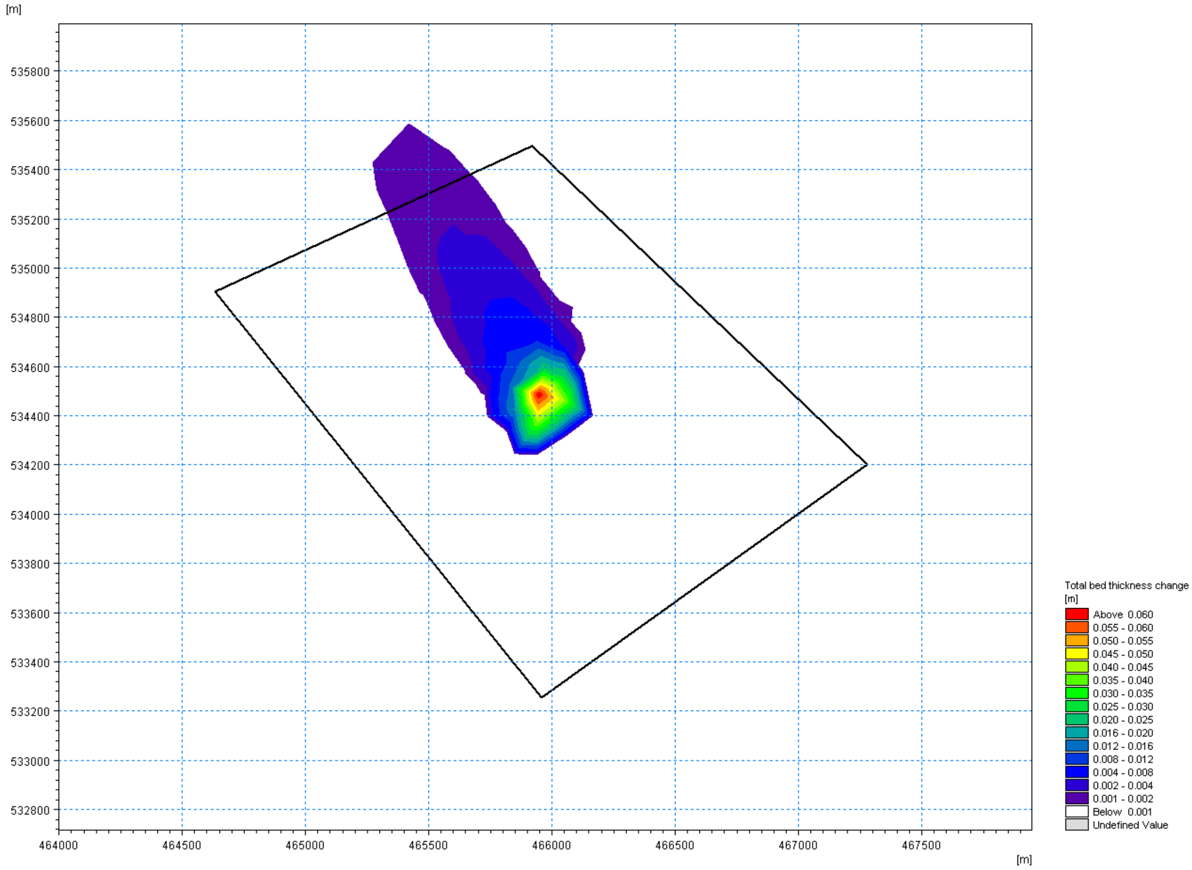

Figure 6.65 Maximum sea bed thickness change due to sediment deposition arising from one disposal event during Stage 1 of the capital dredging programme – local scale

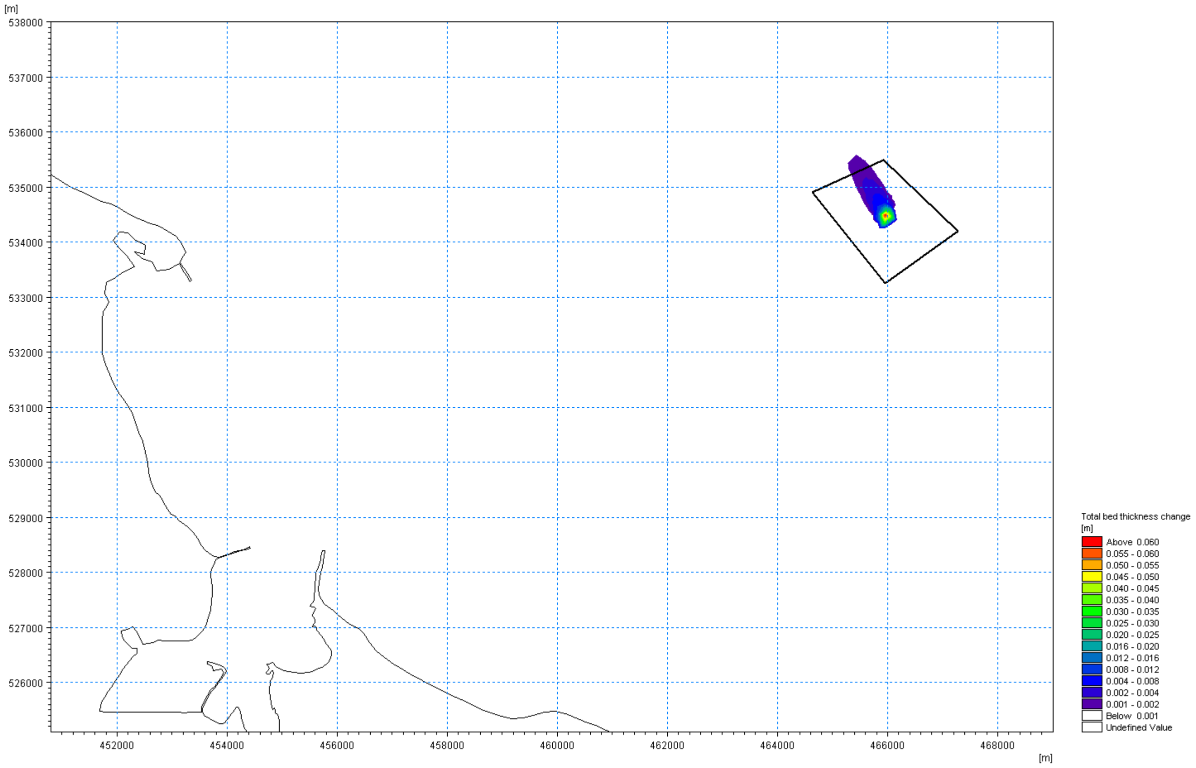

Figure6.66 Maximum sea bed thickness change due to sediment deposition arising from one disposal event during Stage 1 of the capital dredging programme – wider scale

Whilst turbidity and sediment deposition effects within the disposal site are to be expected (and indeed are monitored as part of a national programme), these effects could also potentially affect water quality and ecological receptors on the sea bed in areas that are beyond the boundaries of the deposition site. To further investigate these effects, timeseries plots of changes in SSC have been extracted from the model at a series of points around the offshore disposal site (locations are shown in **Figure 6.67**). The points are:

- Offshore Disposal Point 1 (OD1) – 50m from offshore disposal site's eastern boundary
- Offshore Disposal Point 2 (OD2) – 50m from offshore disposal site's southern boundary
- Offshore Disposal Point 3 (OD3) – 50m from offshore disposal site's western boundary
- Offshore Disposal Point 4 (OD4) – 50m from offshore disposal site's northern boundary

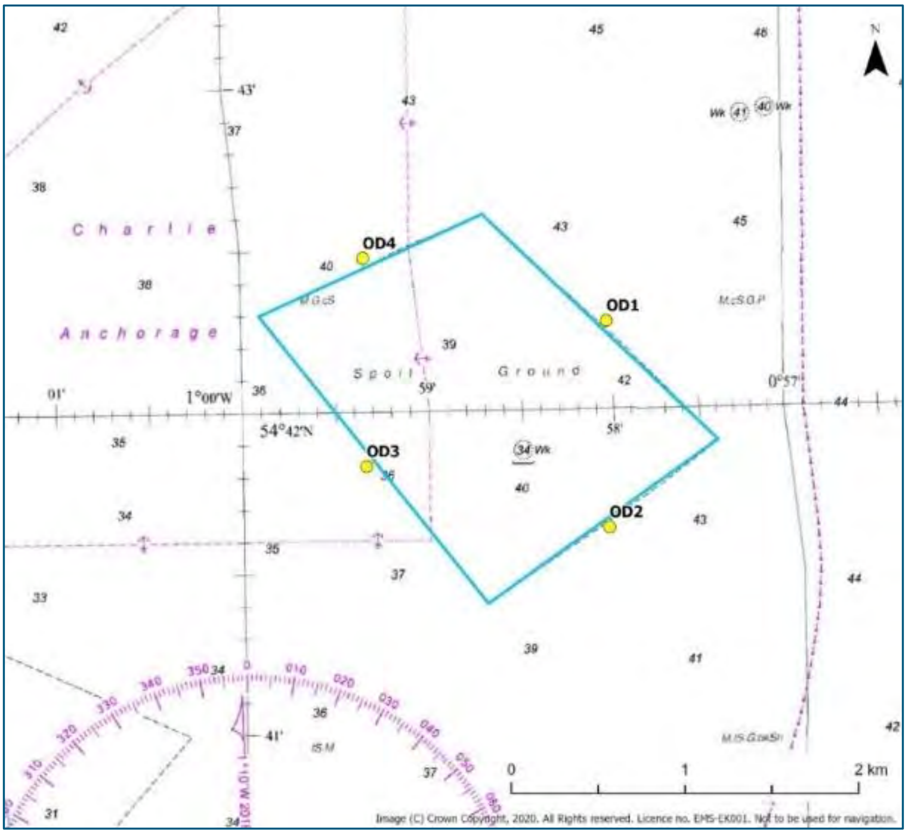

Figure 6.67 Location of points around the offshore disposal site used for of timeseries analysis of changes in SSC and sediment deposition

It should be remembered that for a worst-case scenario, the modelling assumed that all disposals were made at a common point in the centre of the disposal site, but in reality different points will be used for subsequent deposits and therefore the maximum SSC values will be lower than those presented below. At the offshore disposal site monitoring points, SSC is enhanced by the greatest values at the points beyond the northern and southern boundaries (**Figure 6.68**). This correlates to the areas where a plume will extend along the axis of the prevailing tidal currents. Just beyond the northern boundary, peak SSC enhancement can reach 600mg/l and at the southern boundary 400mg/l. Just beyond the western and eastern boundaries the peak values are typically much lower (<50mg/l) but on occasion can temporarily reach 100-200mg/l for short durations. The effects of these changes on water quality, marine ecology and navigation in the offshore area are assessed more fully in **Sections 7. 9** and **14** respectively.

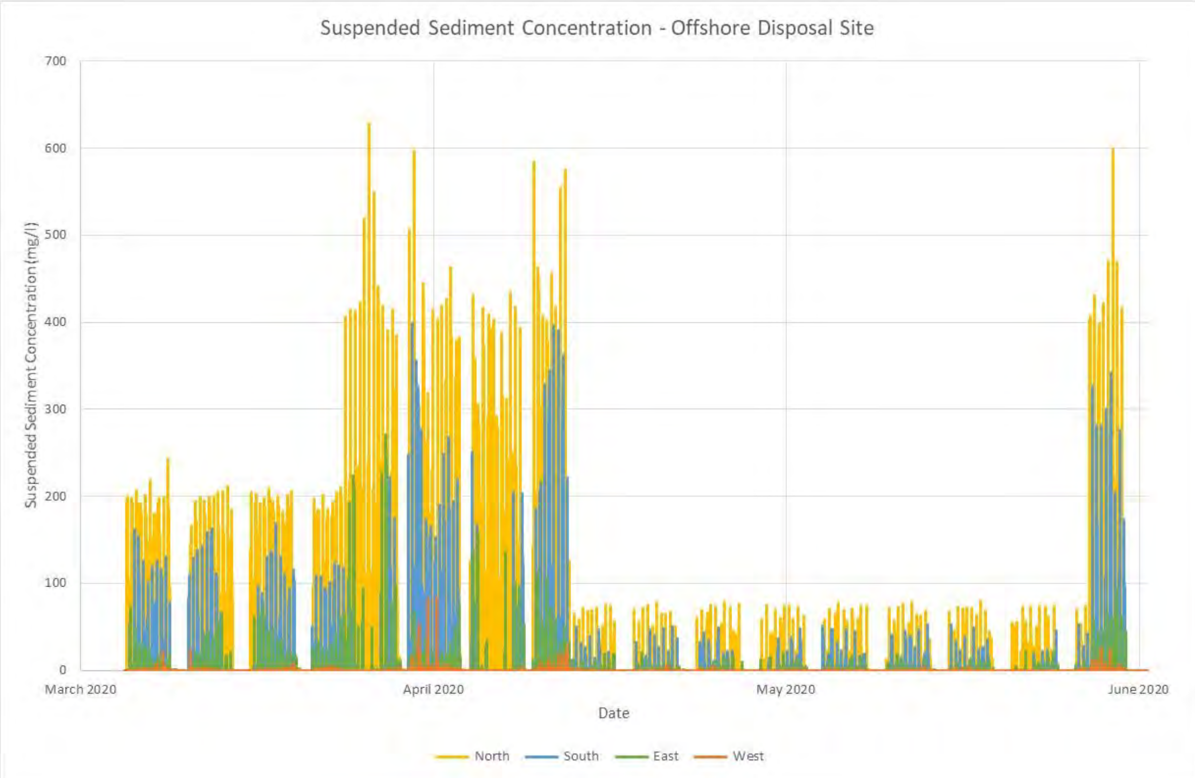

Figure 6.6 Timeseries of changes in SSC at the offshore disposal site monitoring points

Summary

The river dredging and offshore disposal activities will both cause plumes of sediment to form close to the release point of material into the water column. These plumes will disperse under wave and current action and all sediment particles suspended in the water column will eventually settle to the river or seabed, causing deposition.

During dredging, there will be a release of sediment particles from the deliberate physical disturbance to the riverbed and, more significantly, from overflow when dredged material is loaded into the dredger's hopper (for TSHD) or the transport barge (for BHD). Such releases will be ongoing through each dredging cycle until the dredging activity ceases due to downtime (e.g. adverse weather, vessel maintenance) or at scheduled breaks between stages of dredging activity. During offshore disposal, a single hopper load will near-instantaneously deposit material at the surface of the water column on each disposal visit.

Once a plume is generated, the highest SSC values will be recorded at the point of river dredging or offshore disposal, but these concentrations reduce rapidly after cessation of the activity. At distances away from the point of sediment release, the enhanced SSC values are considerably lower because the coarser material falls relatively rapidly to the bed, with only the finer proportions being retained in suspension, becoming advected away from the point of release by the prevailing currents. At the peripheries of each plume, the enhanced SSC values will be barely distinguishable from the background levels.

During some stages of the dredging and disposal activities, most notably when both TSHD and BHD are working in parallel, there could be instances where two separately formed plumes coalesce to form one (spatially) larger plume. However, the same principles of dispersion by prevailing currents applies, with peak concentrations remaining close to the point of release of the material for a short duration after its release before diminishing thereafter.

The plume effects arising from the river dredging are characterised by a short-lived localised increase in SSC by a few hundred mg/l at the point of dredging activity, followed by a general dispersion in spatial extent and reduction in concentration over following hours. Since the dredging is a near-continuous operation, the plume effects will be observed throughout much of the approximately four-month period, but at varying extents during the four different stages. During Stages 1-3 the dredging-related plume effects will be largely confined to the channel areas south of the centreline of the river and in reaches between Middlesbrough Dock and Tees Dock. During Stage 4 the dredging-related plume effects will be largely confined to the channel areas north of the centreline of the river and in reaches between North Tees Works Oil Refinery and the Oil Terminal. Other than within the dredged areas, sediment deposition on the riverbed will be of very minor magnitudes, in areas covering the same spatial extent as the sediment plumes. Where this occurs in the river channel or at jetties, it will subsequently be dredged as part of ongoing maintenance dredging regimes, whilst material deposited back into the newly dredged areas will be re-dredged during the capital works in order to achieve the desired design depths.

The plume effects arising from the offshore disposal similarly show peak concentrations at the point of release, but because a larger volume of material is near-instantaneously disposed, the peak concentrations are typically a few thousand mg/l at the point of disposal activity. Plumes become advected by tidal currents along the principal axis of tidal flow (north-west to south-east), diminishing in magnitude over a few hours after disposal. Just beyond the boundaries of the disposal site, the maximum seabed deposition can be up to 0.5m, but this is in water depths that are approximately 43.5m. Furthermore, this represents a worst case of all material being deposited at a common point within the disposal site, whereas in reality deposits will be spread around various locations within the site's boundaries and thus this maximum potential change is highly unlikely to occur in practice.

Overall, the changes in SSC and sediment deposition arising from the river dredging and offshore disposal activities are very much in-keeping with those experienced by similar activities in other areas, which has been the subject of considerable industry-wide monitoring and assessment.

6.5.3 Construction of a new quay (to be set back into the riverbank)

The new quay will be built from land, using predominantly land-based plant, with no construction activity in the river. There will therefore be no effects during construction of the quay on the hydrodynamics and sedimentary regime of the Tees estuary.

6.6 Potential impacts during the operational phase

6.6.1 Direct effects on inter-tidal and sub-tidal morphology

The proposed scheme will result in direct effects to the existing intertidal and subtidal morphology of the following magnitudes:

- Existing intertidal = 25,000m^2 loss
- Existing subtidal = 325,000m^2 impacted
- New subtidal = 55,000m^2 created

Of the 325,000m^2 of existing sub-tidal that will become impacted, some 50,000m^2 will subsequently be covered by the proposed rock blanket. Similarly, of the 55,000m^2 of sub-tidal area that will newly be created due to the set-back alignment of the new quay, some 45,000m^2 will subsequently be covered by the proposed rock blanket. The remaining 10,000m^2 of newly created sub-tidal will remain unaffected by proposed rock blanket. This means that in total some 95,000m^2 of sub-tidal will become covered by proposed rock blanket.

The impacts of these changes in intertidal and subtidal areas upon existing habitats and species is discussed in **Section 9.**

6.6.2 Changes in hydrodynamics

Since the new quay is to be set back from the existing riverbank, there will be expected local changes to the baseline hydrodynamics due to the new alignment. Changes in hydrodynamics will also arise from absence (due to removal) of the existing wharf and jetties and deepened areas of riverbed arising from the capital dredging to the Tees Dock turning circle and approach channel and to create a berth pocket.

To determine the hydrodynamic conditions with the above aspects of the scheme when it is in its operational phase, numerical modelling during both neap and spring tides was undertaken, with a mean daily river flow through the Tees Barrage (20 cumecs). **Figures 6.69** and **6.70** show the peak current speeds during the flood and ebb phases of a neap tide with a mean daily river flow, whilst peak current speeds during corresponding phases of a spring tide with a mean daily river flow are shown in **Figures 6.71** and **6.72**. The general baseline tendencies, showing maximum current speeds being greater on the spring tides than the neap tides and an ebb dominance during neap tides and flood dominance during spring tides, remain unaffected by the scheme.

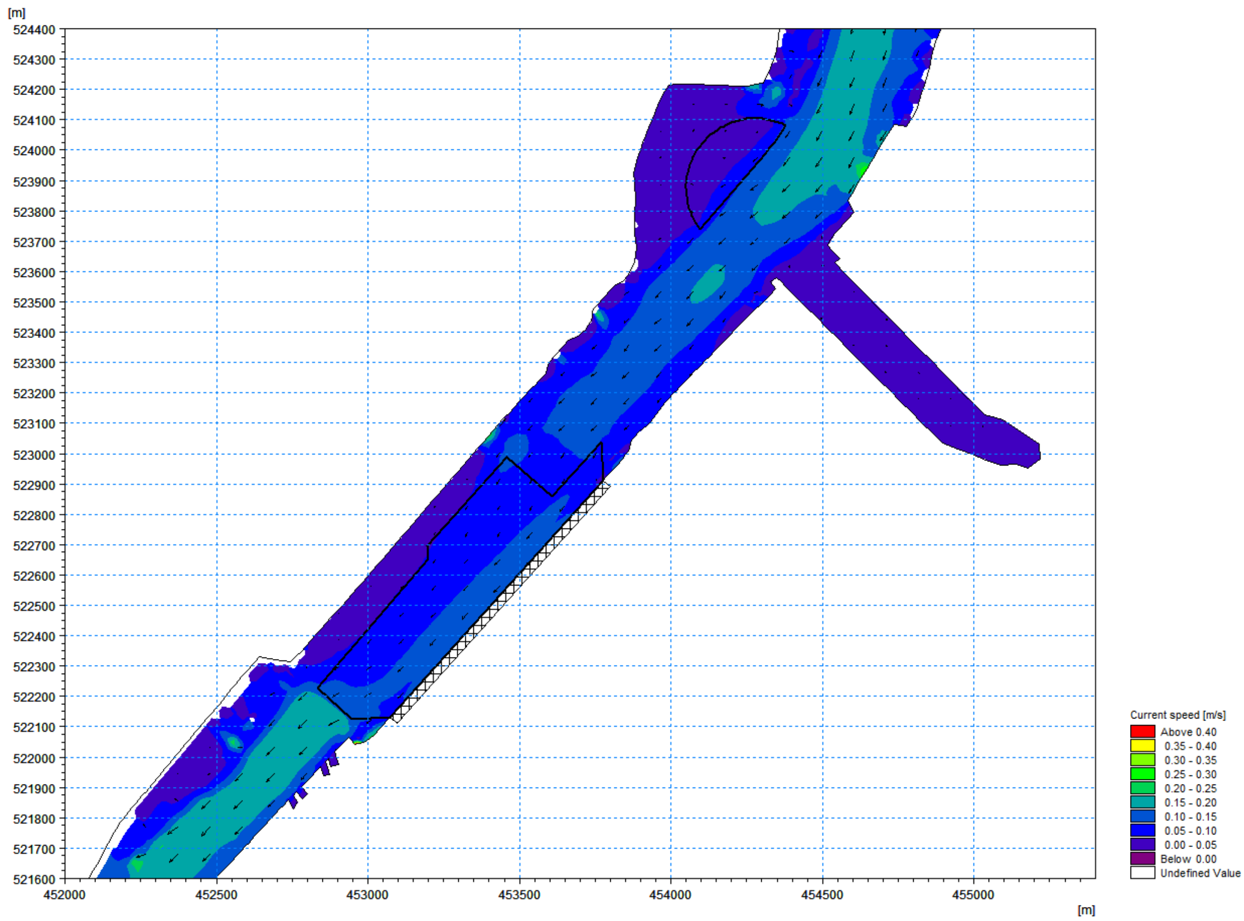

Figure 6.69 Peak current velocities during the flood phase of a neap tide with mean daily river flow – with scheme

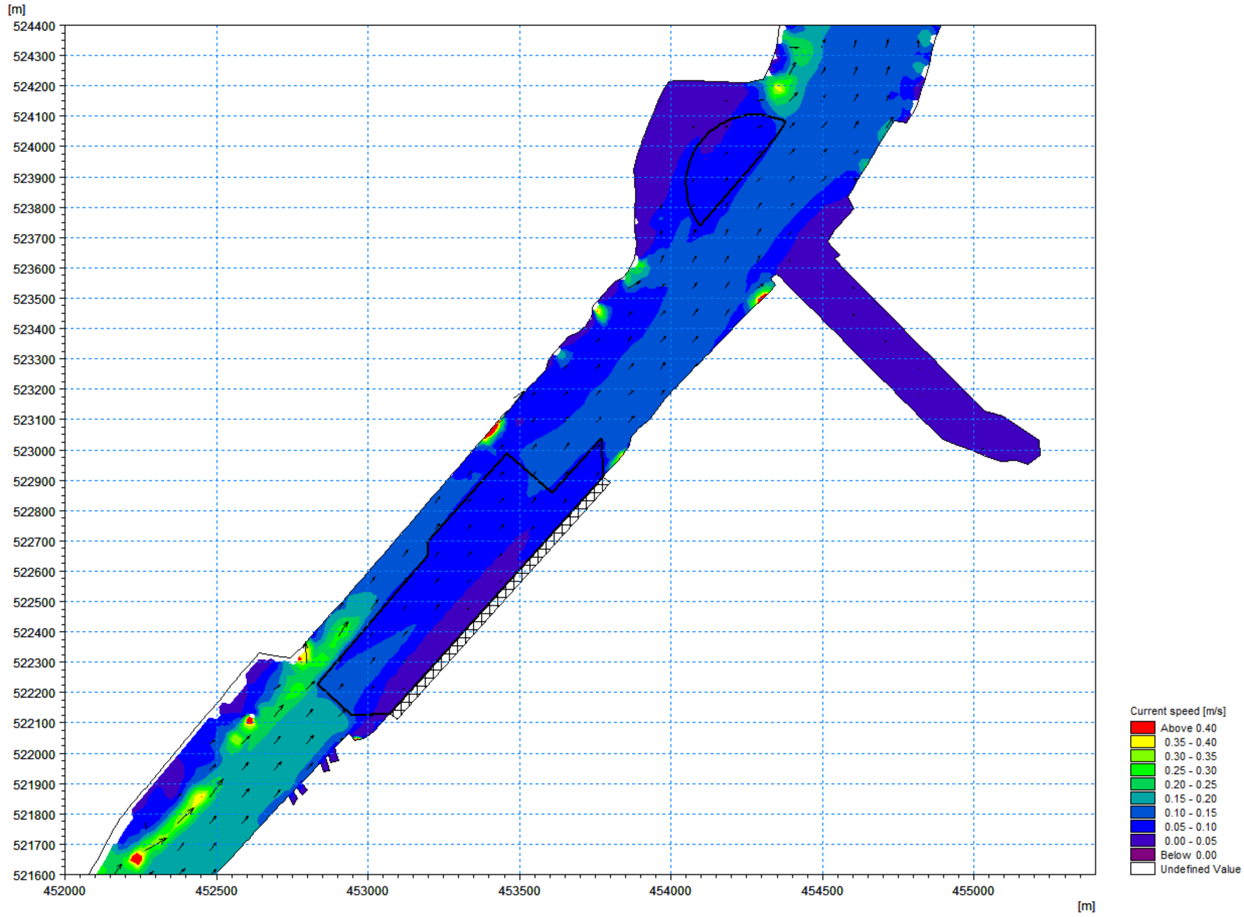

Figure 6.70 Peak current velocities during the ebb phase of a neap tide with mean daily river flow – with scheme

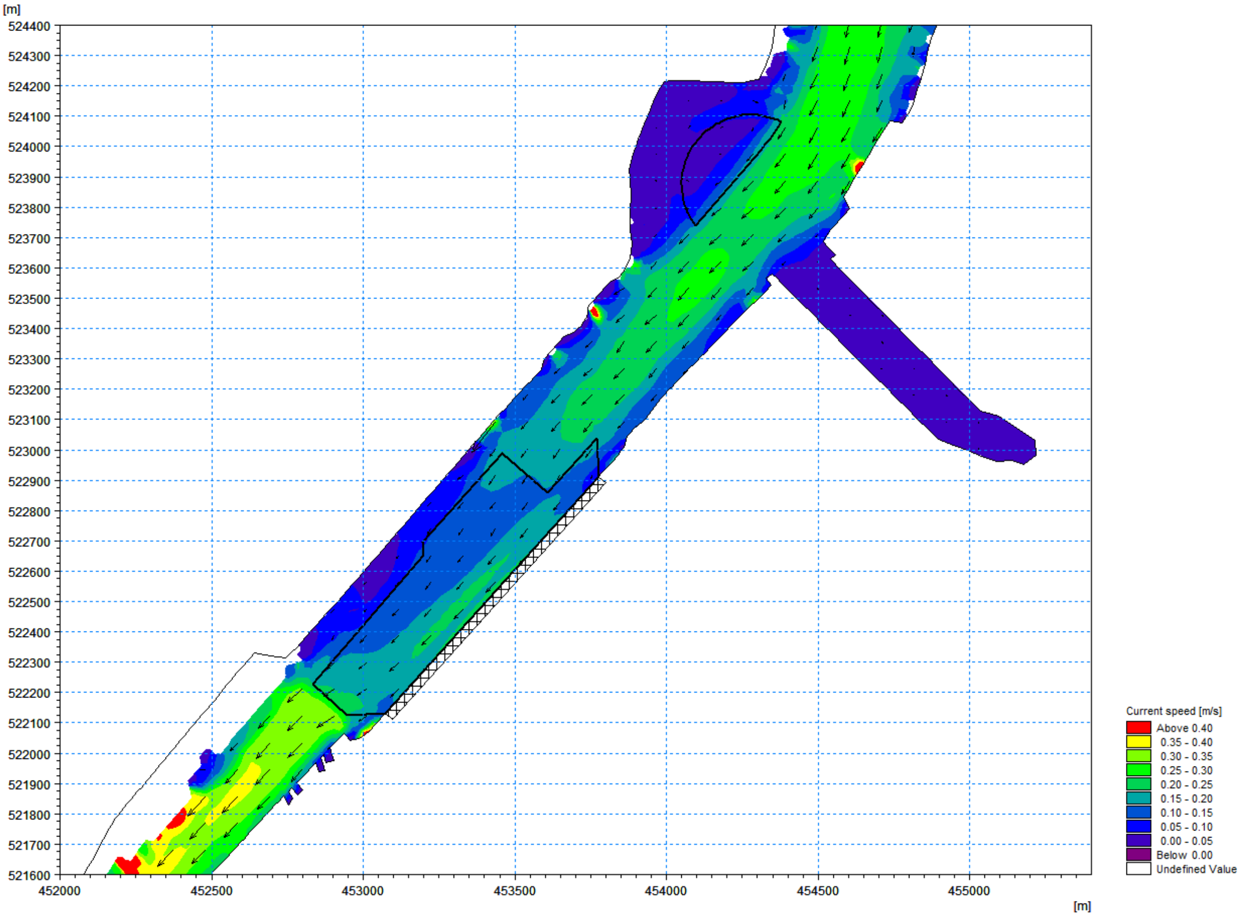

Figure 6.71 Peak current velocities during the flood phase of a spring tide with mean daily river flow – with scheme

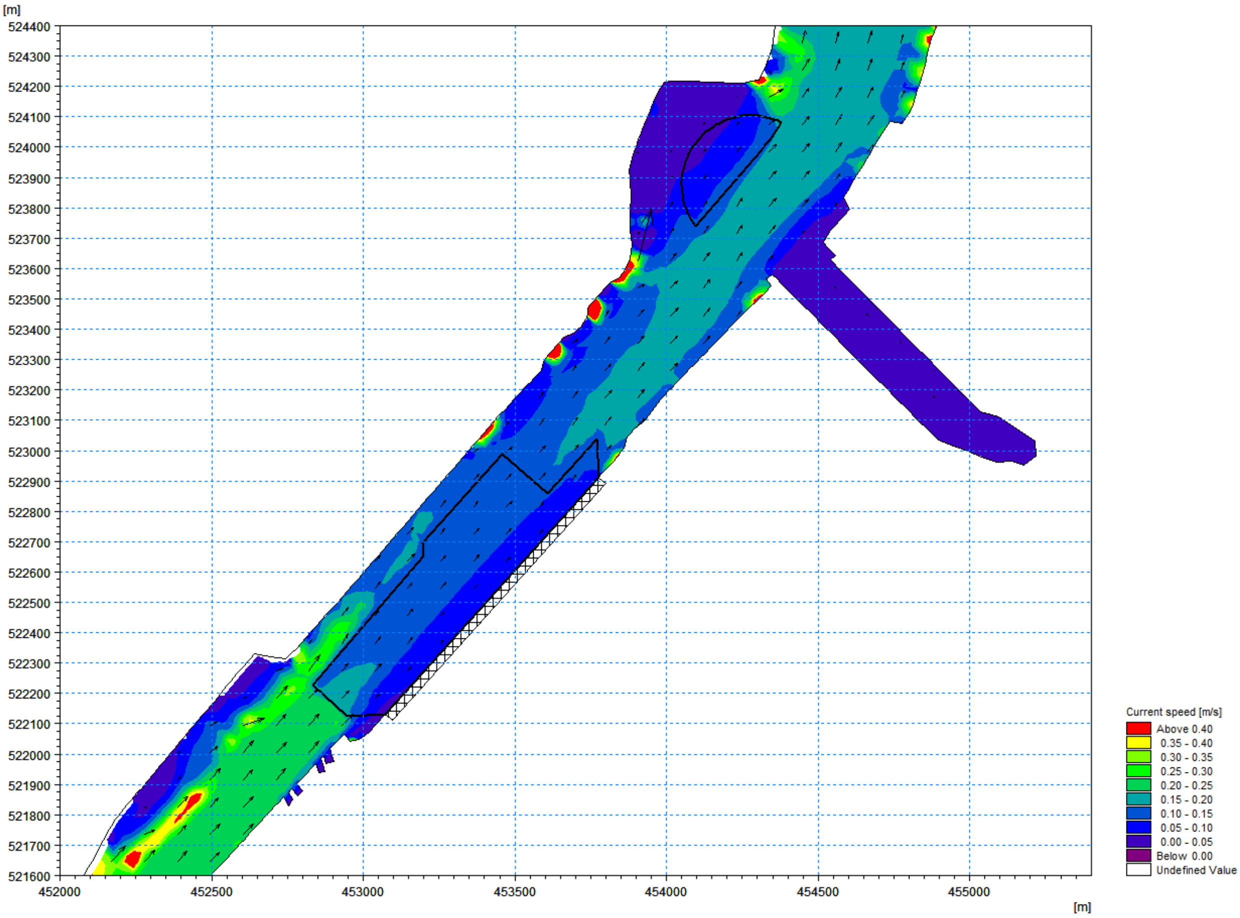

Figure 6.72 Peak current velocities during the ebb phase of a spring tide with mean daily river flow – with scheme

The 'with scheme' conditions have been compared against the baseline conditions and the resulting difference plots in **Figures 6.73** to **6.76** show the changes in peak current speeds on the ebbing and flooding phases of neap and spring tides, respectively.

During the peak of the flood phase of a neap tide (**Figure 6.73**), current velocities are newly created locally along the length of the quay's set-back alignment, mostly by 0.05 – 0.10m/s but in small areas by up to 0.15 m/s in magnitude. There are also zones of reduction in baseline flow in the centre of the channel and along the northern bank, but the magnitude of these changes is mostly 0.05 – 0.10 m/s, with up to 0.15 m/s in small areas. There is no measurable change within the Tees Dock turning circle.

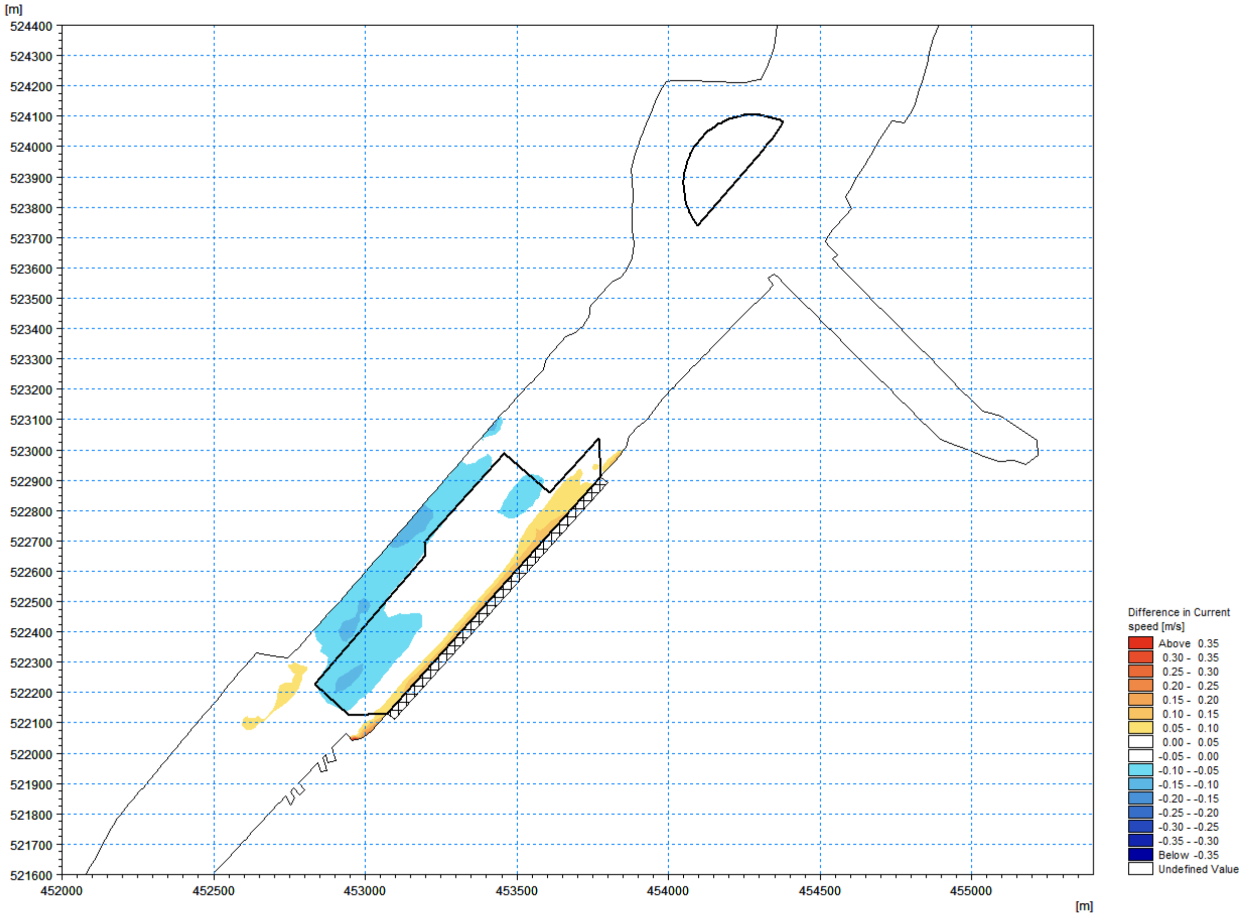

Figure 6.73 Change in peak current velocities due to the scheme during the flood phase of a neap tide with mean daily river flow

During the peak of the ebb phase of a neap tide (**Figure 6.74**), current velocities are also newly created locally along the length of the quay's set-back alignment, but the magnitude of change is less than 0.05 m/s and so is not apparent in the plot. Only in the corners at either end of the quay is a slight increase above this threshold modelled. There are zones of reduction in baseline flow towards the southern bank of the channel, with the magnitude of these changes mostly in the range 0.05 – 0.10 m/s, with up to 0.20 m/s in small areas towards the downstream end of the quay. There is minimal change in the centre of the channel and there is no measurable change at the northern bank or within the Tees Dock turning circle.

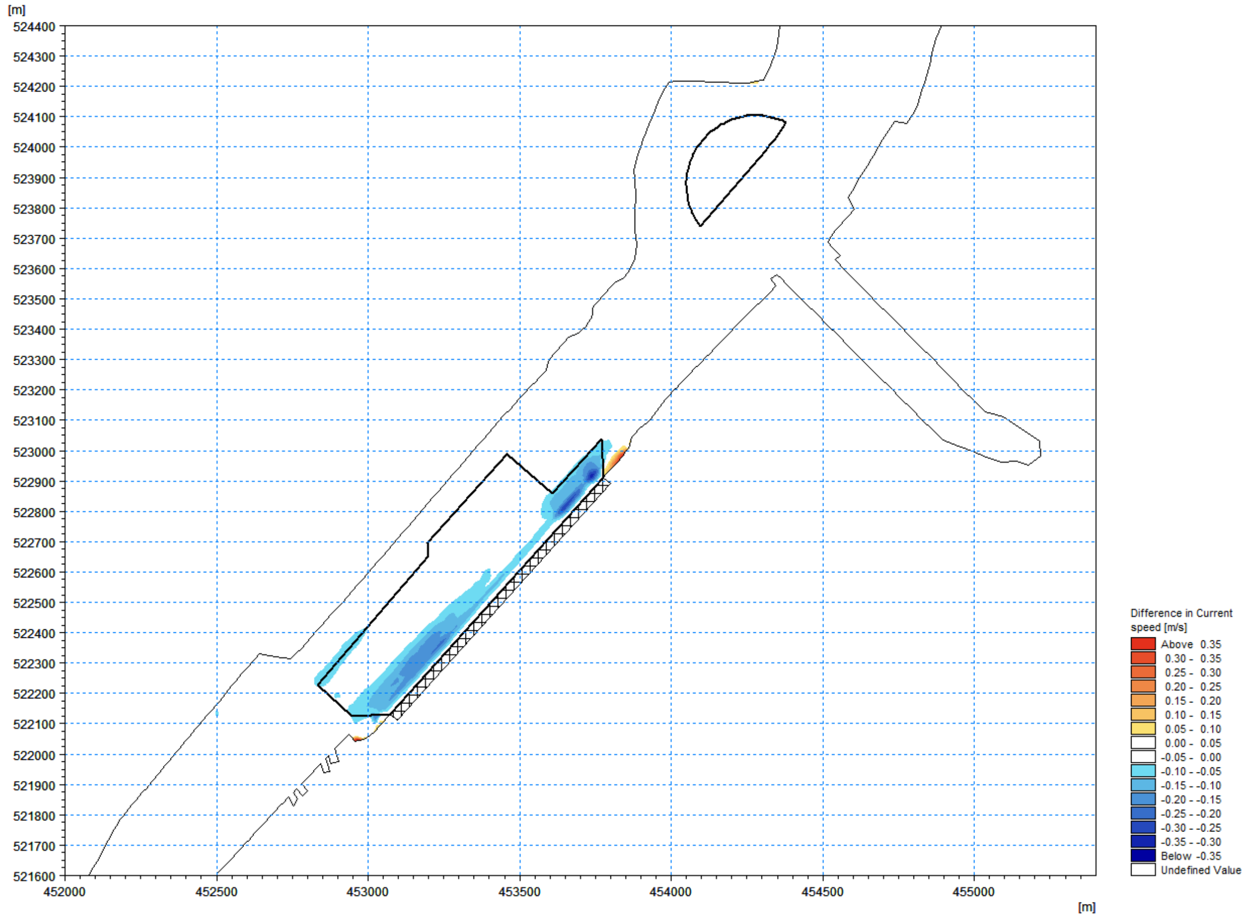

Figure 6.74 Change in peak current velocities due to the scheme during the ebb phase of a neap tide with mean daily river flow

The spring tide results for peak flood and ebb phases (**Figure 6.75 and 6.76**, respectively) exhibit similar patterns to those described for the corresponding phases of the neap tide, but the area of effect is slightly larger and, in local areas, the magnitude of effect slightly larger. Notably, however, the area of effect does not extend significantly further along the axis of the channel (i.e. upstream or downstream), just across the width of the channel opposite the new quay. For example, during the peak of the flood much of the channel immediately opposite the quay experiences a slight reduction in baseline flows, whereas under the corresponding neap conditions is was only parts of the channel width (with changes elsewhere being less than 0.05 m/s and therefore not apparent in the plots).

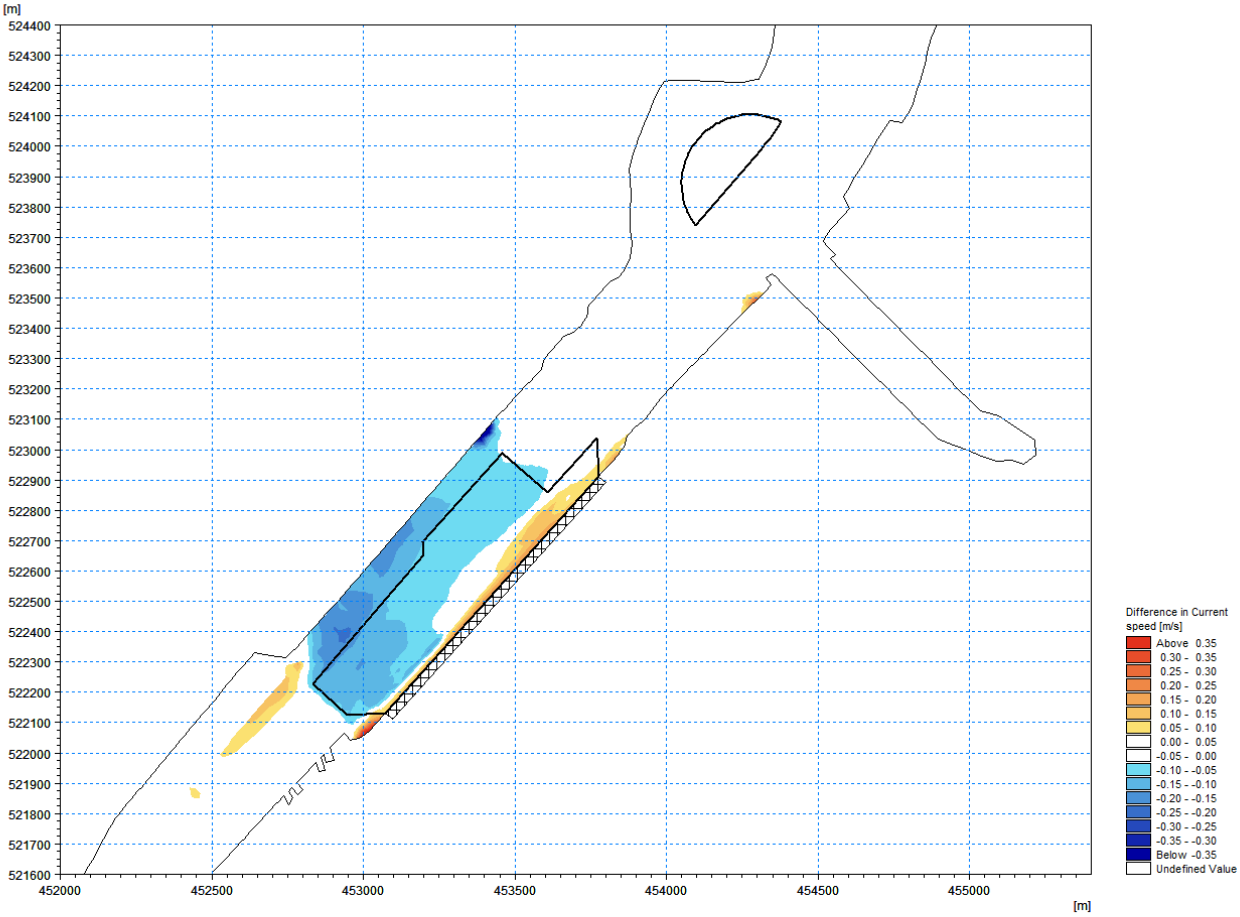

Figure 6.75 Change in peak current velocities due to the scheme during the flood phase of a spring tide with mean daily river flow

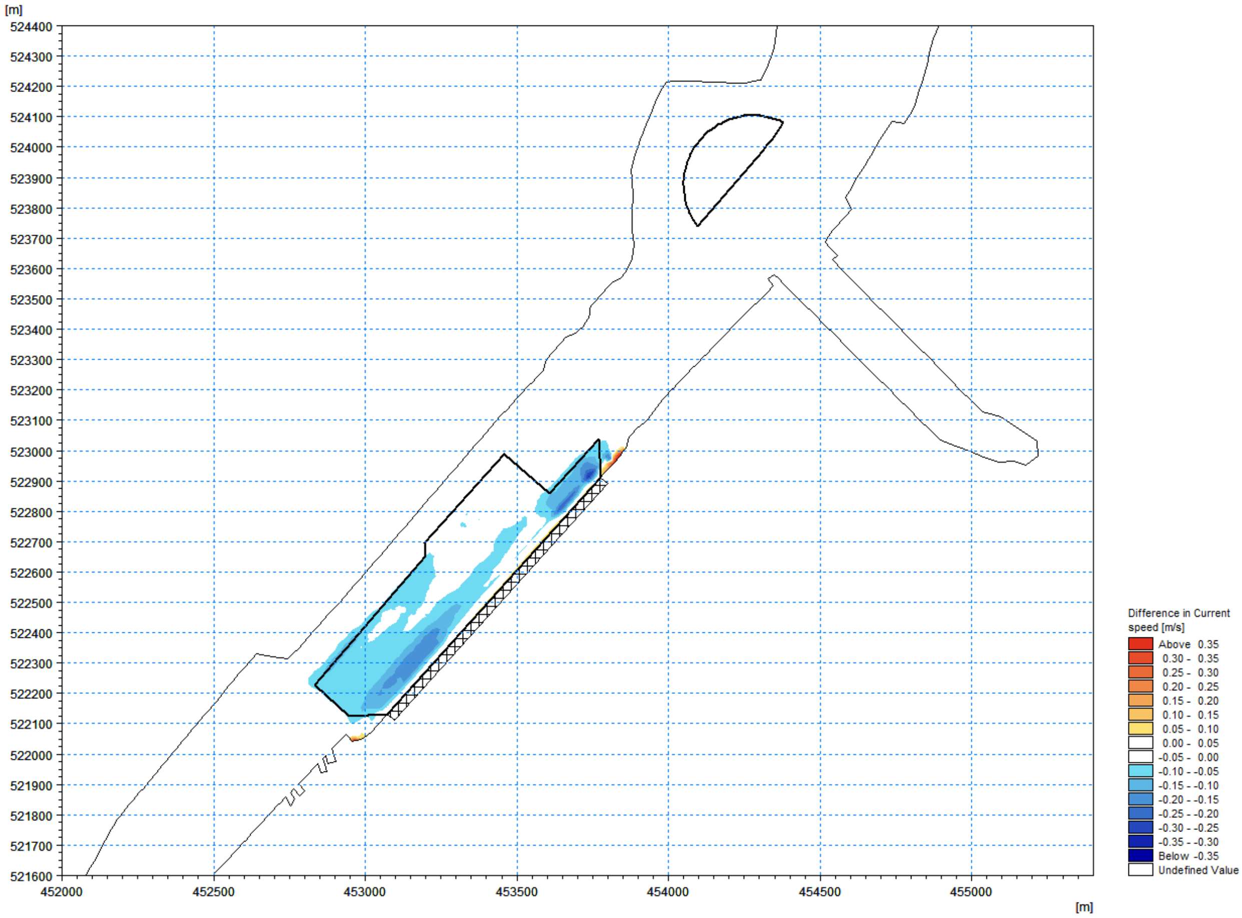

Figure 6.76 Change in peak current velocities due to the scheme during the ebb phase of a spring tide with mean daily river flow

The principal findings from the numerical hydrodynamic modelling are:

- The proposed new quay alignment and capital dredging to deepen the Tees Dock turning circle and approach channel and to create a berth pocket will not significantly affect the existing baseline hydrodynamic conditions.

- There will be flow newly occurring in the area of the new quay because it is being set-back from the existing river bank, but even the peak flows in this area will be low.

- Elsewhere, there will be a general small magnitude reduction in baseline flows varying during different phases of the tidal cycle, but always remaining largely within the reach immediately opposite the new quay. This reduction in baseline flows is caused by both a slight widening of the channel (due to the new quay alignment) and the local deepening of the bed due to the capital dredging.

- The reductions in baseline current speeds in these areas may lead to a slight increase in deposition of sediment. 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.

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- There is no measurable change caused by the capital dredging at the Tees Dock turning circle.
- There is no predicted effect on local wind-generated waves at the site since the changes in hydrodynamics are so small and localised.
- There are no estuary scale effects on baseline hydrodynamic conditions.

6.6.3 Changes in tidal prism of the estuary

In addition to changes in baseline current speeds, the Environment Agency particularly requested that the impacts of the proposed scheme on the tidal prism of the estuary be considered. Townend (2005) calculated the volume of the Tees estuary at mean low water to be 1.31 x 10^7 m^3 and at mean high water to be 3.23 x 10^7 m^3, yielding a mean tidal prism of 1.92 x 10^7 m^3. Design calculations for the proposed scheme show that the increase in mean tidal prism as a result of the new quay's set-back alignment and dredging of part of the existing estuary bed is 150,901 m^3. This represents an increase in the existing tidal prism of the estuary by less than one percent (0.8% to one decimal place) and is not deemed to be a cause of significant estuary-wide change in hydrodynamics.

6.6.4 Maintenance dredging and offshore disposal of dredged sediments

In order to provide an estimate of the present annual average maintenance dredging undertaken in the reach that is modelled to experience some minor change in baseline hydrodynamics (i.e. the reach local to the proposed new quay), it can be assumed that the affected area covers approximately half of dredging reach 6 and approximately one-third of dredging reach 5 (these 'dredging reaches' are shown in the earlier **Figure 6.29**).

Between 2001 and 2019 inclusive, the average annual maintenance dredging in reach 5 was 3,585m^3 and in reach 6 was 14,078m^3 (see the earlier **Table 6.14**). Assuming, for the purposes of this assessment, that maintenance dredging is evenly located through each dredging reach so that the spatial scaling described above can be applied, then the total annual average maintenance volume from the river reach where changes in hydrodynamics are modelled to occur is around 8,234m^3. This relatively low quantity of maintenance dredging is likely to be due to the low levels of suspended sediment measured in this reach of the river. By far the greatest contributions to the overall annual maintenance dredging total come from close to the barrage in dredging reaches 1-3 inclusive or towards the estuary mouth in dredging reaches 8-11 inclusive. All non-contaminated material from maintenance dredging is usually taken to the Tees Bay A licensed offshore disposal site.

The modelled reductions in current speeds in the reach of the channel local to the new quay, combined with the creation of a new berth pocket at the quay, may lead to a small increase in deposition rates and hence a requirement for more material to become from this local reach dredged annually. Recognising this, a 10% increase in annual maintenance dredging requirement may be a reasonable assumption recogising the low baseline SSCs in this reach. Even under this scenario, the maintenance dredging from this reach local to the new quay will still yield a very low overall contribution to the net annual maintenance dredging requirements from the estuary as a whole. Therefore the potential increase in maintenance dredging requirement is not expected to be significant and could easily be managed within existing maintenance dredging and offshore disposal regimes.

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7 MARINE SEDIMENT AND WATER QUALITY

7.1 Introduction

This section presents the baseline conditions with regard to sediment and water quality of the Tees estuary and describes the predicted effects of the construction and operational phases of the proposed scheme on water quality. The section incorporates work undertaken to assess the potential effects on hydrodynamic and sedimentary regime (see **Section 6**) as well as recent survey data collected to inform other project EIAs within the estuary, the latest being from a survey undertaken in 2019 to inform the NGCT EIA.

The findings of this assessment have the potential to influence other technical sections within this EIA, namely:

- **Section 9** Marine ecology;
- **Section 13** Fish and fisheries; and
- **Section 28** WFD compliance assessment.

7.2 Policy and consultation

7.2.1 Policy

National Policy Statement for Ports

The assessment of potential impacts on marine sediment and water quality has been made with reference to the policy guidance for this topic area contained within the NPS for Ports. **Table 7.1** summarises the requirements of the NPS which are of relevance to this section of the EIA Report.

Table 7.1 Summary of NPS requirements with regard to marine sediment and water quality

NPS for Ports requirement	NPS reference	EIA Report reference
Infrastructure development can have adverse effects on the water environment, including groundwater, inland surface water, transitional waters and coastal waters. During the construction, operation and decommissioning phases, it can lead to increased demand for water, involve discharges to water and cause adverse ecological effects resulting from physical modifications to the water environment.	Section 5.6, Paragraph 5.6.1	Refer to **Section 7.5** and **7.6** where potential impacts are assessment and mitigation measures outlined where required. The WFD compliance assessment is presented in **Section 28**.
There may be increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health or on protected species and habitats and could, in particular, result in surface waters, groundwaters or protected areas failing to meet environmental objectives established under the Water Framework Directive.	Section 5.6, Paragraph 5.6.2	Method statements and risk assessments would be developed prior to works commencing. These would be supplemented with a CEMP where measures to minimise reductions in water quality due to accidental spills would be detailed. See **Section 3** for further detail.
Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of, the proposed project on water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent.	Section 5.6, Paragraph 5.6.3	Refer to **Section 7.5** and **7.6** where potential impacts are assessed, and mitigation measures outlined where required.

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7.2.2 Consultation

As noted in **Section 5**, scoping consultation has been undertaken with both the MMO and RCBC during August and September 2020 (see **Appendix 3**). The consultation with both parties was informed through the formal scoping process undertaken for the same site in 2019. The comments of relevance to this section of the EIA Report are contained within **Table 7.2**.

Table 7.2 Summary of scoping consultation responses with regard to marine sediment and water quality

Comment	Response / section of report where comment addressed
Scoping Opinion from RCBC (September 2020)	
The Environment Agency recommended following the *Clearing the Waters for All* guidance before ruling out a quantitative assessment of water quality.	A quantitative water quality assessment has been undertaken and the results are presented in **Section 7.5**.
The applicant must ensure no deterioration in water quality as a result of the development in terms of WFD.	Refer to **Section 28** where the findings of the WFD compliance assessment are presented.
The applicant needs to ensure they can demonstrate no adverse impacts will be observed (to water quality), and mitigation may be required such as water quality monitoring.	Refer to **Section 7.5** and **7.6** where potential impacts are assessment and mitigation measures outlined where required.
Method statements need to ensure that consideration is given to the sensitivities during the build process; this should include surface run-off management during construction and following completion of construction to ensure no impact to water quality.	Method statements and risk assessments would be developed prior to works commencing. These would be supplemented with a CEMP where measures to minimise reductions in water quality due to surface water runoff would be detailed.
Mitigation measures with regard to dredging may be required to manage potential impacts to migratory fish due to potential water quality reductions. Such measures would entail limiting dredging to certain times of the year and/or providing suitable monitoring and mitigation including stop / start thresholds for parameters such as suspended sediment and dissolved oxygen.	Refer to **Section 7.5** and **7.6** where potential impacts are assessment and mitigation measures outlined where required.
Scoping Opinion from MMO (received in August 2019)	
The MMO would expect water quality to be scoped into the EIA.	Noted. This section of the report addresses this comment.
Dredging has the potential to cause negative impacts on the water environment. It can alter flow regimes, release contaminants within the sediment and create smothering effects / turbidity / sediment plumes.	Refer **to Section 7.5** and **7.6** where effects of the proposed dredge on water and sediment quality are assessed. The assessment has been informed by the findings of hydrodynamic and sedimentary plume modelling. Impacts to marine ecology associated with the proposed dredge are detailed in **Section 9**
The applicant should consider the (dredging) methodology to be used, the disposal of dredged material and the timing of works.	The proposed dredging plant has been selected based on the anticipated sediment types to be encountered during the dredge, as well as the plant which has been used for previous capital dredging projects elsewhere in the Tees. The proposed plant to be used, disposal of dredged material and timing of works is set out in **Section 3** of this report.

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Comment	Response / section of report where comment addressed
The disposal site must be specified, ensuring that it has taken capital dredged material previously and it can accept the total proposed amount of dredged material.	As detailed in **Section 3**, the dredged material is proposed to be deposited in the Tees Bay C offshore disposal site. This site has previously been used to dispose of capital dredged sediment. Impacts associated with offshore disposal are detailed in **Section 26**.
As part of the application, the applicant will need to provide sediment sample analysis results to ensure that the material is suitable for offshore disposal.	Refer to **Section 7.4** where this matter is discussed further.
Due to the quantity of material proposed to be dredged, it is advised that the plan for beneficial use / disposal should be clearly defined within the application.	Refer to **Section 3** where the proposals for disposal of dredged material are presented.

7.3 Methodology

7.3.1 Study area

For marine sediment and water quality, the study area comprises the likely maximum extent over which potentially significant environmental impacts of the proposed scheme may occur. This is informed by hydrodynamic and sediment dispersion modelling and is based on the maximum extent over which effects are predicted to occur (e.g. sediment plumes generated during capital dredging and effects on tidal currents during operation) (see **Figure 6.1**).

7.3.2 Methodology used to describe the existing environment

The description of the existing environment with regard to sediment quality has been informed through desk-based review of existing sediment quality data. The most recent publicly available sediment quality data to the proposed scheme footprint has been sourced from the MMO's Public Register.

Information on water quality has been collected through desk-based review and information from the Environment Agency's Catchment Data Explorer and the Northumbria River Basin Management Plan (RBMP) (Environment Agency, 2019). Although water quality information from the Catchment Data Explorer and the RBMP is routinely used to inform the WFD compliance assessment (**Section 28**), the data that was used to classify chemical status within and adjacent to the proposed scheme footprint is of relevance to this section of the EIA Report.

7.3.2.1 Sediment data

The assessment of potential impacts associated with disturbance of sediment during the construction phase has been undertaken in accordance with recognised guidelines and Action Levels, namely:

- Cefas Guideline Action Levels for the disposal of dredged material (Cefas, 2000); and,
- Canadian Sediment Quality Guidelines (CSQG) for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment (CCME), 2002).

The Action Levels are used as part of a 'weight of evidence' approach to assessing the suitability of dredged material for disposal at sea but are not themselves statutory standards. Selected Action Levels are set out in **Table 7.3**.

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Table 7.3 Selected Cefas Action Levels

Contaminant	Action Level 1 (mg/kg)	Action Level 2 (mg/kg)
Arsenic	20	100
Cadmium	0.4	5
Chromium	40	400
Copper	40	400
Nickel	20	200
Mercury	0.3	3
Lead	50	500
Zinc	130	800
Organotins (TBT, DBT)	0.1	1
Polychlorinated biphenyl (PCBs) (sum of ICES 7)	0.01	None
PCBs (sum of 25 congeners)	0.02	0.2
Polyaromatic Hydrocarbons (PAHs)	0.1	None
Dichlorodiphenyltrichloroethane (DDT)	0.001	None
Dieldrin	0.005	None

The MMO (using the Cefas Action levels) states that, in general, contaminant levels below Action Level 1 are not considered to be of concern. Material with persistent contaminant levels above Action Level 2 is generally considered to pose an unacceptable risk to the marine environment (and therefore material is unlikely to be considered suitable for disposal to sea). For material with persistent contaminant levels between Action Levels 1 and 2, further consideration of additional evidence is often required before the risk can be quantified. Therefore, for EIA, in the same way, if contaminant levels in the sediments under consideration persistently exceed Action Levels, additional assessment is required. This might be the application of additional sediment quality guidelines (as outlined below) or undertaking more detailed water quality assessment against Environmental Quality Standards (EQS).

The CSQG involved the derivation of interim marine sediment quality guidelines (ISQGs), or Threshold Effect Levels (TEL) and Probable Effect Levels (PEL). Selected Canadian guidelines are presented in **Table 7.4** and comprise two assessment levels. The lower level is referred to as the TEL and represents the concentration below which adverse biological effects are expected to occur only rarely (in some sensitive species for example). The higher level, the PEL, defines a concentration above which adverse effects may be expected in a wider range of organisms.

These levels were derived from an extensive database containing direct measurements of toxicity of contaminated sediments to a range of aquatic organisms exposed in laboratory tests and under field conditions (CCME, 2002). As a result, these guidelines provide an indication of likely toxicity of sediments to aquatic organisms. However, these guidelines should be used with caution as they were designed specifically for Canada and are based on the protection of pristine environments. In the absence of suitable alternatives, however, it has become commonplace for these guidelines to be used by regulatory and statutory bodies in the UK, and elsewhere, as part of a 'weight of evidence' approach.

Table 7.4 Selected CSQG values (taken from CCME, 2002)

Contaminant	Units	TEL	PEL
Arsenic	mg/kg	7.24	41.6
Cadmium	mg/kg	0.7	4.2
Chromium	mg/kg	52.3	160
Copper	mg/kg	18.7	108
Mercury	mg/kg	0.13	0.7
Lead	mg/kg	30.2	112
Zinc	mg/kg	124	247
Acenaphthene	µg/kg	6.71	88.9
Acenaphthylene	µg/kg	5.87	128
Anthracene	µg/kg	46.9	245
Benz(a)anthracene	µg/kg	74.8	693
Benzo(a)pyrene	µg/kg	88.8	763
Chrysene	µg/kg	108	846
Dibenz(a,h)anthracene	µg/kg	6.22	135
Fluoranthene	µg/kg	113	1,494
Fluorene	µg/kg	21.2	144
Napthalene	µg/kg	34.6	391
Phenanthrene	µg/kg	86.7	544
Pyrene	µg/kg	153	1,398

7.3.2.2 Water quality

If additional assessment is indicated to be required as a result of recording elevated sediment concentrations above the lower Cefas Action Level 1, the undertaking of simple calculations using estimates of sediment losses from dredging equipment and concentrations of contaminants within the sediments to be dredged can be used to provide an indication of the amount of contamination that could be released into the water body. The volume of water into which the contamination is released can then be used to calculate the potential dilution and indicate potential water concentrations. These are then compared to EQSs as shown in **Table 7.5**.

Table 7.5 Selected Environmental Quality Standards

Contaminant	AA (Annual Average) (µg/l)	MAC (Maximum Allowable Concentration) (µg/l)
Arsenic	25	-
Cadmium	0.2	-
Chromium	0.6	32
Copper	2.15	3.76
Mercury	-	0.07
Lead	1.3	14
Zinc	7.9	-

Contaminant	AA (Annual Average) (µg/l)	MAC (Maximum Allowable Concentration) (µg/l)
Fluoranthene	-	0.120
Benzo[k]fluoranthene	-	0.017
Benzo[ghi]perylene	-	0.00082
Benzo(b) fluoranthene	-	0.017
Benzo(a)pyrene	-	0.027
Tributyl Tin (TBT)	-	0.0015

7.3.3 Methodology for assessment of potential impacts

The methodology used to assess the significance of the potential environmental impacts on marine sediment and water quality is as described in **Section 5**. Water quality in the Tees estuary is considered to be of medium sensitivity due to the failing of chemical status under the WFD and therefore potential for limited capacity to accommodate physical or chemical changes or influences. Parts of the estuary are also designated as a SPA and Ramsar site and bathing waters are located at the estuary mouth. The potential impacts associated with the proposed offshore disposal of dredged material are considered in **Section 26**, whilst potential effects on the SPA and Ramsar site are detailed in **Section 29**.

7.4 Existing environment

As noted above, baseline information has been sourced from publicly available information. The most applicable information to this EIA is outlined below.

7.4.1 Sediment quality

Results of the sediment quality data from the NGCT marine licence application

PDT carried out a sediment quality survey in July 2019 to inform the marine licence application for the NGCT application. The footprint of the proposed NGCT scheme is located approximately 1km downstream of the proposed new quay at South Bank. There is however a degree of overlap between the dredge footprint for the two schemes, specifically at the Tees Dock turning circle. Results from the NGCT sediment quality survey are detailed below. The NGCT sediment quality sampling positions in relation to the proposed scheme footprint are shown in **Figure 7.1**. The results from the survey are summarised in **Table 7.6** and discussed below.

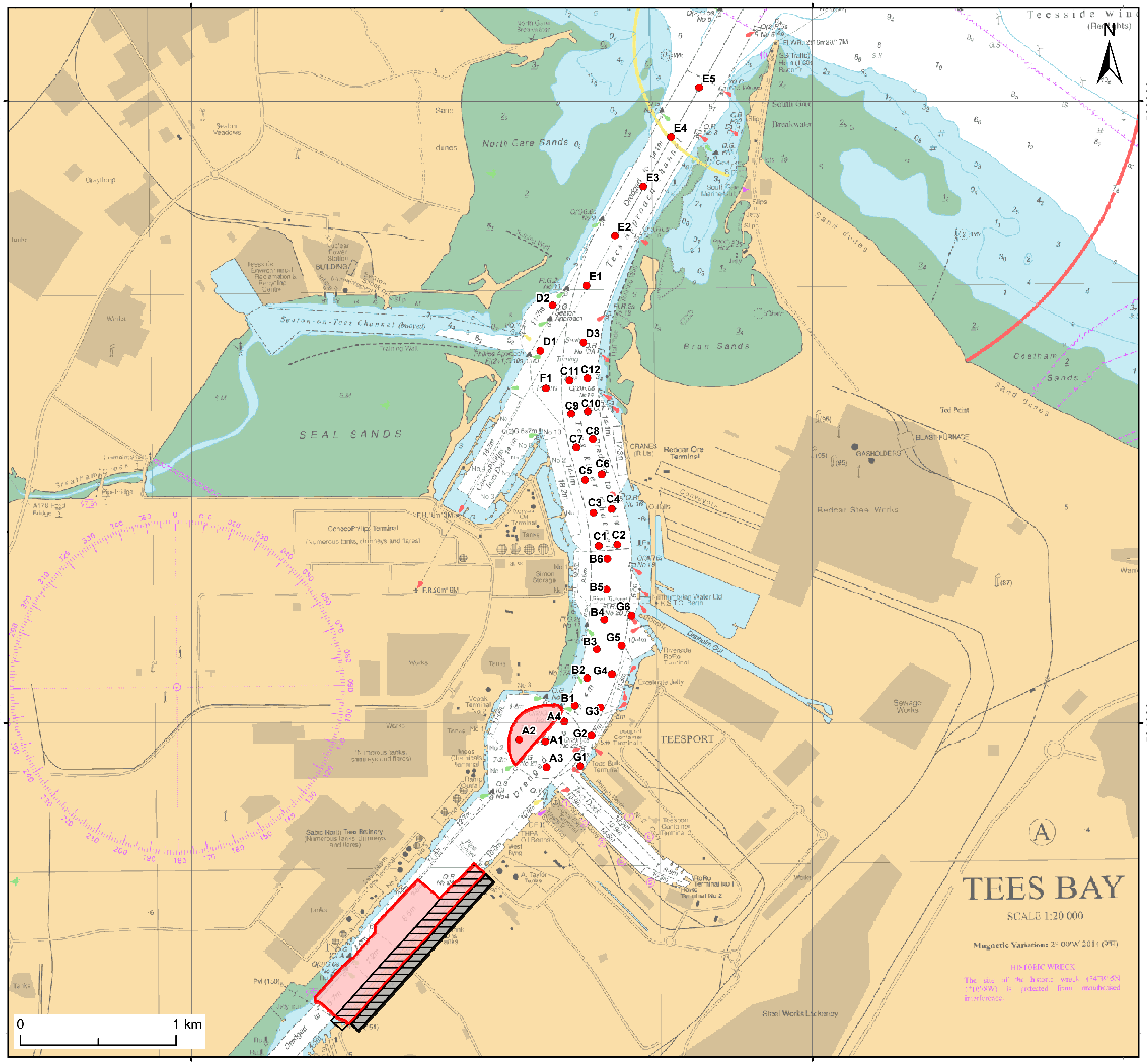
Metals

Concentrations of metals in the vast majority of samples were elevated above Action Level 1 (30 of the 36 samples contained at least one metal above Action Level 1). The exceedances above Action Level 1 were marginal only. There were no exceedances of Action Level 2.

With regard to the CSQG values, the vast majority of samples contained arsenic, copper, mercury, lead and zinc in concentrations above the TEL. Two metals exceeded the PEL – lead and zinc.

Organotins

Concentrations of organotins in all samples were below Action Level 1. In the vast majority of cases, concentrations were less than the laboratory detection limit. There is no TEL or PEL for organotins and therefore screening of the results against the CSQG was not possible.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- 2019 sediment sampling locations for NGCT

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: NGCT Sediment sampling locations (2019)

Figure: 7.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	27/10/2020	TC	CP	A3	1:25,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together
ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Table 7.6 Summary of sediment quality data from the NGCT sediment quality survey (2019)

Contaminant	Min conc. (mg/kg) (dry weight)	Max conc. (mg/kg) (dry weight	Average (mg/kg) (dry weight)	Action Level 1 exceedance (number of samples)	Action Level 2 exceedance (number of samples)	TEL exceedance (number of samples)	PEL exceedance (number of samples)
Arsenic	6.9	33.3	24.89	Yes (30)	No (0)	Yes (35)	No (0)
Cadmium	0.04	0.59	0.25	Yes (4)	No (0)	No (0)	No (0)
Chromium	5.4	52.2	33.0	Yes (12)	No (0)	No (0)	No (0)
Copper	7.8	74.3	36.9	Yes (12)	No (0)	Yes (31)	No (0)
Mercury	0.05	0.6	0.33	Yes (22)	No (0)	Yes (32)	No (0)
Nickel	5.2	35.6	24.7	Yes (27)	No (0)	No (0)	No (0)
Lead	13.2	135	80.7	Yes (30)	No (0)	Yes (33)	Yes (6)
Zinc	35.2	254	144.69	Yes (23)	No (0)	Yes (25)	Yes (2)
DBT	<0.005	0.020	0.006	No (0)	No (0)	-	-
TBT	<0.005	0.014	0.005	No (0)	No (0)	-	-
Acenaphthene	0.04	0.88	0.21	Yes (33)	-	Yes (36)	Yes (33)
Acenaphthylene	0.02	3.78	0.26	Yes (24)	-	Yes (36)	Yes (19)
Anthracene	0.05	1.20	0.29	Yes (33)	-	Yes (36)	Yes (36)
Benzo(a)anthracene	0.07	1.15	0.52	Yes (34)	-	Yes (36)	Yes (5)
Benzo(a)pyrene	0.06	1.10	0.49	Yes (34)	-	Yes (34)	Yes (4)
Benzo(b)fluoranthene	0.04	0.96	0.48	Yes (34)	-	-	-
Benzo(e)pyrene	0.09	0.85	0.49	Yes (34)	-	-	-
Benzo(ghi)perylene	0.08	0.81	0.47	Yes (34)	-	-	-
Benzo(k)fluoranthene	0.02	0.52	0.22	Yes (32)	-	-	-
C1 Naphthalene	2.14	7.83	4.11	Yes (36)	-	-	-
C1 Phenanthrene	0.65	4.55	1.71	Yes (36)	-	-	-
C2 Naphthalene	1.42	5.46	2.96	Yes (36)	-	-	-

Contaminant	Min conc. (mg/kg) (dry weight)	Max conc. (mg/kg) (dry weight	Average (mg/kg) (dry weight)	Action Level 1 exceedance (number of samples)	Action Level 2 exceedance (number of samples)	TEL exceedance (number of samples)	PEL exceedance (number of samples)
C3 Naphthalene	1.05	3.35	2.37	Yes (36)	-	-	-
Chrysene	0.10	1.05	0.55	Yes (36)	-	Yes (34)	Yes (3)
Dibenzo(ah)anthracene	0.01	0.16	0.09	Yes (14)	-	Yes (36)	Yes (5)
Fluoranthene	0.10	2.20	0.96	Yes (36)	-	Yes (35)	Yes (4)
Fluorene	0.10	3.00	0.42	Yes (36)	-	Yes (36)	Yes (33)
Indeno(1,2,3-c,d)pyrene	0.02	0.65	0.33	Yes (33)	-	-	-
Naphthalene	0.70	1.94	1.40	Yes (36)	-	Yes (36)	Yes (36)
Perylene	0.006	0.23	0.10	Yes (15)	-	-	-
Phenanthrene	0.54	5.83	1.62	Yes (36)	-	Yes (36)	Yes (36)
Pyrene	0.13	2.54	0.95	Yes (36)	-	Yes (34)	Yes (4)
PCB – sum of ICES7	0.001	0.019	0.004	Yes (1)	-	-	-
PCB – sum of ICES25	0.003	0.03	0.011	Yes (1)	No	-	-
Alpha-hexachlorocyclohexane	<0.0001	0.00028	0.00011	-	-	-	-
Beta-hexachlorocyclohexane	<0.0001	0.00014	0.00010	-	-	-	-
Gamma-hexachlorocyclohexane	<0.0001	0.00134	0.00015	-	-	-	-
Dieldrin	<0.0001	0.00059	0.00025	No (0)	-	-	-
Hexachlorobenzene	0.00018	0.00868	0.00147	-	-	-	-
1,1,-dichloro-2,2-bis(p-chlorophenyl) ethane (PPTDE)	0.00012	0.00204	0.00100	-	-	-	-
1,1,-dichloro-2,2-bis(p-chlorophenyl) ethylene (PPDDE)	0.00020	0.00106	0.00062	-	-	-	-
Dichlorodiphenyltrichloroethane (PPDDT)	<0.0001	0.00389	0.00039	Yes (2)	-	-	-

Contaminant	Min conc. (mg/kg) (dry weight)	Max conc. (mg/kg) (dry weight	Average (mg/kg) (dry weight)	Action Level 1 exceedance (number of samples)	Action Level 2 exceedance (number of samples)	TEL exceedance (number of samples)	PEL exceedance (number of samples)
Polybrominated diphenyl ethers BDE17	<0.00002	0.000926	0.0003	-	-	-	-
BDE28	<0.00002	0.000701	0.0002	-	-	-	-
BDE47	0.000104	0.00417	0.0018	-	-	-	-
BDE66	<0.00002	0.000707	0.0002	-	-	-	-
BDE85	<0.00002	0.000278	0.0001	-	-	-	-
BDE99	0.0000988	0.00493	0.0022	-	-	-	-
BDE100	0.0000202	0.000598	0.0003	-	-	-	-
BDE138	<0.00002	<0.00002	0.00002	-	-	-	-
BDE153	<0.00002	0.000968	0.0004	-	-	-	-
BDE154	<0.00002	0.000466	0.0002	-	-	-	-
BDE183	<0.00002	0.000841	0.0003	-	-	-	-
BDE209	0.00381	0.407	0.107	-	-	-	-

Polyaromatic Hydrocarbons (PAH)
Virtually all samples recovered contained nearly all PAH compounds analysed for in concentrations above Action Level 1 (and the TEL and PEL where available). There is no Action Level 2 for PAH compounds.

The concentrations ranged from marginal exceedances above Action Level 1 with regard to the majority of PAH compounds, however, concentrations of napthalenes were present in one location (in the NGCT berth pocket approximately 1.5km downstream of the South Bank scheme footprint) up to seven times greater than Action Level 1 (however were generally two or three times the Action Level 1 value).

Concentrations of C1 Naphthalene, C2 Naphthalene and C3 Naphthalene were present above Action Level 1 in all 36 samples, whilst C1 Phenanthrene, Naphthalene and Phenanthrene were elevated above Action Level 1 in 33 samples. Concentrations of THC were also relatively high, peaking at 975mg/kg.

It should be noted that concentrations of PAH compounds within the Tees estuary have historically been elevated, and based on the results of sampling undertaken in 2006 (to support the NGCT Harbour Revision Order application), there does not appear to have been a significant change in the concentrations of these contaminants throughout the estuary over time.

Polychlorinated biphenyls (PCB)
One of the 36 samples analysed contained PCBs (sum of ICES7 and sum of 25 congeners) in concentrations marginally greater than Action Level 1. This sample was recovered from the proposed NGCT berth pocket, approximately 1.5km downstream of the proposed South Bank scheme footprint (see **Figure 7.1**). There were no exceedances of Action Level 2. There is no TEL or PEL for PCBs and therefore screening of the results against the CSQG was not possible.

Organochlorines
The concentration of organochlorines present was generally less than the laboratory detection limit of 0.0001mg/kg. Dieldrin was not located in any sample above Action Level 1, whilst Dichlorodiphenyltrichloroethane (DDT) was marginally elevated in two of the 36 samples analysed. There is no Action Level 2 for OCPs or CSQG values.

Polybrominated diphenyl ethers (PDBE)
The concentrations of PDBEs ranged from <0.02μg/kg to 4.93μg/kg (excluding BDE209). The concentrations of BDE209 ranged from 3.81μg/kg to 407μg/kg.

Cefas has previously advised (within SAM/2018/00069) that the distribution and concentrations of PBDE congeners in the marine environment are highly variable, and whilst named as a Chemical for Priority Action, there are no formal OSPAR assessment values developed with which to assess status. The significance of the concentrations reported above has therefore been informed by a review of concentrations present within historic samples within the Tees, as well as information provided by Cefas and the MMO within SAM/2018/00069.

Within SAM/2018/00069, Cefas stated that BDE congener 209 is generally expected to be found in much higher concentrations in the marine environment (compared with the results of the other BDE congeners); the data presented above confirms this expectation. This trend was also evident within the findings of the sediment samples recovered in 2006, with BDE209 concentrations ranging from <0.5μg/kg to 340μg/kg. The results of BDE209 found in 2019 as part of the NGCT survey were similar but marginally higher than that found in 2006. The MMO has recently confirmed that the sediment to be dredged from the NGCT footprint is suitable for offshore disposal into the Tees Bay C site, and no concerns were raised with regard to the PDBE concentrations.

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Summary of previous sediment quality surveys in the Tees
The findings of sediment quality surveys undertaken in support of previously consented schemes in the Tees estuary is summarised below.

A sediment quality survey was undertaken in the Tees estuary during July 2014 to inform the EIA for the Anglo American Harbour Facilities project. A total of six vibrocores were taken within the footprint of the berth pocket and port terminal for the Anglo American Harbour Facilities, with two vibrocores taken from the adjacent approach channel (that will be deepened as part of the NGCT project and the results are therefore directly applicable to the NGCT scheme). The vibrocore logs reported that the strata within the approach channel (from positions VC1A and VC2A) comprised soft extremely low strength clay, underlain by gravelly sand at 1.5m depth (VC1A) and rock debris at 0.9m depth (VC2A). The samples from all strata from VC1A and VC2A did not contain any concentrations of contaminants above Action Level 2. Minor exceedances of Action Level 1 only were identified.

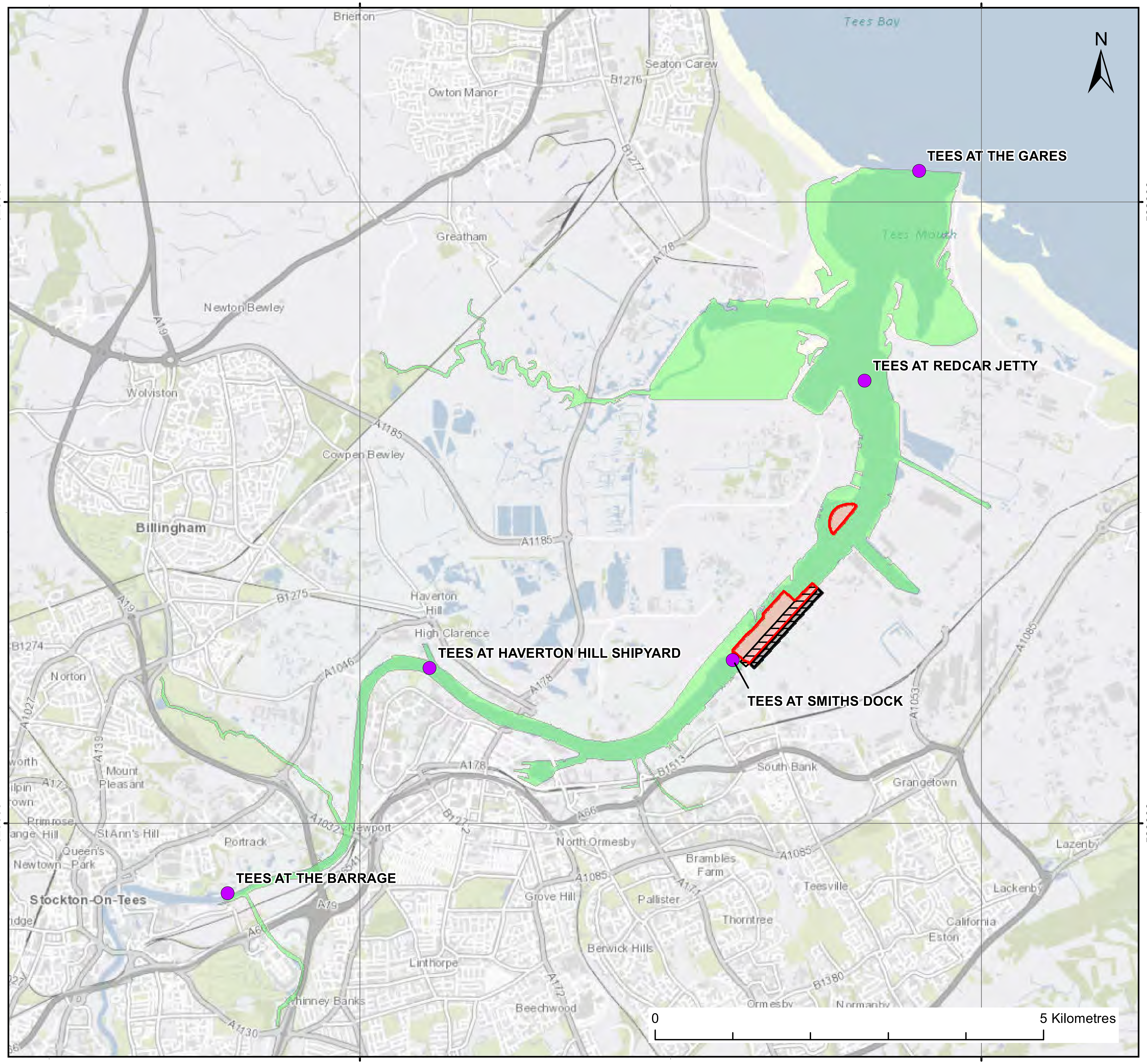
Royal HaskoningDHV carried out an EIA on behalf of PDT in 2012 for proposed strengthening of the existing No.1 Quay at Tees Dock, and also the widening and deepening of the existing berth and adjacent areas within Tees Dock. Though showing signs of minor contamination, it was determined that the 'soft' sediments within 'Tees Dock Water Area' (identified in marine licence 34396) were suitable for offshore disposal.

The 2006 sediment quality survey undertaken to inform the 2008 HRO application involved the recovery of 13 surface samples from within and adjacent to the proposed dredge footprint for the NGCT scheme. Overall, the chemical data from the NGCT study indicated some level of contamination within the samples, particularly heavy metals and PAH compounds. However, levels were not deemed high enough to prohibit the material from being disposed of to sea (no exceedances of Action Level 2 were present). Concentrations of individual PAH compounds were found in concentrations greater than three times Action Level 1.

7.4.2 Water quality

Water Framework Directive baseline information
In terms of marine water bodies, the proposed scheme is located within the Tees transitional water body (ID GB510302509900) (see **Figure 7.2**). The Tees transitional water body is heavily modified and has an overall potential of 'Moderate'. The chemical quality element of the water body has been assessed in 2019 due to concentrations of cypermethrin, Polybrominated diphenyl ethers (PBDE), Benzo(g-h-i) perylene, Mercury (and its compounds) and Tributyltin (TBT) compounds. Dissolved Inorganic Nitrogen (DIN) was also classified as moderate.

Water quality data was also obtained from the Environment Agency for the latest classification that has been formally quality assured for metals and PAHs, the parameters exceeding Cefas Action Level 1. This is for the period 2016 to 2018 and is presented in **Table 7.7** for Tees at Smiths Dock, the monitoring point closest to proposed project (see **Figure 7.2**).



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Water Quality Monitoring Points

WFD Transitional Waterbody

- Tees (GB510302509900)

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: Water Quality Monitoring Points

Figure: 7.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	07/09/2020	TC	CP	A3	1:50,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Table 7.7 Summary of selected water quality data for Tees at Smiths Dock monitoring point

Parameter	Mean (µg/l)	Maximum (µg/l)
Benzo(a)pyrene	0.001485	0.00319
Benzo(b)fluoranthene	0.001561	0.00361
Benzo(g-h-i)perylene	0.001538	0.00295
Benzo(k)fluoranthene	0.000771	0.00195
Cadmium	0.030333	0.03
Copper	1.03725	1.49
Fluoranthene	0.018595	0.05
Indeno(1-2,3-cd)pyrene	0.001625	0.00362
Arsenic[1]	1	1
Lead	0.628917	1.83
Mercury[2]	0.01	0.01
Nickel	1.614417	3.35
TBT	0.000313	0.00125
Zinc	3.99	5.06
Chromium[3]	0.3	0.3

Bathing Waters

The Environment Agency takes water samples at each of England's designated bathing waters during the bathing season, which is between May and September each year. The samples are analysed for bacteria that indicate the presence of faecal matter in the water. A classification for each bathing water is calculated annually based on samples from the previous four years. The classifications are:

- Excellent – the cleanest seas;
- Good – generally good water quality;
- Sufficient – the water meets minimum standards; and,
- Poor – the water has not met the minimum standards

The proposed scheme footprint is not located within a designated bathing water. However, there are bathing waters located to both the north and south of the proposed scheme footprint, the closest of which are:

- Seaton Carew North Gare - Carew North Gare Beach is the southern end of an extensive sandy beach close to the mouth of the Tees. The water quality has been classified as Excellent.
- Seaton Carew Centre - this designated bathing water is at the southern end of an extensive sandy beach fronting the town of Seaton Carew, approximately 1.5km north of the mouth of the Tees estuary. This bathing water has a classification of Excellent.

[1] Concentrations of arsenic were all below the Limit of Detection (LOD) of 1µg/l
[2] Concentrations of mercury were all below the LOD of 0.01µg/l
[3] Concentrations of chromium were all below the LOD of 0.3µg/l

- Seaton Carew North – this designated bathing water is at the northern end of an extensive sandy beach fronting the town of Seaton Carew, approximately 2.5km north of the estuary mouth. This bathing water has a classification of Good.

Turbidity

In general, suspended sediment concentrations are low within the estuary and within Tees Bay. The highest observed values tend to occur on spring tides. This relationship is not strong, but the extreme values are also attributed to either high rainfall or storm events. In general, concentrations appear to be dominated by freshwater inputs in the reaches above Middlesbrough and marine influences in reaches located further downstream. In the vicinity of the proposed scheme (i.e. in the Tees Dock area) suspended solid concentrations, for the most part, are less than 20mg/l with short-term peaks from 40-80mg/l (Royal Haskoning, 2006).

Further information was also collected during a met ocean Survey in July 2020. In total, 52 water quality samples were collected from the centre point of transect T8 (T8 was located in front of the proposed scheme, within the estuary) and analysed in the laboratory for suspended sediment concentrations. The results from the survey are detailed in **Section 6** and summarised in **Table 7.8** below. The data show that during this period, concentrations of suspended sediment were very low. It should be noted however, that the conditions during this period were very dry and calm and therefore are considered to only be reflective of potential spring/summer conditions.

Table 7.8 Suspended sediment concentrations recorded at Transect T8 in July 2020

Location	Tidal condition	Suspended sediment concentrations (mg/l)		
		Minimum	Mean	Maximum
Transect T8 (shown on **Figure 6.5**)	Neap	0.0	3.9	7.5
	Spring	0.0	2.5	8.5

7.4.3 Planned survey works

A site-specific sediment quality survey is proposed to be undertaken during 2020 to provide a detailed understanding of sediment quality within the proposed scheme footprint and validate the information set out above. As agreed with the MMO via SAM/2020/00026 (**Appendix 6**), this is proposed to comprise recovery of sediment samples from 25 stations from the surface and at depth, with sampling positions equally spread across the proposed dredge footprint. Samples will be recovered at the surface and at 1m intervals at each of the 25 positions to the proposed dredge depth, or until geological mudstone is encountered beforehand (the MMO has confirmed recovery of samples for laboratory analysis within geological mudstone is not required).

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

In the absence of the proposed scheme, there is no reason to believe that sediment and water quality within the Tees estuary is likely to materially change from the present-day conditions. PDT will continue to undertake maintenance dredging of the river to maintain the advertised dredge depths, with mid-licence sediment sampling being undertaken from the surface in accordance with the conditions on the maintenance dredge disposal licence (to ensure that the maintenance dredged material remains suitable for offshore disposal).

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7.5 Potential impacts during the construction phase

7.5.1 Dispersion and redistribution of sediment during capital dredging

Capital dredging would result in the creation of sediment plumes. To consider the potential extent and severity of effect on suspended solid concentrations within the Tees, hydrodynamic modelling was undertaken. Full detail on the modelling is presented in **Section 6** but the key points are summarised here for ease of reference.

Modelling was undertaken using a MIKE3-MT sediment dispersion model coupled with the 3D hydrodynamic model MIKE3-HD and run for the four-month period over which dredging is likely to occur. The simulations also accounted for the movement of dredgers and transport barges (including dredging, sailing, disposal and downtime) and four 'stages' of dredging (which would occur in sequence) were modelled to allow for the potential timing of phasing in the proposed construction methodology as follows:

- Stage 1: BHD working to dredge the upper soft material in the berthing pocket and river channel.
- Stage 2: BHD and TSHD working in parallel to dredge the middle soft material in the berthing pocket and river channel.
- Stage 3: BHD working to dredge the bottom hard material in the berthing pocket and river channel.
- Stage 4: BHD and TSHD working in parallel to dredge the material in the Tees Dock turning circle.

7.5.1.1 Stage 1

An example of the results of the model simulation for Stage 1 is presented in **Figure 7.3**. It can be seen in the figure that the largest concentrations are local to the dredger and typically reach around 100 to 200mg/l. In all tidal conditions modelled, the lateral extent of the plume across the river channel is very narrow and the magnitude of concentrations within the plume beyond a few hundred metres from the point of release is in the order of 10 - 20mg/l and in the extremities of the plume, reduces further to concentrations 0-10mg/l (see **section 7.5**). Plots for the different tidal conditions are presented in **Section 6.**

7.5.1.2 Stage 2

Results for this stage were similar to those in Stage 1 but with separate plumes created by the different dredgers. At some points in the cycle, areas of these initially separate plumes combine as they move upstream and downstream according to the tidal phase, albeit at relatively low (typically <30mg/l and often <10 mg/l) concentrations once a few hundred metres away from the point of initial release. An example plot is shown in **Figure 7.4.** Plots for the different tidal conditions are presented in **Section 6.**

7.5.1.3 Stage 3

The maximum concentrations and the spatial extents of the plume arising from Stage 3 of the dredging are much lower than those experienced during Stage 1, largely because the material being released is coarser and the production rate of dredging is notably lower. **Figure 7.5** shows an example plume during Stage 3 dredging. Plots for the different tidal conditions are presented in **Section 6.**

7.5.1.4 Stage 4

Again, peak concentrations close to the dredger are shown in the plume modelling output. On the ebb phase, the plume can extend at low concentrations (<30mg/l) along the jetties of the Oil Terminal towards (but not entering) the Conoco Phillips Inset Dock, whilst on the flood phase it remains close to the northern bank over a narrow channel width extending along the North Tees Works jetties. An example plot is shown in **Figure 7.6**. Plots for the different tidal conditions are presented in **Section 6.**

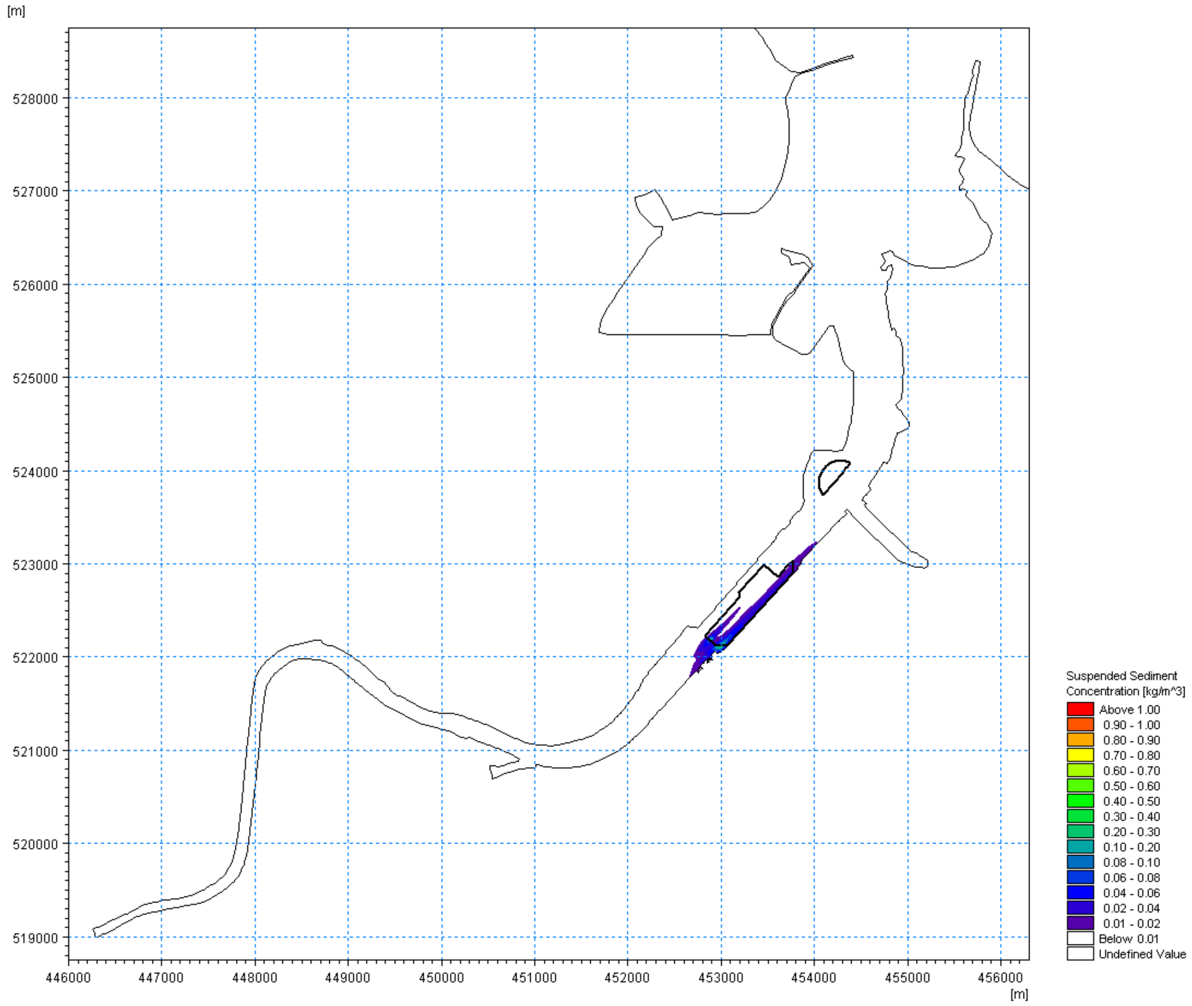

Figure 7. 3 Plume of suspended sediment concentrations arising from dredging activities during Stage 2 (release from south-western ends of the two parallel dredging transects)

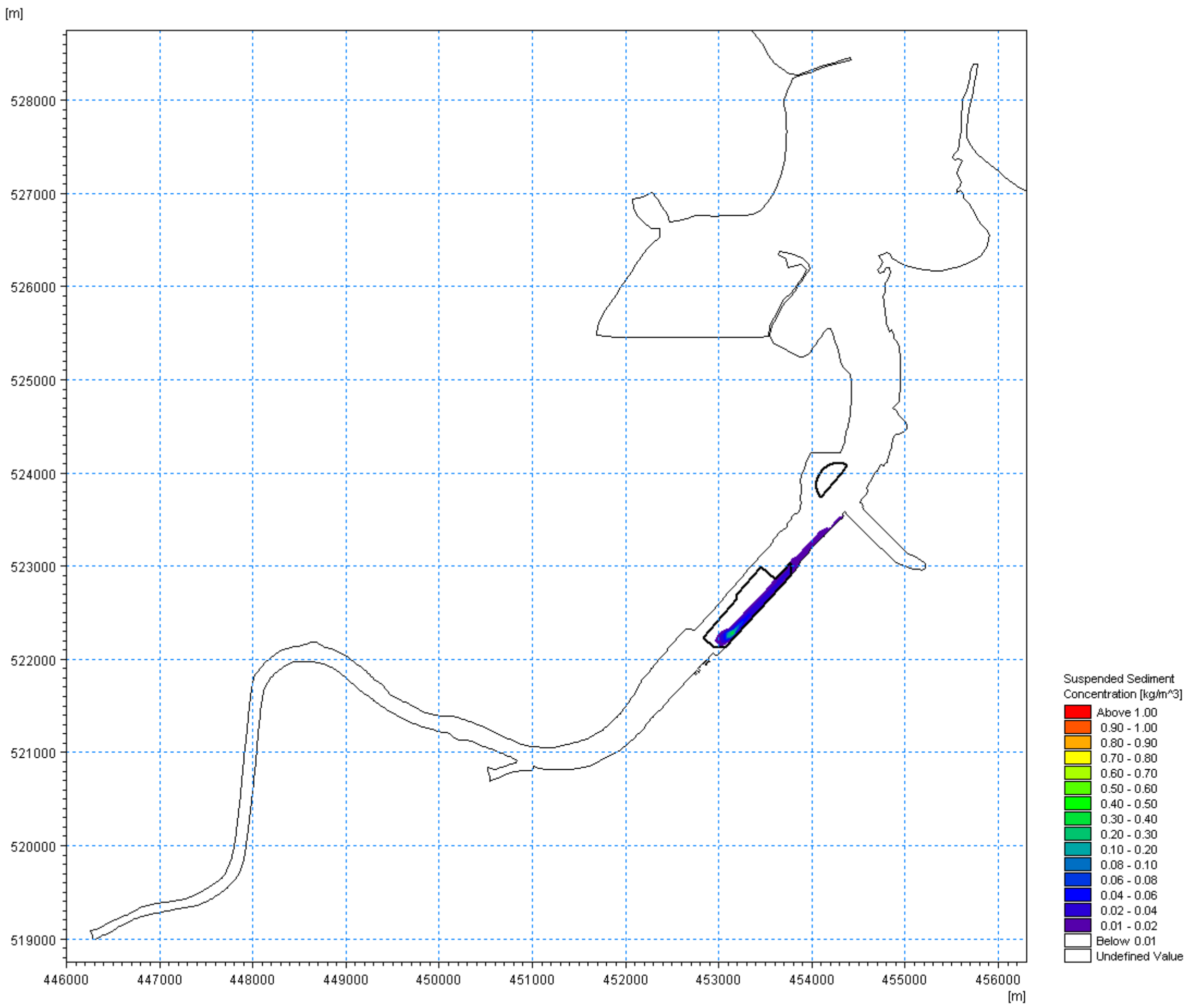

Figure 7. 4 Plume arising from dredging activities during Stage 1 of the capital dredge (release from the south-western corner of the dredging transect during the ebb phase)

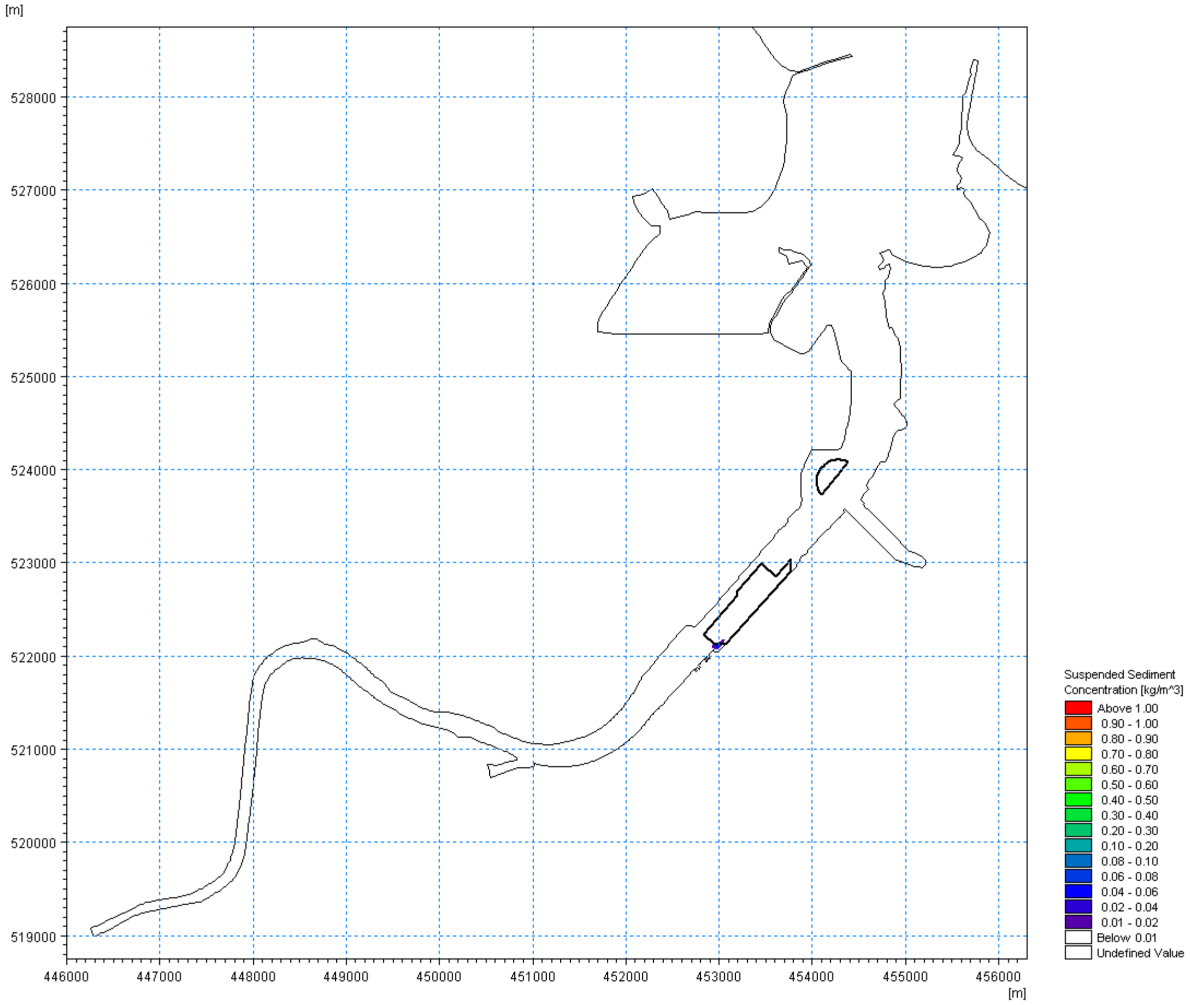

Figure 7. 5 Plume of suspended sediment concentrations arising from dredging activities during Stage 3 (release from the south-western corner of the dredging transect during the ebb phase)

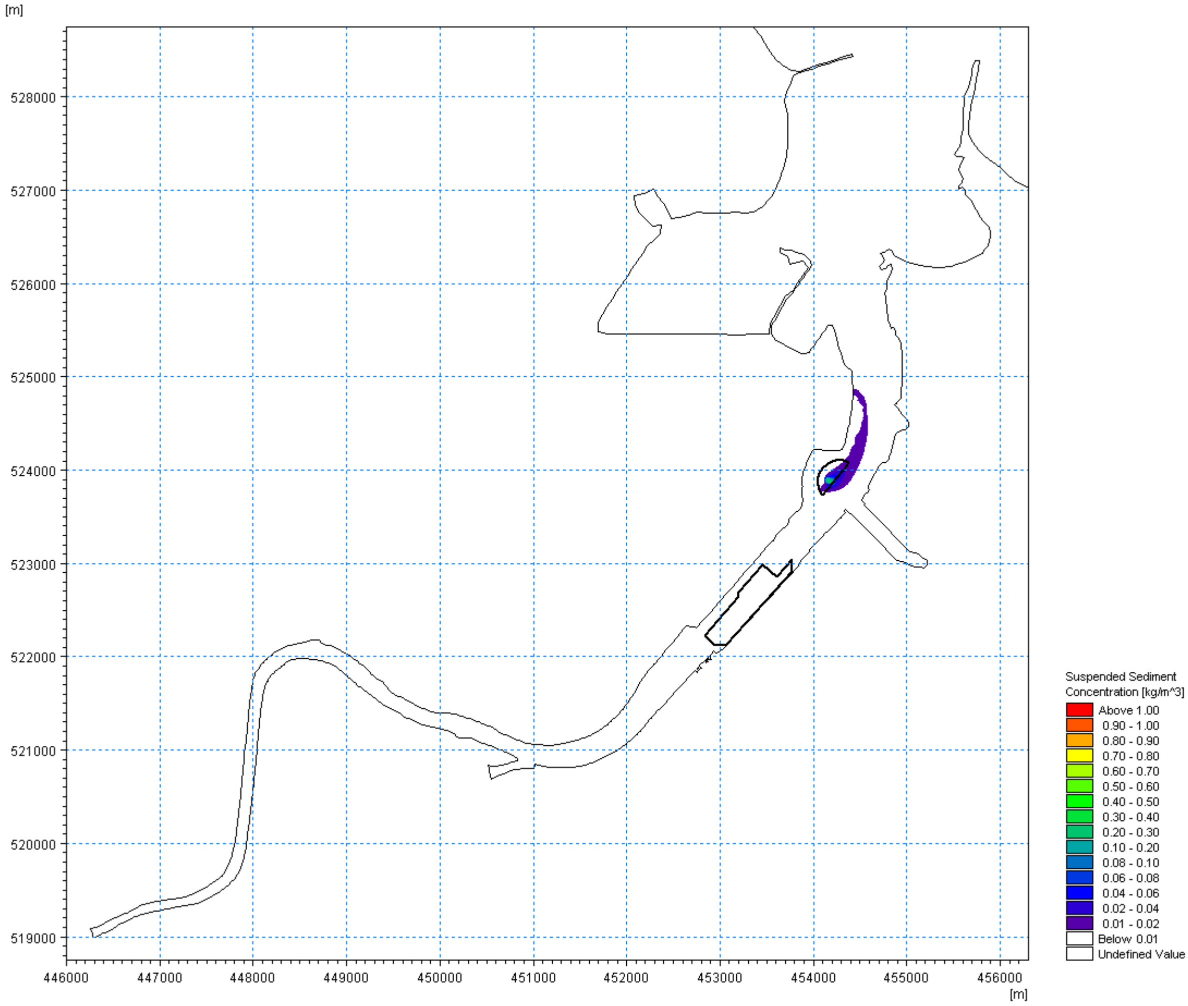

Figure 7.6 Plume of enhanced suspended sediment concentrations arising from dredging activities during Stage 4 (during a release from the turning circle during the flood phase of the tide).

To investigate potential levels of suspended solid concentrations at the WFD water quality monitoring points (see **Figure 7.2**), time series plots were produced as follows:

- WQ1 – Water quality monitoring point (Tees at the Gares);
- WQ2 – Water quality monitoring point (Tees at Redcar Jetty);
- WQ3 – Water quality monitoring point (Tess at Smiths Dock);
- WQ4 – Water quality monitoring point (Tees at Haverton Hill Shipyard);
- WQ5 – Water quality monitoring point (Tees at the Barrage);

The results are presented in **Figure 7.7**.

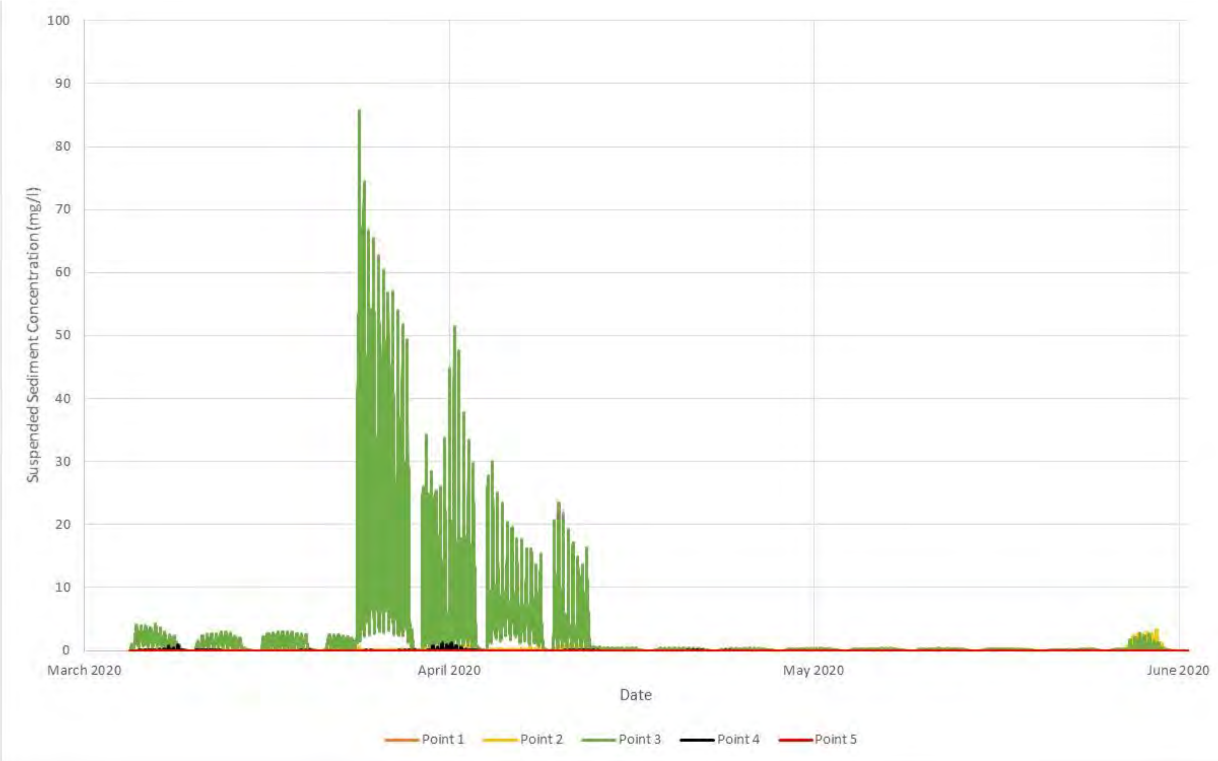

Figure 7.7 Timeseries of changes in suspended sediment concentrations at water quality monitoring points in the Tees Estuary.

Only point 3 (Smiths Dock – **Figure 7.2**) experiences elevated levels of suspended solids and only during Stage 2 of the proposed dredging schedule (when the BHD and TSHD would be working in parallel to dredge the middle soft material in the berthing pocket and river channel for a period of approximately four weeks). Peak concentrations reach 85mg/l which reduce back to baseline within an hour followed by subsequent, but lower concentration peaks, again reducing to baseline concentations within an hour. All other stages of the proposed capital dredging works either do not cause elevations at the water quality monitoring points or only elevate concentrations by very small amounts (i.e. by up to 5mg/l). It should be noted that given the sediment plume is not predicted to reach The Gares water quality monitoring point, no effects on the designated bathing waters are predicted.

As a result, the magnitude of effect on water quality in the Tees estuary is deemed to be medium as there will be exceedances over baseline conditions throughout Stage 2 of the dredging schedule (as noted above, a period of approximately four weeks within the approximately four month dredging programme). The effect is, however, temporary and reversible. Given the sensitivity of the Tees estuary is medium, the overall impact is of **minor adverse** significance.

Mitigation measures and residual impact

No mitigation measures are required. The residual impact is predicted to be of **minor adverse** significance.

7.5.2 Effects on water quality physical parameters during capital dredging

The relatively limited nature of the plume extents predicted for the proposed capital dredging indicates that long term effects on dissolved oxygen concentrations are unlikely to be experienced within the Tees estuary. Additionally, a significant component of the dredged material is likely to be geological sediment, which is unlikely to contain significant amounts of organic matter. Any effect is therefore likely to be temporary i.e. only for the duration of the dredge (approximately four months) and reversible. As a result, the magnitude of effect is deemed to be low. Given the sensitivity of the Tees estuary is medium, the overall impact is of **minor adverse** significance.

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

7.5.3 Remobilisation of contamination during capital dredging

The concentrations of PAHs and metals within the sediments in the Tees estuary could potentially affect water quality, given the significantly elevated concentrations greater than Action Level 1 and the CSQGs. An assessment to look at the potential for sediments exceeding Action Level 1 to cause EQS failures has therefore been undertaken. It should be noted that data for TBT did not indicate elevated concentrations and all samples were below Cefas Action Level 1 with the majority being below the limit of detection. As a result, no further consideration is given to this parameter.

This assessment uses a previously accepted methodology agreed with the Environment Agency which was undertaken to inform whether maintenance dredging within a dock in Dover Harbour could give rise to EQS failures (see MLA/2019/00055). This exercise requires the undertaking of simple calculations using estimates of sediment losses from dredging equipment and concentrations of contaminants within the sediments to be dredged to provide an indication of the amount of contamination that could be released into the water environment. The volume of water into which the contamination is released can then be used to calculate the potential dilution and indicate potential water concentrations. These are then be compared to EQSs.

The volume of water within the Tees transitional water body was taken from Townend (2005) which calculates that the volume at mean low water is 1.31×10^7 m^3 and at mean high water is 3.23×10^7 m^3 (see **Section 6** for further detail). Additionally, it is assumed that the maximum predicted loss occurs (as presented in CIRIA guidance) and that all contamination is released into the water column. Note that this is a highly precautionary approach given the preference of PAH compounds to remain adsorbed to sediments and no account is made of any settlement of sediment that may occur immediately following release (see **Section 6**).

The results are presented in **Table 7.9** for mean low water (i.e. worst-case estuary volume). It can be seen from these calculations that a risk is presented by the concentrations of zinc in the sediment and benzo(b)fluoranthene. Benzo(g-h-i) perylene, using the Environment Agency data set, indicates that there is the potential for an EQS exceedance in the existing baseline situation (i.e. prior to any disturbance of sediment as a result of the proposed scheme) although the maximum allowable concentration was not formally applied to the data to assess compliance during this period. The latest data available on the Catchment Data Explorer does, however, record ‘fail’ for this parameter.

Calculations were also undertaken for the high tide volume for zinc and benzo(b)fluoranthene to see what implications this would have on EQS exceedances predicted in **Table 7.9**. The results are presented in **Table 7.10.**

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Table 7.9 Summary of calculations undertaken for potential water column effects within the Tees estuary at low water (based on removal of 15,000m³ of dredged sediment per day and maximum concentrations both in the water and in the sediment)

Parameter	Max [4]concentration in sediments (µg/kg)	Mean concentration in sediments (µg/kg)	Max loss to water body (µg)[5]	Mean loss to water body (µg)[5]	Mean concentration in water (µg/l)	Max concentration in water (µg/l)	MAC[6] EQS (µg/l)	Exceedance without baseline	Baseline concentration (max value at Smiths Dock) (µg/l)[7]	Sum of baseline plus max concentration (µg/l)	Exceedance with baseline
Arsenic	33300	24890	7.493E+09	5600250000	0.4275	0.57194656	25	No	1	1.57194656	No
Cadmium	590	250	132750000	56250000	0.004293893	0.01013359	0.2	No	0.03	0.04013359	No
Chromium	52200	33010	1.175E+10	7427250000	0.566965649	0.89656489	32	No	0.3	1.19656489	No
Copper	74300	36850	1.672E+10	8291250000	0.632919847	1.27614504	3.76	No	1.49	2.76614504	No
Lead	135000	80700	3.038E+10	1.8158E+10	1.386068702	2.31870229	14	No	1.83	4.14870229	No
Mercury	600	330	135000000	74250000	0.005667939	0.01030534	0.07	No	0.01	0.02030534	No
Nickel	35600	24710	8.01E+09	5559750000	0.424408397	0.61145038	34	No	3.35	3.96145038	No
Zinc	254000	144700	5.715E+10	3.2558E+10	2.485305344	4.36259542	7.9	No	5.06	9.42259542	Yes
Benzo(g-h-i)perylene	810	470	182250000	105750000	0.008072519	0.013912214	0.00082	Yes	0.00295	0.016862214	Yes
Benzo(b)fluoranthene	960	490	216000000	110250000	0.008416031	0.01648855	0.017	No	0.00361	0.02009855	Yes
Benzo(k)fluoranthene	520	220	117000000	49500000	0.003778626	0.008931298	0.017	No	0.00195	0.010881298	No
Fluoranthene	2200	960	495000000	216000000	0.01648855	0.03778626	0.12	No	0.05	0.08778626	No
Benzo(a)pyrene	1100	490	247500000	110250000	0.008416031	0.01889313	0.027	No	0.00319	0.02208313	No

[4] *Sediment data taken from NGCT 2019 (see **Table 7.5**)*
[5] *Calculated loss of sediment derived using indicative values for the mass of sediment resuspended per m³ of dredged material in CIRIA guidance (John et al., 1999) in kg/m³. Worst case S-Factor for TSHD with limited overflow is 15kg/m³*
[6] *MAC EQS Maximum Allowable Concentration. Used given the fact that dredging is not continuous as opposed to annual average EQS which averages samples collected over a year.*
[7] *Uses highest concentration recorded within the WFD water body sampling data provided by the Environment Agency.*

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Table 7.10 Summary of calculations undertaken for potential water column effects within the Tees Estuary at high water (based on removal of 15000m^3 of sediment per day and maximum concentrations in the water and in the sediment)

Metals	Max concentration in sediments (µg/kg)	Mean concentration in sediments (µg/kg)	Max loss to water body (µg)	Mean loss to water body (µg)	Mean concentration in water (µg/l)	Max concentration in water (µg/l)	MAC EQS (µg/l)	Exceedance without baseline	Baseline concentration (max value at Smiths Dock) (µg/l)	Sum of baseline plus max concentration (µg/l)	Exceedance with baseline
Zinc	254000	144700	5.715E+10	3.256E+10	1.0079721	1.7693498	7.9	No	5.06	6.82934985	No
Benzo(b)fluoranthene	960	490	216000000	110250000	0.0034133	0.0066873	0.017	No	0.00361	0.01029731	No

Tables 7.9 and **7.10** show that there is the potential for EQS exceedances for both maximum concentrations of zinc and benzo(b)fluoranthene (both sediment and water quality values) at low water volumes within the estuary. If the calculations at mean low water are re-run using average concentrations (sediment and water quality) the anticipated concentrations fall below the respective EQS. This is also the case if the maximum concentrations are run with the mean high-water volume. This indicates that whilst there is a risk to the EQS, this only occurs under a certain set of circumstances that are very unlikely to occur simultaneously because:

- The calculations assume that all sediment remains in suspension. In reality, it is likely that some settlement will occur.
- A relatively large proportion of the total volume of dredged material is anticipated to comprise geological material (i.e. mudstone). It is generally accepted that geological material does not contain contaminants. This is confirmed by MMO advice which does not request analysis of geological material within its sampling plan document (reference SAM/2020/00026).
- The calculations assume that all contamination is released into the water column. In reality, it is likely that some contamination will remain bound to sediment particles.
- The maximum concentration within the sediments used for each parameter does not occur across the dredge area.
- The maximum values for water quality concentrations are not reflective of sediment conditions across the site.
- The daily dredge volume is likely to be less than that accounted for due to stoppages associated with transiting vessels and disposal activities.
- The calculation is based on loss from a TSHD whereas a considerable component of the dredge will be undertaken with a backhoe dredger which has a lower production rate and therefore releases less sediment into the water column.

Additionally, information from sediment plume modelling (see **Section 7.5.1**) indicates that only the Smiths Dock water quality monitoring point (point 3) could experience elevated levels of suspended solid concentrations which could be in the region of 85mg/l above baseline. This would only occur for several weeks during Stage 2 of the proposed dredging programme.

Overall therefore, the magnitude of effect is deemed to be low. Given the sensitivity of the Tees estuary is considered to be medium, the overall impact is of **minor adverse** significance.

Mitigation measures and residual impact

No mitigation measures are required. The residual impact is predicted to be of **minor adverse** significance.

7.5.4 Release of sediment during riverbank excavation to create the berth pocket

The proposed scheme requires the excavation of soils/landside materials from the riverbank in front of the proposed new quay wall to create the berth pocket. There is therefore the potential for some of the soils to spill into the river during the excavation process as some of the material is likely to be excavated below the water line. To reduce the potential effects as far as possible, control measures would be put in place to reduce spill as far as possible and it is proposed to remove the material using a backhoe. This enables control over the excavation process and care will be taken to remove as much as possible at low water and therefore out of the water. Additionally, excavation will only be required for a short period and therefore any potential effect on water would be limited to the timeframe over which excavation in the water would occur.

Overall therefore, the magnitude of effect is deemed to be very low. Given the sensitivity of the Tees estuary is considered to be medium, the overall impact is of **negligible** significance.

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

7.5.5 Remobilisation of contaminants due to construction and riverbank excavation

Construction works would include the excavation and removal of a significant amount of Made Ground and superficial deposits. Land-based construction therefore has the potential to increase the infiltration of rainwater and surface run-off to the underlying strata. This could potentially mobilise any residual contamination that may already be present within the overlying strata, which may ultimately migrate to the estuary.

Prior to the commencement of construction activities, a programme of site characterisation works will be undertaken which would comprise a programme of intrusive ground investigation works across the site to facilitate the recovery of soil and groundwater samples for laboratory analysis. The findings of the intrusive investigation will allow appropriate assessments to be undertaken to ascertain if contaminants are present at concentrations that could result in harm to controlled waters.

It is also possible that potentially contaminated groundwater could be diverted around the physical barriers introduced through the installation of sheet piles and other infrastructure required for the proposed scheme. This could create the potential for contaminated groundwater to impact areas outside of the proposed scheme footprint. However, following the execution of a pre-construction ground investigation, it will be possible to determine whether contaminated groundwater and mobile contaminants are present within the study area. If contaminated groundwater and mobile contaminants are identified, remediation would be required to mitigate the risk the contamination poses to controlled waters.

Overall therefore, the magnitude of effect would be significantly reduced by the proposed mitigation measures outlined above to low. Given the sensitivity of the Tees estuary is considered to be medium, the overall impact is of **minor adverse** significance.

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

7.5.6 Effects on water quality associated with other construction works (demolition of derelict structures and rock blanket)

As these works progress, there is the potential for sediment to be suspended when working in and around the riverbed. However, any increases in suspended solids concentrations are likely to be highly localised and reduce to baseline conditions quickly following cessation of works. Overall therefore the magnitude of effect would be very low. Given the sensitivity of the Tees estuary is considered to be medium, the overall impact is of **negligible** significance.

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

7.6 Potential impacts during the operational phase

7.6.1 Dispersion and redistribution of sediment during maintenance dredging

As detailed in **Section 6**, the predicted reductions in current speeds in the reach of the channel local to the proposed new quay, combined with the creation of a new berth pocket at the quay, may lead to a small increase in deposition rates and hence a requirement for more material to be dredged from this local reach annually (see **Section 6** for more information). A 10% increase in annual maintenance dredging requirement in the area local to the new quay has been estimated.

However, the majority of material removed during the weekly maintenance dredging campaigns undertaken by PDT is from the reaches close to the Tees Barrage and at the mouth of the estuary; therefore even a 10% increase in the reach local to the proposed new quay equates to a very small increase in the overall net annual maintenance dredging requirement from the estuary as a whole. Therefore the potential increase in maintenance dredging requirement is not expected to be significant and would be managed within existing maintenance dredging and offshore disposal regimes.

Consequently, the magnitude of water quality effects above those already experienced during maintenance dredging operations is predicted to be very low. Given the sensitivity of the Tees estuary is considered to be medium, the overall impact is of **negligible** significance.

Mitigation measures and residual impact

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

7.6.2 Surface water discharge to the Tees associated with run off

As outlined in **Section 3**, it is anticipated that the majority of the quay would be surfaced with crushed stone. Uncontaminated surface water would therefore drain through the crushed stone into the underlying material without the need for a formal drainage system.

In areas where there is a risk that the water could become contaminated, such as in the heavy lift areas of the proposed quay, surfaces would be concreted capturing surface water runoff via a series of gullies. The collected surface water would then be passed through an interceptor to remove contaminants and discharged via the quay wall into the Tees estuary.

Welfare facilities are not proposed on the quay itself in order to maximise the available space to support with operations; there would therefore be no foul sewage generated as a result of the proposed scheme.

As a result, the magnitude of effect is deemed to be very low. Given the sensitivity of the Tees estuary is considered to be medium, the overall impact is of **negligible** significance.

Mitigation measures and residual impact

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

8 LAND QUALITY AND GEOLOGY

8.1 Introduction

This section of the EIA Report considers the likely effects of the proposed scheme with respect to land quality and geology and how this could affect human health, the natural and the built environment. It describes the methods used to assess potential effects, the baseline conditions currently existing at the proposed scheme footprint and surrounding area, the mitigation measures required to prevent, reduce or off-set any significant adverse effects, and the likely residual effects after these measures have been adopted.

The findings of this assessment have the potential to influence other technical sections within this EIA Report, namely **Section 11**, **20** and **25**.

8.2 Policy and consultation

There are a number of overarching international, national and regional items of legislation, policy and guidance applicable to the proposed scheme, as detailed in **Section 4**. The following sections build on the information provided in **Section 4** by focusing on key legislation, policy and guidance with specific reference to land quality and geology.

8.2.1 National policy and guidance

National Planning Policy Framework

The NPPF (Ministry of Housing, Communities and Local Government, 2019) provides guidance to planning authorities on how to assess planning applications. **Table 8.1** provides a summary of the requirements of the NPPF with regard to land quality and geology and signposts to the applicable section of this EIA Report where the requirement has been addressed.

Table 8.1 NPPF guidance relevant to land quality and geology

NPPF reference	NPPF requirement	EIA reference
NPPF15-170	The planning system should contribute to and enhance the natural and local environment by: • protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan); • preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; • remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.	The existing environment within the proposed scheme footprint is discussed in **Section 8.4**. Potential impacts and subsequent mitigation measures are discussed in **Sections 8.5** and **8.6**.
NNPF15 - 178	Planning policies and decisions ensure that: • a site is suitable for its proposed use taking account of ground conditions and any risk arising from land instability and contamination. This includes risks arising from natural hazards or former activities	The existing environment for ground conditions and contamination is discussed in **Section 8.4.** Potential linkages and impacts arising from ground conditions and contamination

NPPF reference	NPPF requirement	EIA reference
	such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation); • after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and • adequate site investigation information, prepared by a competent person, is available to inform these assessments"	are discussed within the land quality preliminary risk assessment (PRA) included as **Appendix 7**.
NPPF15 -179 and NPPF15-180	Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and / or landowner. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: • mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; • identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and • limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.	The existing environment in relation to any sources of contaminated land is discussed in **Section 8.4**. The potential impacts relating to contaminated land during the construction and operational phases of the proposed scheme are discussed in **Sections 8.5** and **8.6** respectively.
NPPF15-183	The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.	The existing environment and baseline in relation to the proposed scheme is addressed in Section 8.4. An assessment of any potential effects from the proposed scheme during construction and operational phases is given in Sections 8.5 and 8.6.

Environmental Protection Act 1990 (Part 2A): Contaminated Land Statutory Guidance

The Environmental Protection Act 1990 makes provision for the improved control of pollution arising from certain industrial and other processes. Part 2A of the Act provides the statutory definition of contaminated land: "*Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land that:*

- *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- *Significant pollution of controlled waters is being or is likely to be caused*."

The guidance also provided the regulatory basis for the identification, designation and remediation of contaminated land. The proposed scheme could have an effect on land potentially affected by contamination. This requires assessment to ensure that the land is suitable for use following the proposed scheme, and that the land cannot be determined as contaminated land under Part 2A of the Act.

Contaminated Land (England) Regulations (2006) and 2012 amendment

The Contaminated Land (England) Regulations 2006 provides an update to the Part 2A regime to cover land contaminated by radioactive material. The 2012 addendum includes changing to the wording of paragraphs in the 2006 regulations in relation to controlled waters and remediation notices.

Environmental Permitting (England and Wales) Regulations 2016

The Environmental Permitting (England and Wales) Regulations 2016 (Her Majesty's Stationery Office (HMSO), 2016) consolidate and replace the Environmental Permitting (England and Wales) Regulations 2010 (S.I. 2010/275), which have been amended several times. The 2016 Regulations were amended in 2018 (S.I.2018 No.110) (HMSO, 2018).

The 2016 Regulations (as amended) set out an environmental permitting and compliance regime that applies to various activities and industries, including the management of waste. The environmental permitting regime is a common framework for applying for, receiving, varying or transferring and surrendering permits, along with compliance, enforcement and appeals arrangements. It rationalises the previous permitting and compliance regimes into a common framework that is easier to understand and simpler to use.

A key component is that it allows applicants that would otherwise require several permits for activities falling under various regulations on a single site to complete a single application, and to be issued with one permit. The framework introduces different levels of control, based on risk: exclusions (lower risk activities which may be undertaken without any permit), exceptions (lower risk activities which may be undertaken after registering, which is free), standard rules permits (standard requirements and conditions for the relevant activities are set out so that applicants can determine in advance whether the permit is applicable to their proposals) and bespoke permits (permits written specifically for activities which are unique or of higher risk).

If the regulator considers that an operator has contravened, is contravening or is likely to contravene an environmental permit condition, the regulator may serve a notice on the operator to remedy any environmental effects, including pollution.

Land Contamination Risk Management 2020 Framework

The Environment Agency Land Contamination Risk Management (2020) Framework provides an update to the former Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11). The principles of the guidance are to help those assessing potentially contaminated sites identify and assess the risks posed to sensitive receptors, make appropriate decisions in relation to the outcome of the assessment and take the required actions necessary e.g. implement remediation, if deemed necessary following the assessment.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

The aim of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 is for all waterbodies to achieve Good Status by 2027 (which is comprised of scoring for both Ecological and Chemical Status) and to ensure that there is no deterioration from current status. This legislation is relevant to land quality as it will assist in determining the sensitivity of waterbodies within the proposed scheme. The WFD compliance assessment is presented in **Section 28.**

Groundwater (Water Framework Directive) (England) Direction 2016

The aim of the Groundwater (Water Framework Directive) (England) Direction (2016) is to set out instructions and obligations for the Environment Agency to protect groundwater, including monitoring and setting threshold values for both existing and new pollutants in groundwater. This legislation is relevant to land quality as it will assist in determining the sensitivity of groundwater resources within the proposed scheme.

Water Resources Act

The Water Resources Act (1991) as amended by the Water Act (2003) provides the definition of and regulatory controls for the protection of water resources, including the quality standards expected for controlled waters. This legislation is relevant to land quality as it will assist in determining the sensitivity of controlled waters within the proposed scheme, particularly when assessing the effect of the proposed scheme from construction and operational activities.

Environment Act

The Environment Act (1995) established the Environment Agency and gave it responsibility for environmental protection of controlled waters. This legislation is relevant to land quality as it will help aid identification of the sensitivity and potential effects of the proposed scheme during construction and operational activities. It will also aid in the identification of suitable mitigation measures to provide protection to controlled waters.

Environmental Damage Regulation

The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 transposes into domestic law the EU Directive 2004/35/EC on environmental liability with regards to the prevention and remedying of environmental damage. This legislation is relevant to land quality as it will aid in the identification of suitable preventative measures and mitigation techniques for the construction and operational phases of the proposed scheme.

Construction (Design and Management) Regulations

The Construction (Design and Management (CDM)) Regulations 2015 are the main set of regulations used to manage the health, safety and welfare of construction projects. This legislation is relevant to both land quality and the construction activities of the proposed scheme as a whole as it ensures the safety of human receptors involved in the construction phase.

Guiding Principles for Contaminated Land

The Guiding Principles for Contaminated Land comprise three documents produced by the Environment Agency. The documents include GPCL 1 – Guiding principles for land contamination introduction, GPCL 2 – FAQs, technical information, detailed advice and references, and GPCL 3 – reporting checklist. The aims of these documents are to provide guidance to those who are involved with contaminated land, encourage good practice, promote compliance with regulatory requirements and to provide reference to applicable guidance.

8.2.2 Local policy guidance

The RCBC Local Plan and the subsequent South Tees Area Supplementary Planning Document (both adopted in May 2018) outline the statutory guidelines for developments within the borough. Policy LS4 of the South Tees Spatial Strategy includes guidance relevant to the environment. This policy includes a requirement to undertake the following, which are directly or indirectly linked to this section of the EIA Report:

- enhance the environmental quality of employment through well planned boundary treatments;
- secure decontamination and redevelopment of potentially contaminated land;

- protect European sites, and safeguard and improve sites of biodiversity interest particularly along the River Tees and the estuary and encourage integrated habitat creation and management;
- enhance the environmental quality of the River Tees and coastline; and,
- encourage improvements to access, interpretation and wildlife conservation and biodiversity across the area;

8.2.3 Consultation

Consultation is a key part of the EIA process. Consultation regarding land quality and geology has been conducted through the scoping process (**Appendix 2** and **Appendix 3**). There were no comments received during the scoping process that have impacted on the proposed approach set out in the scoping note. The assessment has therefore been undertaken in accordance with that set out in **Appendix 2**.

8.2.4 Assessment guidance

The land quality assessment has been carried out in accordance with the principles contained within the following key guidance documents:

- Environment Agency Land Contamination: Risk Management (formerly – Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11) (Environment Agency, 2020);
- Contaminated Land Risk Assessment, A Guide to Good Practice (CIRIA C552 2001);
- British Standard BS10175:2011 +A2:2017 Investigation of Potentially Contaminated Sites;
- Department for Environment, Food and Rural Affairs (Defra), Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance;
- Environment Agency, Guiding Principles Land Contamination (GPLC2); Environment Agency, Land contamination groundwater compliance points: quantitative risk assessments, 2017; and,
- Environment Agency, The Environment Agency's approach to groundwater protection, 2018.

8.3 Methodology

8.3.1 Study area

The land quality and geology study area is defined by the distance over which impacts from the proposed scheme may occur and by the location of any receptors that may be affected by those potential impacts. The land quality and geology study area incorporates the landside elements of the proposed scheme plus an additional buffer up to 250m for direct impacts and 1km for indirect impacts. This has been established by professional judgement supported by a land quality desk study and PRA (**Appendix 7**).

Contamination sources are considered within the 1km buffer of the proposed scheme within the land quality PRA (**Appendix 7**). The direct impacts associated with contamination sources greater than 1km are not considered as part of the PRA as it is anticipated that with increasing distance the risk from potential sources of contamination to the proposed scheme diminishes, due to factors such as an absence of viable pathways.

8.3.2 Assessment parameters

This section identifies the project parameters utilised for the land quality assessment of the proposed scheme. **Section 3** provides more detail regarding specific activities and their durations. **Table 8.2** identifies those assessment parameters within **Section 3** that are relevant to the potential impacts on land quality and geology during the construction and operational phases of the proposed scheme.

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Table 8.2 Assessment parameters for land quality and geology assessment

Impact	Assessment parameters	Notes
Direct impact on surface waters and associated ecological receptors	Volume of soils to be excavated is approximately 1,415,000m^3 (approximately 1,140,000m^3 of excavation to create the berth pocket and 275,000m^3 of excavation to install the tie rods between the combi-wall and the anchor structure). .	There is the potential for earthworks to disturb pre-existing contamination and mobilise contaminants resulting in the migration of contaminants to surface waters. This may impact both surface water quality and / or usability and associated ecological receptors. Details of surface water features and abstraction licenses are included within **Section 8.3.4** and sensitive land use in **Section 8.3.5**. Details of the potential impacts on surface waters are discussed in **Section 8.5** and **8.6**.
Direct impact on groundwater	Volume of excavated soils circa 1,415,000m^3. The proposed scheme is predicted to require up to 3,000 piles on land to construct the quay.	There is the potential for earthworks and piling activities to disturb pre-existing contamination which may be present within the proposed scheme footprint. The works may result in the migration of contaminants to the underlying aquifers and create new pathways which may impact both groundwater quality and / or usability. Details of aquifers, Source Protection Zones (SPZs) and groundwater abstraction licences are included within **Section 8.3.3**. The details of the potential impacts on groundwater are discussed in **Section 8.5** and **8.6**.
Direct impact on geology	Volume of excavated soils circa 1,415,000m^3. The proposed scheme is predicted to require up to 3,000 piles on land to construct the quay..	Earthworks and piling activities have the potential to impact the geology within the proposed scheme footprint through physical intrusion into the geology. Details of the geology within the proposed scheme footprint is presented in **Section 8.4.2**. Due to the absence of designated geological sites within the proposed scheme footprint, the geological sensitivity is considered to be negligible. As there are no designated geological sites recorded within the proposed scheme footprint, or within 250m of it, impacts to geology during construction and operational phases of the proposed scheme have not been considered further.
Direct impact on human health	Volume of excavated soils circa 1,415,000m^3.	Earthwork required during the construction phase have potential to disturb pre-existing contamination within the proposed scheme footprint. Construction activities have the potential to create pollutant linkages through ingestion, inhalation and direct dermal contact pathways.

Impact	Assessment parameters	Notes
		Details of the potential impacts on human health are discussed in **Section 8.5** and **8.6**.

8.3.3 Assessment of potential environmental impacts

The criteria for determining the significance of environmental impacts is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of effect. This section describes the criteria applied to assign values to the sensitivity of receptors and the magnitude of potential effects. The terms used to define the sensitivity, magnitude and overall significance are based on those outlined in **Section 5**.

Receptor sensitivity

Receptor sensitivity has been defined with reference to the adaptability, tolerance, recoverability and value of individual receptors. **Table 8.3** provides an example of the likely criteria for appraisal of sensitivity for identified land quality receptors based on professional judgement.

Table 8.3 Definitions of sensitivity levels for land quality receptors

Importance	Definition
High	Has very limited or no capacity to accommodate physical or chemical changes
Medium	Has limited capacity to accommodate physical or chemical changes
Low	Has moderate capacity to accommodate physical or chemical changes
Negligible	Is generally tolerant of physical or chemical changes

Receptor value considers, for example, whether the receptor:

- is rare;
- has protected or threatened status;
- has importance at a local, regional or national scale; or
- has a key role in ecosystem function (in the case of biological receptors).

Generic receptor sensitivity examples based on the above criteria are presented below in **Table 8.4**.

Table 8.4 Receptor sensitivity criteria

Sensitivity	Examples
Very high	**General** Receptor is internationally or nationally important / rare with limited potential for offsetting / compensation.
	Land quality – Human health • construction workers involved in below ground construction works; • public and local residents / school aged children (off-site within50 m); and • future end users (residential or allotment end use).
	Land quality – Controlled waters and ecology • groundwater SPZ 1; • public water supplies / licensed surface water and groundwater abstractions for potable use; • supports habitats or species that are highly sensitive to changes in surface hydrology or water quality; and • surface and groundwaters supporting internationally designated sites.
	Land quality – Built environment • sites of international importance, World Heritage Sites and Scheduled Monuments.
High	**General** Receptor is regionally important / rare with limited potential for offsetting / compensation.

Sensitivity	Examples
	Land quality – Human health • future end users (commercial / industrial end use/ open space); • public and local residents / school aged children (off-site at distances >50m but <250m); • commercial workers (off-site within 50m); and • construction workers (above ground).
	Land quality – Controlled waters • groundwater SPZ 2 and SPZ 3; • private water supplies; • Principal Aquifers; and • surface and groundwaters supporting nationally designated sites SSSI, SPA, Ramsar sites).
	Built environment • commercial or residential buildings.
Medium	**General** Receptor is locally important / rare.
	Land quality – Human health • future end users (transport end use such as car parks or highways); • public and local residents / school aged children (off-site >250m); and • commercial workers (off-site at distances >50m but <250m).
	Land quality – Controlled waters • Secondary A and B Aquifers; and • groundwater or surface waters supporting regionally important sites (e.g. Local Nature Reserve (LNR), Statuary Nature Conservation Organisation (SNCO)).
	Built environment • car parks, highways, transport infrastructure and utilities.
Low	**General** Receptor is not considered to be particularly important / rare.
	Land quality – Human health Commercial workers (off-site >250 m).
	Land quality – Controlled waters • unproductive strata; and • supports or contributes to habitats that are not sensitive to changes in surface hydrology or water quality.

Magnitude of change/ effect

Potential effects may be adverse, beneficial or neutral. The magnitude of an effect is assessed qualitatively, according to the criteria set out in **Table 8.5**. The following definitions apply to time periods used in the magnitude assessment:

- long-term: > 5 years;
- medium-term: 1 to 5 years; and
- short-term: < 1 year.

For effects related to human health, magnitude reflects the likely increase or decrease in exposure risk for a receptor. For controlled waters, magnitude represents the likely effect that an activity would have on resource availability or value, at the receptor. Magnitude is therefore affected by the distance and connectivity between an impact source and the receptor.

Table 8.5 Definition of magnitude levels for land quality

Magnitude	Definition
High – permanent or large-scale change affecting usability, risk or value over a wide area, or certain to affect regulatory compliance	**Land quality – Human health** • permanent or major change to existing risk of exposure (adverse / beneficial); • unacceptable risks/ severe harm to one of more receptors over the long-term or permanently (adverse); or • remediation and complete source removal (beneficial).
	Land quality – Controlled waters and ecology • permanent, long-term or wide scale effects on water quality or availability (adverse / beneficial); • permanent loss or long-term derogation of a water supply source resulting in prosecution (adverse); • change in WFD water body status / potential or its ability to achieve WFD status objectives in the future (adverse / beneficial); • permanent habitat creation or complete loss (adverse / beneficial); or • measurable habitat change that is sustainable / recoverable over the long-term (adverse / beneficial).
	Land quality – Built environment • catastrophic damage to buildings or structures.
Moderate – permanent or long-term reversible change affecting usability, value, or risk, over the medium-term or local area: possibly affecting regulatory compliance	**Land quality – Human health** • medium-term or moderate change to existing risk of exposure (adverse / beneficial); • unacceptable risks to one or more receptors over the medium-term (adverse); or • serious concerns or opposition from Statutory Consultees (adverse).
	Land quality – Controlled waters and ecology • medium-term or local scale effects on water quality or availability (adverse / beneficial); • medium-term derogation of a water supply source, possibly resulting in prosecution (adverse); • observable habitat change that is sustainable / recoverable over the medium-term (adverse / beneficial); or • temporary change in status / potential of a WFD waterbody or its ability to meet objectives (adverse / beneficial).
	Land quality – Built environment • damage to buildings or structures.
Low – temporary change affecting usability, risk or value over the short-term or within the site; measurable permanent change with minimal effect, usability, risk or value; no effect on regulatory compliance	**Land quality – Human health** • short-term temporary or minor change to existing risk exposure (adverse / beneficial); or • unacceptable risks to one or more receptors over the short-term (adverse).
	Land quality – Controlled waters and ecology • short-term or very localised effects on water quality or availability (adverse / beneficial); • short-term derogation of a water supply source (adverse); • measurable permanent effects on a water supply source that do not impact on its operations (adverse); • observable habitat change that is sustainable / recoverable over the short-term (adverse / beneficial); or • no change in status / potential of a WFD waterbody or its ability to meet objectives (neutral).
	Land quality – Built environment • easily repairable damage to buildings or structures.
Very Low – minor permanent or temporary change, indiscernible over the medium to long-term.	**Land quality – Human health** • negligible change to existing risk of exposure; or • activity is unlikely to result in unacceptable risks to receptors (neutral).
	Land Quality – Controlled waters and ecology

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Magnitude	*Definition*
Short-term with no effect on usability, risk or value	• very minor or intermittent impact on local water quality or availability (adverse / beneficial); • usability of a water supply source will be unaffected (neutral); • very slight local changes that have no observable impact on dependent receptors (neutral); or • no change in status / potential of a WFD waterbody or its ability to meet objectives (neutral).
	Land Quality – Built environment • Very slight non-structural damage or cosmetic harm to buildings or structures.

Impact significance

The impact significance assessment combines receptor sensitivity with magnitude of effect as shown in **Table 8.6**. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool.

Table 8.6 Impact significance matrix

		Magnitude							
		High	Medium	Low	Very Low	Very Low	Low	Medium	High
Sensitivity	Very high	Major adverse	Major adverse	Moderate adverse	Minor adverse	Minor beneficial	Moderate beneficial	Major beneficial	Major beneficial
	High	Major adverse	Moderate adverse	Minor adverse	Minor adverse	Minor beneficial	Minor beneficial	Moderate beneficial	Major beneficial
	Medium	Moderate adverse	Minor adverse	Minor adverse	Negligible	Negligible	Minor beneficial	Minor beneficial	Moderate beneficial
	Low	Minor adverse	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor beneficial

Major or moderate environmental impacts are considered to be 'significant' in EIA terms. Whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant (negligible) impacts as they may contribute to significant impacts cumulatively or through interactions.

The definitions of significant impacts are presented in **Table 8.7**.

Table 8.7 Impact significance definitions

Impact significance (level)	Definition
Major	Very large or large change in receptor condition (adverse or beneficial), which are likely to be key factors in the decision-making process because they contribute to achieving international, national or regional objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition (adverse or beneficial), which are likely to be important considerations in the decision-making process because they contribute to achieving local objectives or could result in exceedance of statutory objectives and / or breaches of legislation.
Minor	Small change in receptor condition (adverse or beneficial), which may be important but are unlikely to be important considerations in the decision-making process.
Negligible	Very small changes in receptor condition (adverse or beneficial), which may be raised as local issues but are unlikely to be important in the decision-making process.
No change	No or imperceptible effects, within normal variations or within the margins of forecasting error.

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Assessment of interaction effects

Prior to undertaking the primary assessment, the potential for interactions between land quality and other factors was considered. The assessment identified **Section 11**, **Section 20** and **Section 25** as having potential interactions with land quality.

8.4 Existing environment

The characterisation of the existing environment has been undertaken using the data sources listed in **Table 8.8** plus other relevant literature.

Table 8.8 Data sources used to inform the land quality assessment

Data	Source
Historical maps	Groundsure Insight Report (provided within Wood, 2019)
Site sensitivity data	Groundsure Insight Report (provided within Wood, 2019) Natural England
Geology & ground conditions	British Geological Survey (BGS) onshore Geoindex map: http://mapapps2.bgs.ac.uk/geoindex/home.html Groundsure Insight Report (provided within Wood, 2019)
Hydrogeology & hydrology	Environment Agency: http://apps.environment-agency.gov.uk/wiyby/117020.aspx Groundsure Insight Report (provided within Wood, 2019) Department for Environment, Food and Rural Affairs (DEFRA) MAGIC (Multi Agency Government Information for the Countryside) Map: https://magic.defra.gov.uk/magicmap.aspx
Regulatory information	Groundsure Insight Report (provided within Wood, 2019)
Unexploded bomb (UXO) risk	Zetica UXO: https://zeticauxo.com/
Radon gas risk	Public Health England UK radon affected areas: http://www.ukradon.org/information/ukmaps
Historical landfill sites	Groundsure Insight Report (provided within Wood, 2019)
Permitted waste sites – authorised landfill site boundaries	Groundsure Insight Report (provided within Wood, 2019)

Pre-existing publicly available reports were also used to inform the land quality PRA which helped inform the understanding of the baseline environment, including:

- South Tees Development Corporation, Former Steelworks Land, South Tees Outline Remedial Strategy, Ref. 41825-wood-XX-XX-RP-OC-0001_S0_P01, June 2019 (Wood, 2019);
- Design of a Site Protection and Monitoring Programme for Cleveland Works, Teesside (CORUS UK LTD, 2004),;
- Soil and Groundwater Baseline Characterisation Study Teesside Works, Factual Report June 2004 (Enviros, 2004);
- First Phase Reporting of the Site Protection and Monitoring Programme (CORUS UK LTD, 2008); and,
- Data Review, TS4 South Bank – Phase 1 Geo Environmental Desk Study. August 2017 (CH2M Hill, 2017).

8.4.1 Assumptions and limitations

The land quality PRA (**Appendix 7**) was informed by a range of publicly available information, including the findings of previous ground investigations undertaken within the proposed scheme footprint. However, due to the limited number of sample positions within the proposed scheme footprint in addition to the age of the survey data (2004 and 2008), the assessment has relied heavily on publicly available information and so has adopted a precautionary approach i.e. if a potential pollutant linkage has been identified, it is assumed to be present until further site specific information is available to clarify whether the linkage exists. It is proposed that the ground investigation works recommended within the land quality PRA will be undertaken post submission of this EIA; this therefore reaffirms the precautionary approach undertaken within the assessment on land quality and geology.

8.4.2 Geology

Information on the reported geological conditions within the proposed scheme footprint has been collated from BGS datasets, including 1:50,000 scale geological mapping and historical borehole records, and a Groundsure Insight Report. The anticipated geological sequence within the proposed scheme footprint is outlined in **Table 8.9** below.

Table 8.9 Reported geology within the proposed scheme footprint

Stratum	*Unit*	Depth to base of stratum (m bgl*)	Approximate thickness (m)	Description
Made Ground		Up to 10.00	5.00 – 10.00	Granular deposits comprising silty / sandy ash, clinker with cobbles and boulder sized fragments of grey blast furnace slag. The site and wider area are known to comprise reclaimed mudflat and marshland and therefore Made Ground is likely to have been used to raise site levels and widespread across the site.
Superficial Deposits	Tidal Flat Deposits	10.20	4.00	Post glacial estuarine and marine Alluvium identified as sand, silt and clay. Superficial Deposits formed up to 2 million years ago in the Quaternary Period.
	Glaciolacustrine Deposits	Not recorded		Clay and silt formed 2 million years ago in the Quaternary Period.
	Glacial Till	Not recorded		Glacial Till deposits formed 2 million years ago in the Quaternary Period.
Bedrock	Mercia Mudstone Group	Not recorded		Red mudstone and subordinate siltstone formed approximately 201 to 252 million years ago in the Triassic Period.

*bgl – below ground level

As reported earlier, due to the absence of designated geological sites within the proposed scheme footprint, the geological sensitivity is considered to be negligible. As there are no designated geological sites recorded within the proposed scheme footprint, or within 250m of it, impacts to geology during construction and operational phases of the proposed scheme are not considered further.

8.4.3 Hydrogeology

The land quality PRA (**Appendix 7**) indicates that the Tidal Flat Deposits are classified as a Secondary Undifferentiated Aquifer. This designation is assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifers in different locations due to the variable characteristics of the rock type.

The underlying Mercia Mudstone Group has been designated as a Secondary B Aquifer, these types of aquifers are predominantly composed of lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

The land quality PRA (**Appendix 7**) indicates that the proposed scheme has been assigned a medium to high groundwater vulnerability risk by the Environment Agency. A high groundwater vulnerability designation indicates that the soil is easily able to transmit pollution to groundwater, which is characterised by high leaching potential of soils and the absence of low permeability superficial deposits. A medium groundwater vulnerability designation indicates that there are areas present which offer some groundwater protection.

There are no recorded groundwater abstractions both within the footprint of the proposed scheme or within 1km of its boundary. The proposed scheme footprint is not located within a groundwater SPZ or within 500m of one.

Given that the landward parts of the proposed scheme footprint are immediately adjacent to the tidal River Tees, it is considered likely that the aquifers present beneath the proposed scheme footprint have been impacted by saline intrusion. Given this assumption, it is further assumed that the groundwater present would not be considered suitable for potable groundwater abstraction.

Due to the aquifer designations of both the superficial deposits and underlying Mercia Mudstone Group, the lack of potable groundwater abstractions, likely saline intrusion and the absence of a SPZ, groundwater within the footprint of the proposed scheme is considered to have a low sensitivity.

8.4.4 Hydrology and surface drainage

Information provided within the land quality PRA (**Appendix 7**) indicates that there is one record of a surface inland river (Mill Stream) within the footprint of the proposed scheme. The tidal River Tees runs immediately adjacent to the landward parts of the proposed scheme footprint Mill Stream is culverted beneath the proposed scheme footprint, running under an access track before it outfalls into the Tees at the downstream end of South Bank Wharf. The land quality PRA notes that given the history of the site, it is possible that additional culverted watercourses may be present beneath the site.

The River Tees is a WFD water body, known as Tees (waterbody ID: GB510302509900). The overall rating of the waterbody is moderate with an ecological rating of moderate and a chemical rating of fail (Environment Agency, 2016). Further information regarding this water body from a WFD perspective is detailed in **Section 28**.

There are no recorded surface water abstractions located within the proposed scheme footprint. Two historical surface water abstraction licenses were held by Tees Bulk Handling Limited, located approximately 750m north east of the proposed scheme footprint, for the purpose of general use and dust suppression.

The land quality PRA indicates that the land inshore of the River Tees is classified as Flood Zone 1 with a 1 in 1,000 (<0.1%) annual probability of flooding from rivers. Further information with regard to flood risk at the site is contained within **Section 20**.

The Tees estuary adjacent to the landward parts of the proposed scheme footprint is designated as the Teesmouth and Cleveland Coast SPA, Ramsar site and SSSI.

Based on the above, hydrological receptors are considered to be of high to very high sensitivity.

8.4.5 Sensitive land use

Sensitive land use sites are considered, by statutory agencies, to be of special importance due to their intrinsic qualities which are unique to those areas. There are no designated sites located within the landward parts of the proposed scheme footprint. However, as noted above, the Tees estuary is designated as the Teesmouth and Cleveland Coast SPA, Ramsar site and SSSI.

The sensitivity of the designated sites within 250m of the proposed scheme is considered to be very high.

Further information regarding designated sites can be found in **Section 9, Section 12** and **Section 29**.

8.4.6 Historical setting

The research undertaken to inform the land duality PRA (**Appendix 7**) indicates that the landward parts of the proposed scheme footprint were reclaimed from mudflats using slag fill in the late 1800s when Eston Wharf was constructed (now South Bank Wharf). Travelling cranes and railways were used along the wharf, which served the surrounding industries. Riverside Pumping Station was constructed immediately landward of the wharf in the early 1900s to provide water to the industries to the south of the site. The wharf was redeveloped into South Bank Wharf at this time with further expansion to the north east. The area to the south west of the Riverside Pumping Station was a Benzole Plant from the 1950s to 1987. Between 1959 to 1964 there was a slag crushing works partially within the north of the site. In 1968 the oil depot was developed to the north east of the pumping station, half of which is within the proposed scheme.

During the late 1800s and early 1900s there was significant industrial activity within the landward areas surrounding the proposed scheme footprint including an iron works, sheet and galvanising works, dock yards, iron refinery and basic slag works; these were connected to the proposed scheme footprint via travelling cranes and railways. Industrial activity continued throughout the 20th century including the construction of a tank farm at Teesport to the north, an ore crushing plant (later a ferro manganese crushing plant) to the south and the Teesside Works Cleveland (steel works).

A summary of the historical features that may give rise to potential sources of contamination, is provided below in **Table 8.10**.

Table 8.10 Historical features and activities

Feature	Details
Made Ground across the whole site including demolished buildings, structures, slag and ash associated with the adjacent steel work.	The wharf, originally referred to as Eston Wharf, is first recorded between 1894 to 1899 in the south western part of the proposed scheme footprint. Prior to this the site is reported as sand and mud and the land was reclaimed to form the wharf. The OS map for 1913 to 1915 indicates that the wharf has increased in size and had been renamed South Bank Wharf, no significant changes are reported following this.
Riverside Pumping Station buildings (sterilisation and motors for pumps)	The pumping station is recorded as being within the proposed scheme footprint on the 1913 to 1915 map onwards to the 2010 map (latest map reviewed as part of the PRA). Originally comprising of two buildings, one had been demolished by 1964 to 1968 with the remaining building being extended during this same time period.
Electrical substations and transformers	The first record of an electrical substation within the proposed scheme footprint is on the 1952 to 1953 OS map, an additional substations and a transformer is recorded to the east of the existing substation by 1964 to 1968 until the 2010 map (latest map reviewed as part of the PRA).
Pipelines	Approximately four pipelines recorded on the 1952 to1953 map which run from the pumping station to the wharf. On the maps dated 1964 to 1968 the pipelines are shown to run from the south (South Bank Iron Works) to the north and across the proposed scheme footprint from west to east.

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Feature	Details
Wharf usage and travelling cranes	A travelling crane is reported as running along the wharf on the 1913 to 1915 OS map.
Oil depot tanks and pipelines	An oil depot comprising five circular storage tanks is recorded as being partially on site on the 1964 to 1968 OS map onwards to the 2010 map (latest map reviewed as part of the PRA), three of these tanks were located within the proposed scheme boundary. Information contained within the Land Quality PRA indicates that the oil depot installation comprised a jetty with the facility for discharging fuel oil from ships up to approximately 30,000 tonnes capacity, five 10,000 tonne capacity oil storage tanks located within a single bund, a pumphouse for oil distribution and loading of tankers, and two package boilers to provide steam for tank heating and pipeline tracing. The report also indicates that the oil storage depot was fed by a series of tanks running parallel to the river to the south of the access road within the proposed scheme.
Tanks to the east of the Riverside Pumping Station which have now been demolished	A series of tanks are recorded, along with four rectangular buildings to the east of the Riverside Pumping station on the 1952 to 1953 OS map onwards to 2010 (latest map reviewed as part of the PRA). The PRA states, however, that these tanks have now been demolished.
Benzole plant and associated tanks which have been demolished	Two circular tanks, reported to be a Benzole Plant, are shown 50m to the south of the Riverside Pumping Station on the 1927 OS map. A third smaller tank associated with the plant is recorded on the 1952 to 1953 OS map. The Benzole Plant is no longer recorded on the 1987 OS map.
Slag crushing works (former), Tarmac Teesport Asphalt Plant (asphalt and concrete plant	The slag crushing works, located partially within the proposed scheme footprint and partially off-site, is recorded on the 1959 to 1964 OS map before being referred to as 'works' on the 1981 OS map onwards to the 2010 map (latest reviewed as part of the PRA).
Off-site sources	From the late 1800s and early 1900s there was significant industrial activity in the area surrounding the proposed scheme footprint including Iron Works, Sheet and Galvanising Works, Dock Yards, Iron Refinery and a Basic Slag Works, these were connected to the site via travelling cranes and railways. Industrial activity continued throughout the 20th century including the construction of a tank farm at Teesport to the north, an ore crushing plant (later a ferro manganese crushing plant) to the south and Teesside Works Cleveland (steel works).

8.4.7 Previous ground investigations and environmental assessments

Details of previous ground investigation works undertaken within the landward parts of the proposed scheme footprint are provided in the land quality PRA (**Appendix 7**). A summary of the key findings is provided below.

An investigation undertaken by Enviros in 2004 included exploratory hole locations in and around the oil depot. This described Made Ground soils as black and ashy overlying slag cobbles and boulders. Black odorous tar was observed in shallow soils within one exploratory hole location within the oil depot boundary. Soil samples collected from this location recorded total petroleum hydrocarbons (TPH) at 90,000mg/kg and xylenes at 304mg/kg.

As part of the Environ 2004 investigation, seven trial pits were also excavated from the Riverside Pumping Station to the western boundary of the proposed scheme footprint. The encountered geology was described as ashy Made Ground overlying slag gravels and boulders. Within Made Ground soil samples, there were recorded exceedances of metals and Polycyclic Aromatic Hydrocarbons (PAHs) above generic screening criteria protective of a commercial land use that were applicable in 2004 (but now withdrawn from use).

In 2008, an intrusive investigation was undertaken in and around the oil depot (partially located within the footprint of the proposed scheme) by Corus UK Ltd. The investigation consisted of two boreholes within the proposed scheme boundary and an addition borehole located off-site. The geology was described as slag fill to a maximum depth of 13mbgl underlain by Alluvium. Made Ground soil analysis recorded TPH at a maximum concentration of 285mg/kg and PAHs at 25mg/kg. Groundwater analysis recorded a maximum concentration of TPH at 63µg/kg and PAHs at less than the laboratory detection limit.

A contaminated land remediation strategy was developed by Wood in 2019 which covers STDCs current landholding and encompasses most of the proposed scheme footprint, with the exception of a narrow strip of land closest to the River Tees. The objective of the remediation strategy was to mitigate the level of ground remediation required across the STDC area, minimise conflicts with the many safety restrictions (including various prevailing safety hazard zones) and avoid introducing future end users that would otherwise conflict with the existing industrial and commercial activities within the area.

Numerous remediation options were considered by Wood and screened against a range of generic contaminant groups. Given the size of the landholding under consideration, together with the range and distribution of contaminants and apparent limited risks to potential future industrial end users, the remediation option taken forward by Wood comprised the formation of a capping layer across the area (including part of the proposed scheme footprint which is the subject of this EIA) to break the Made Ground contaminative linkages. This technique included the placement of chemically ‘suitable for use’ materials over contaminated ground (up to 0.3m in thickness). Clean service runs were also recommended by Wood, to protect both future land users (notably maintenance workers) and utility assets. The option for selective excavation and disposal at the adjacent hazardous waste facility of limited ‘hotspots’ of contamination was also recommended to complement the capping layer remediation approach.

The Wood report provided ‘suitable for use’ chemical criteria for soils, based on generic assessment criteria (CL:AIRE, Category 4 Screening Levels (C4SLs) and LQM, Suitable for Use Levels (S4Uls)) protective of human health under a commercial land use scenario. No ‘suitable for use’ chemical criteria for soils or groundwater, protective of controlled water receptors were provided.

8.4.8 Potential sources of contamination

Table 8.11 below sets out the key sources of contamination which have been identified both within and adjacent to the proposed scheme footprint.

Table 8.11 Potential on-site sources of contamination

Potential source	Potential associated contaminants
Made Ground across the landward parts of the proposed scheme footprint including demolished buildings, structures, slag and ash associated with the adjacent steel work.	Asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, aromatic hydrocarbons (SVOCs and VOCs), phenols, cyanides, ammonium, chlorides and sulphates.
Riverside Pumping Station buildings (sterilisation and motors for pumps)	Asbestos, inorganic compounds (chlorine, sodium chloride), fuel and oil hydrocarbons.
Electrical sub-stations and transformers	Asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, polychlorinated biphenyls (PCBs).
Pipelines	Unknown contents and potentially associated with oil depot and may contain fuel and oil hydrocarbons.
Wharf usage, travelling cranes and railway tracks	Fuel and oil hydrocarbons, metals and metalloid, PAHs, phenols, asbestos, organotins, sulphates and sulphides, chlorinated solvents. Potential leaks and spillages from loading of cargo onto ships. Potential re-fuelling of vessels.
Oil depot tanks and pipelines	Asbestos, metals and metalloids, polycyclic aromatic hydrocarbons (PAHs), fuel and oil hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs), phenols and PCBs.
Tanks to the east of the pumping station which have now been demolished.	
Benzole plant and associated tanks which have been demolished.	

Potential source	Potential associated contaminants
Slag crushing works (former) Tarmac Teesport Asphalt Plant (Asphalt and Concrete Plant)	Phenols, PAHs, PCBs, bitumen, hydrochloric acid, organic compounds, fuel and oil hydrocarbons, metals and metalloids.
Off-site sources including: • Easton Sheet and Galvanising Works; • Teesport; • Slag crushing works; • Ore crushing plant; • Travelling cranes and railways; • Hanson Ready-mixed concrete; • Landfill sites; • Teesside Works Cleveland; • Made Ground from land reclamation and infilling of reservoirs; and • Dockyards including saw and timber mills.	Asbestos, metals and metalloids, PAHs, fuel and oil hydrocarbons, volatile and semi-volatile organic compounds (VOCs and SVOCs), phenols, cyanides, ammonium, chlorides, sulphates and sulphides. Ground gases.

8.4.9 Anticipated trends in baseline conditions

Section 8.3.8 highlights a number of potential sources of contamination both within and adjacent to the proposed scheme footprint. Land affected by contamination is primarily managed in the UK through the Town Country Planning Act, 1990 but also by Part 2A of the Environmental Protection Act, 1990 (EPA,1990). Part 2A of the Environmental Protection Act requires local authorities to identify contaminated land and ensure potential risks are assessed and mitigated accordingly.

The Town Country Planning Act and the Environmental Protection Act do not consider future uses. However, future uses would require a specific grant of planning permission and consideration of the potential for contamination to represent unacceptable risks to ensure the site is suitable for the proposed end use. Consequently, in relation to the proposed scheme, and its immediate receiving environment, it is reasonable to predict that no new sources of contaminated land would be introduced and there would be no significant deterioration in ground conditions in the absence of proposed scheme.

Therefore, existing baseline conditions with respect to geology, hydrogeology and land quality would be unlikely to significantly change in the absence of the proposed scheme.

8.4.10 Identification of sensitive receptors

Through the production of the land quality PRA, a number of receptors that may potentially be impacted by the proposed scheme were identified. The receptors identified within the PRA (**Appendix 7**) and used in this assessment are outlined in **Table 8.12**.

Table 8.12 Receptors requiring assessment for land quality

Receptor group	Receptors included with group	Sensitivity
Hydrogeology	Aquifers – Secondary B and Secondary Undifferentiated Aquifers	Low
Hydrology	Surface waters including culverted watercourses and those protected by European and national designations (Tees estuary)	High to Very High
Human health	Construction workers and maintenance workers	Very High
	Site users	Medium
	Off-site users	High
Infrastructure and utilities	New infrastructure and utilities	Medium

8.5 Potential impacts during the construction phase

8.5.1 Impacts on groundwater quality during earthworks and piling

The landward parts of the proposed scheme footprint are underlain by a Secondary Undifferentiated Aquifer associated with the Tidal Flat Deposits and a Secondary B Aquifer associated with the Mercia Mudstone. There are no licenced groundwater abstractions, including potable water, recorded either within the proposed scheme footprint or within 1km of it and there are no SPZs either within or 500m from the proposed scheme footprint.

Construction of the proposed scheme will require substantial earthworks with up to 1,415,000m^3 of soils being excavated in order to facilitate the creation of the berthing pocket and construction of the quay wall. Approximately 3,000 piles will also be required to construct the quay.

During construction, both Made Ground and superficial deposits will be excavated, allowing increased infiltration of rainwater and surface water run-off to the subsurface. This could potentially mobilise contamination already present within the overlying strata, including within perched water that may be present within the Made Ground deposits. These contaminants could potentially migrate and / or be physically transported by the act of excavation itself into the underlying aquifers.

Piling also has the potential to create preferential pathways, allowing contaminant migration to the underlying aquifers. Piling also has the potential to physically drag down contaminants from the overlying Made Ground deposits as well as allowing for potentially contaminated perched groundwater to migrate to the underlying aquifers.

The outline remediation strategy (Wood, 2019) considers that the potential hazard to groundwater is medium but given the low likelihood of occurrence and low sensitivity, in addition to the productivity of the aquifers and likely saline intrusion, the significance of risk to groundwater is moderate to low and Wood concluded that no active remediation of groundwater is required. Comments received by RCBC (Ref:153731, 06/08/2019) following submission of the outline remediation strategy to them confirmed that the Council is satisfied that the strategy adequately covers the standard contaminated land conditions (notably parts a - Site characterisation and b - Submission of a Remediation Scheme). Therefore, it is assumed that the overarching remediation scheme described within the outline remediation strategy is acceptable and that active remediation of groundwater is not required as part of the proposed scheme.

The assessment of the impacts to the Secondary Undifferentiated Aquifer and Secondary B Aquifer concurs with the agreed outline remediation strategy and considers the sensitivity of the aquifers to be **medium**. Given that the aquifers located below the proposed scheme footprint are likely to be impacted by saline intrusion thus rendering the groundwater unsuitable for potable water abstraction, the likely magnitude of effect to the groundwater is considered to be **low.** Therefore the overall impact on groundwater quality during construction is considered to be of **negligible** significance.

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

There remains a data gap with respect to the quality of groundwater across the proposed scheme footprint. Prior to the commencement of construction activities, a programme of site characterisation works will be undertaken which will comprise intrusive ground investigation works to facilitate the recovery of soil and groundwater samples for laboratory analysis, and to facilitate the monitoring of groundwater. The findings of the intrusive investigation will allow appropriate assessments to be undertaken to ascertain if contaminants are present at concentrations that could result in harm to controlled waters. If unacceptable risks are identified a detailed remediation strategy will be designed for the proposed scheme and implemented as an extension of the currently agreed outline remediation strategy (Wood, 2019).

8.5.2 Impact on surface water quality from the discharge of dissolved phase contaminants in groundwater and surface runoff

The landward parts of the proposed scheme footprint are located adjacent to the Tees estuary, and the Mill Stream is reported to be present in a culvert underneath the proposed scheme footprint prior to discharging into the Tees estuary. Of particular note is the presence of the Teesmouth and Cleveland Coast SSSI, SPA and Ramsar site located immediately adjacent to the landward parts of the proposed scheme footprint. It is anticipated that groundwater within the proposed scheme footprint is in hydraulic connectivity with the surface waters identified above.

As mentioned in **Table 8.10** and the land quality PRA (**Appendix 7**), potential sources of contamination have been identified within the proposed scheme footprint. Construction of the proposed scheme will require substantial earthworks and piling; these activities have the potential to disturb potential contamination which could migrate via groundwater or via surface run-off from Made Ground soils, run-off from stockpiling potentially contaminated soils and demolition materials or by accidental spillage whilst handling, storage or treatment of potentially contaminated water or soils.

The sensitivity of the Tees estuary is considered to be very high due to the European and national designations protecting it. The magnitude of potential effect to surface waters is considered to be low with adoption of the embedded mitigation measures outlined in **Section 3**, including the use of the CEMP. The overall impact during construction works is therefore considered to be of **moderate adverse** significance.

Mitigation measures and residual impact

To further assess the potential impact to surface water receptors from impacted groundwater or surface run off during construction works, further supplementary intrusive investigation and groundwater monitoring is required to characterise the soils and groundwater within the proposed scheme footprint and assess the potential impact to surface water from construction activities. The findings of the intrusive investigation will allow appropriate assessments to be undertaken to ascertain if contaminants are present at concentrations that could result in harm to surface waters. If unacceptable risks are identified, such as the presence of mobile non aqueous phase liquids within the footprint of the proposed scheme with the potential to impact surface waters due to excavation activities, a detailed remediation strategy will be designed and implemented prior to construction. This remedial work will in addition to the currently agreed outline remediation strategy (Wood, 2019).

Following the implementation of these mitigation measures, the magnitude of effect will be very low. Therefore the impact is considered to be **minor adverse** for surface waters (very high sensitivity) which is not considered ‘significant’ in terms of this EIA assessment.

8.5.3 Impacts on human health as a result of construction activities

The land quality PRA (**Appendix 7**) confirmed that potential contaminants of concern, including asbestos, could be present within the proposed scheme footprint and could present an unacceptable risk to construction workers and off-site users if exposed during construction activities.

Given the historic uses of the site, there is a risk that any contamination present within the on-site soils or structures to be demolished could be mobilised resulting in risks to human health via a range of pathways including ingestion, inhalation and direct dermal contact. For on-site human health receptors (construction workers), all pathways would be relevant, but for off-site human health receptors it is likely that the critical pathway would be inhalation of contaminated dusts, vapours or gases that may be generated during construction works. These impacts would however be temporary in nature, lasting for the duration of the construction phase only.

The sensitivity of human health receptors (construction workers and the off-site users), is considered to be medium to very high.

As discussed earlier, the assessment has been undertaken on the assumption that works would be undertaken in accordance with best practices measures to be set out within the CEMP. In addition, construction works will follow best practice and guidance including compliance with the Health and Safety at Work Act 1974 legislation, Construction (Design and Management) Regulations 2015 and Control of Substances Hazardous to Health (COSHH) Regulations. This will include the production and adoption of site and task specific health and safety plans. The plan will outline the use of risk mitigation strategies including appropriate Personal Protective Equipment (PPE), provision of welfare facilities and relevant good working practices applied to avoid potential risk to human health from any potential ground contamination, in line with relevant available guidance. As a result, the magnitude of effect is considered to be very low.

Due to the medium to very high sensitivity of human health receptors and the low magnitude of effect, the overall impact during construction is considered to be of **negligible to minor adverse** significance.

Mitigation measures and residual impact

The mitigation measures detailed in **Section 16.5** (specifically those associated with the avoidance of construction phase dust) would also be applicable to this impact. No further mitigation measures have been identified to manage the risk of human health to on-site construction workers. The residual impact is of **negligible to minor adverse** significance.

8.6 Potential impacts during the operational phase

8.6.1 Impacts on controlled waters

The proposed re-use of excavated soils on-site has the potential to affect the Tees estuary due to leaching of any contaminants which may be present. However, soils to be re-used on site will be assessed for their chemical suitability in line with the outline remediation strategy (Wood, 2019) and in accordance with waste management legislation and best practice including the CL:AIRE Definition of Waste: Code of Practice (2008). Such an approach essentially removes the risk of reductions in water quality within the Tees estuary associated with re-use of materials on site (as they would need to be proved to be suitable for re-use).

In addition, impermeable or low permeability hard standing would be installed on the surface of the proposed quay, which would minimise the potential for leaching of any contaminants. Furthermore, the presence of a piled quay wall along the river frontage is likely to reduce the connectivity of site soils with the River Tees.

The creation of the piled wall along the river frontage has the potential to create different hydraulic flow regimes along the piled wall to those that currently exists. This then creates the potential for contaminated groundwater (if present) to impact areas outside the proposed scheme footprint, for example neighbouring sites.

Following the execution of a pre-construction ground investigation, it will be possible to determine whether contaminated groundwater and mobile contaminants, e.g. non-aqueous phase liquids (NAPLs) are present within the proposed scheme footprint. If contaminated groundwater and mobile contaminants are identified during the ground investigation which have the potential to cause unacceptable risks to surface waters receptors, remediation will be required to mitigate the impact it may have to either the proposed scheme or the neighbouring sites / controlled waters.

There are unlikely to be significant impacts to controlled waters from the operation of the proposed scheme as proposed operational phase activities will follow standard procedures, for example including appropriate control techniques to reduce the risk of pollution incidents and to limit the consequences of an accident, therefore minimising any potential impacts.

The sensitivity of the surface water is very high and the magnitude of impact following mitigation is very low beneficial. The overall impact to controlled waters during operation is therefore considered to be of **minor beneficial** significance.

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

8.6.2 Impacts on human health

The only building to be constructed on the quay comprises a substation. The exact construction of the substation is unknown at this stage, however it has been assumed that it would be well ventilated due to the equipment it would contain. Operational phase maintenance of the substation is likely to be the only time when the building is occupied, therefore unacceptable risks relating to the inhalation of potential ground gases and vapours that may accumulate in buildings is considered highly unlikely.

A programme of remedial works would be undertaken prior to operation of the proposed scheme which would reduce the potential for impact on human health during operation. In addition, exposure of future end-users will be further limited as the quay will be covered with hard-standing or a gravel capping layer which would break the pollutant linkage. The remediation works will be undertaken in accordance with the Outline Remediation Strategy (Wood, 2019).

The sensitivity of human receptors during operation is medium and the magnitude of effect is considered to very low. Thus, the impact to human receptors is of **negligible** significance.

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

8.6.3 Impacts to the built environment

Construction material including concrete to be used in the proposed scheme have the potential to undergo degradation due to chemical attack from aggressive ground, should acids or sulphates be present. This has the potential to compromise the integrity of structures.

As set out in the Outline Remediation Strategy (Wood, 2019), clean or lined service corridors will be installed to protect land users and utilities. This will mitigate against the potential for material degradation of utilities during the operational phase of the proposed scheme.

The sensitivity of the built environment during operation is medium and the magnitude of the impact is considered to medium following development. Thus, the impact to the built environment is of **minor adverse** significance.

Mitigation measures and residual impact

The material for use in the development will be specified taking into consideration aggressive ground conditions at the design/ construction phase. The assessment methodology is set out in BRE Special Digest 1 (20015) will be adopted to determine concrete classification in the development.

Following implementation of the mitigation described above the magnitude of the impact is considered to be very low and the residual impact would be of **negligible** significance.

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

Royal HaskoningDHV

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.

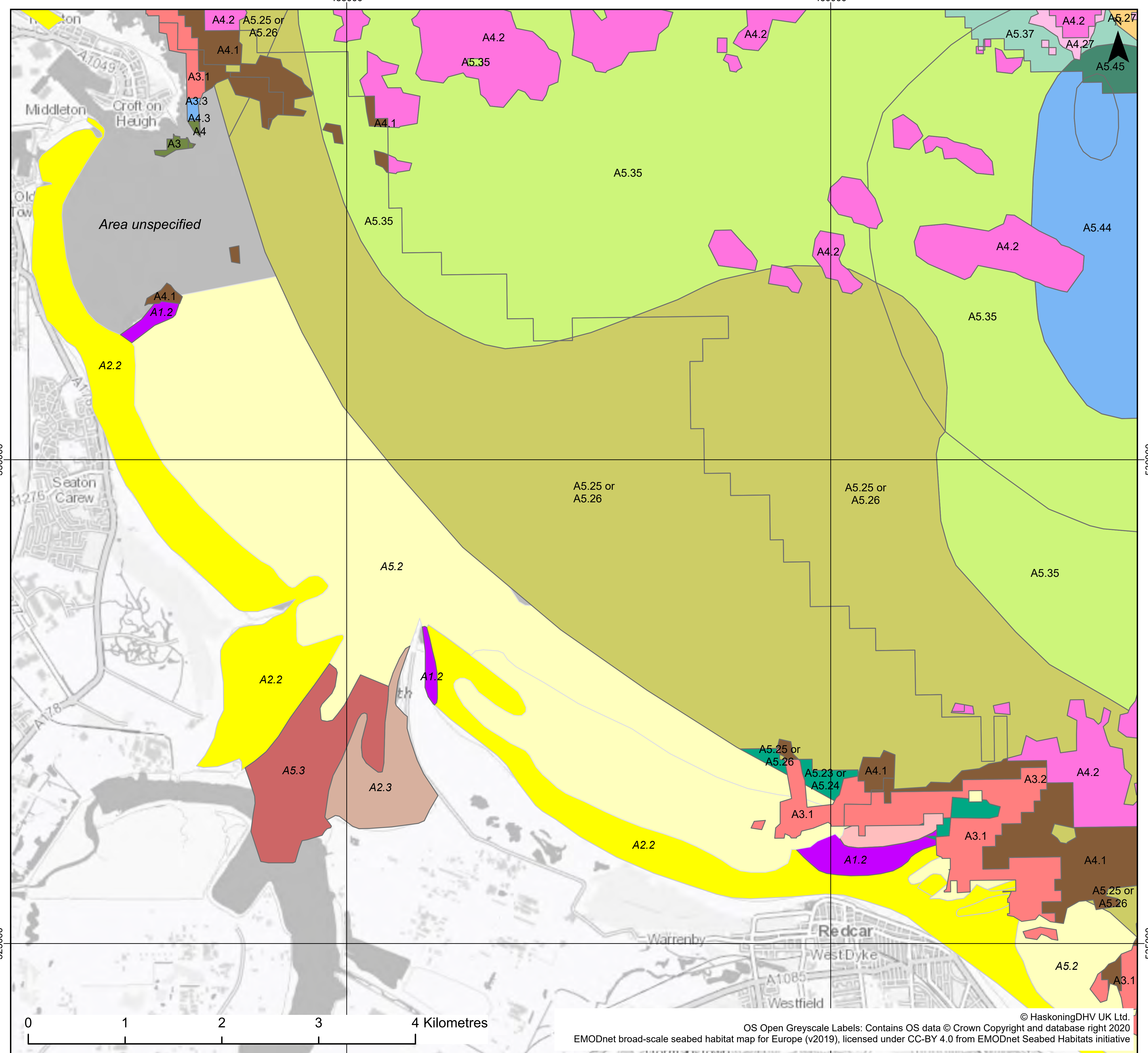
A review of the Priority Habitats Inventory (available on the MAGIC maps website) has determined that localised areas of intertidal mudflat are present within the proposed berth pocket, as well as a much larger area of intertidal mudflat on the opposite side of the river (North Tees Mudflat) (**Figure 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:	Project:
Tees Valley Combined Authority	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

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

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.

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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

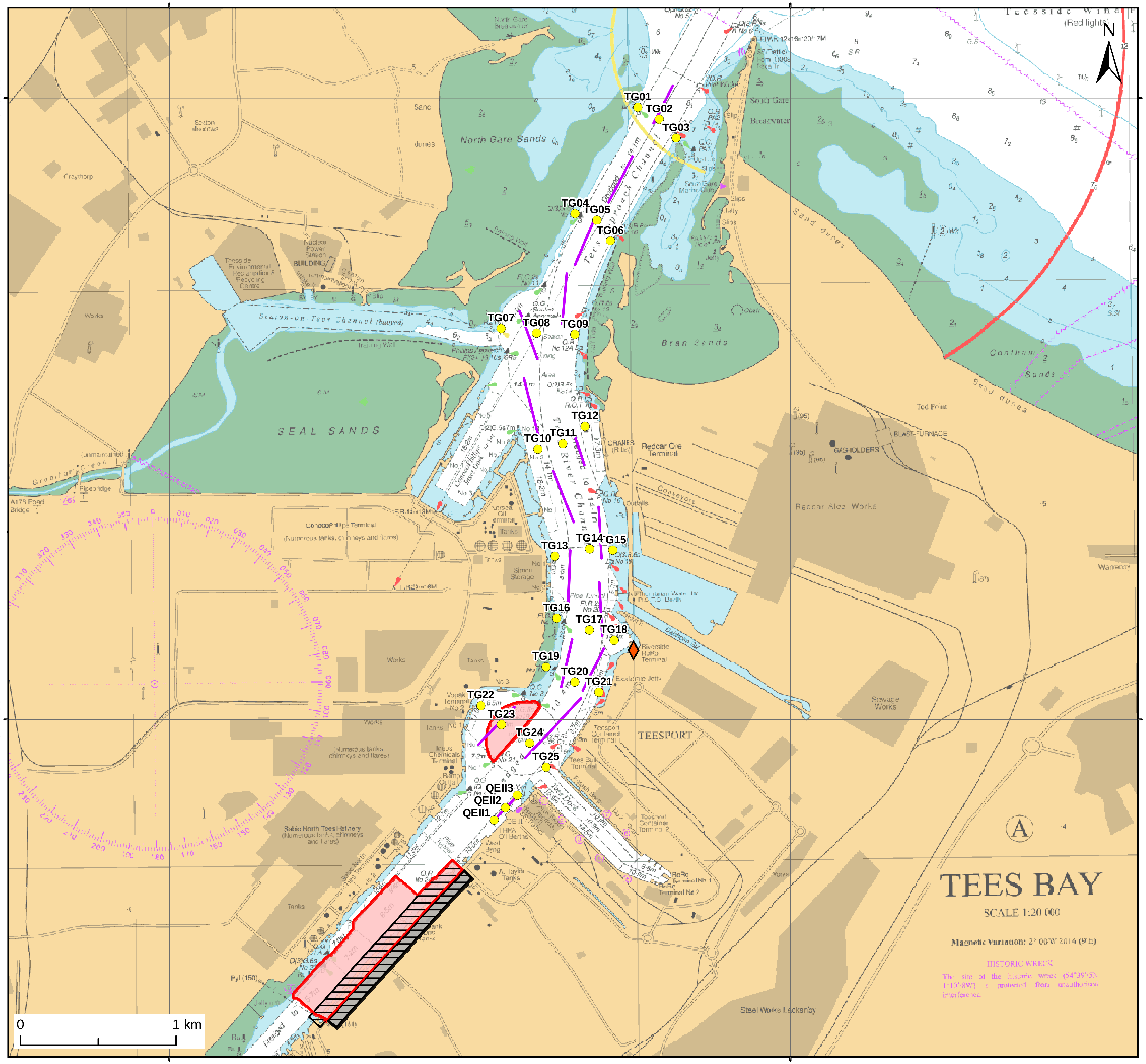
Sediment types, as classified using the Folk triangle (Folk, 1954) for each of the sample stations across the 2019 survey area are provided in **Figure 9.3**. A variety of sediment types were present across the survey area and most samples ranged from poorly sorted to extremely poorly sorted. The samples 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).



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:
0	30/10/2020	TC	MV	A3	1:25,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

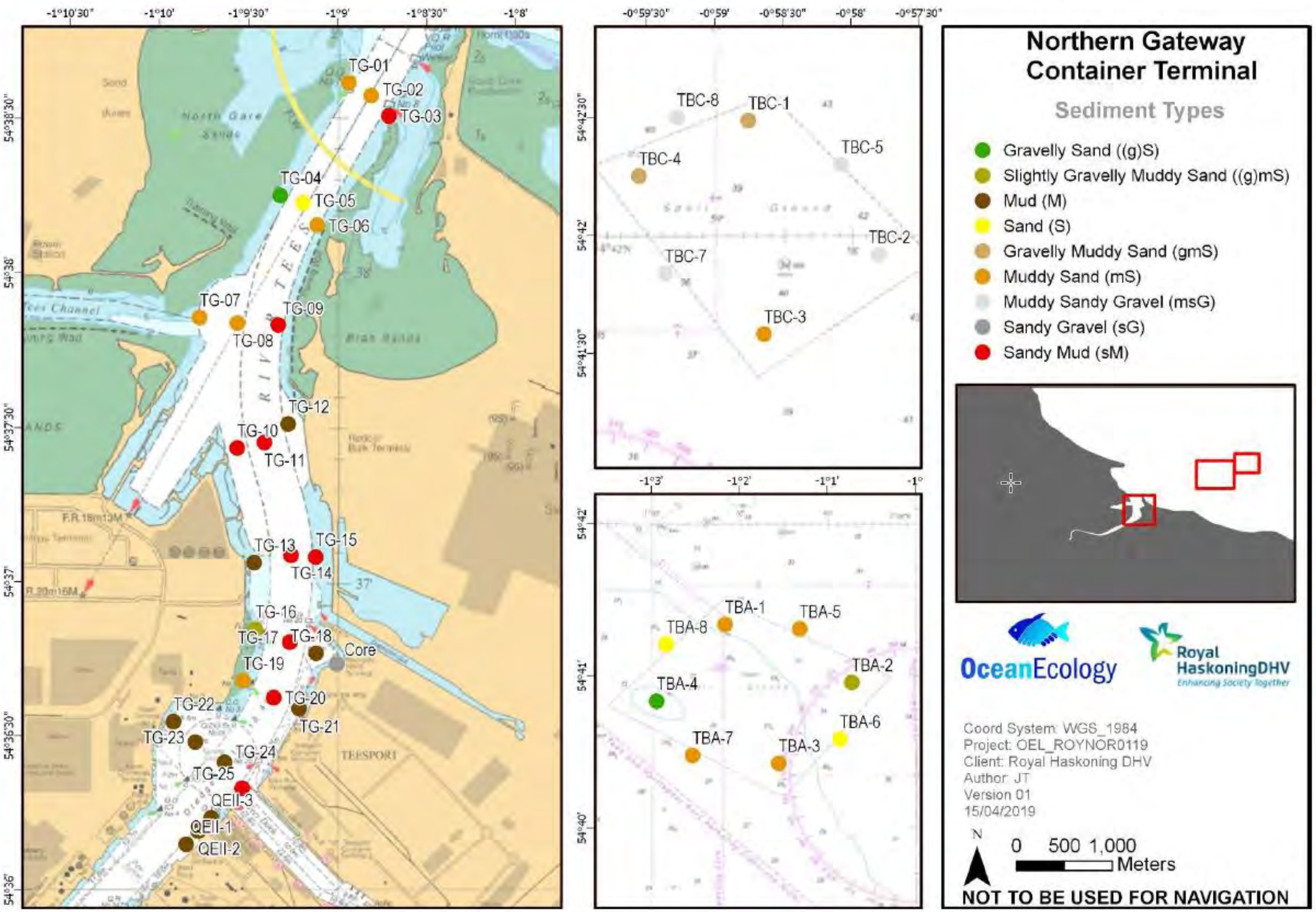


Figure9.3 ***Comparison of Folk (Folk, 1954) sediment types as determined from PSD analysis of samples acquired during the NGCT sediment and marine ecology survey, 2019***

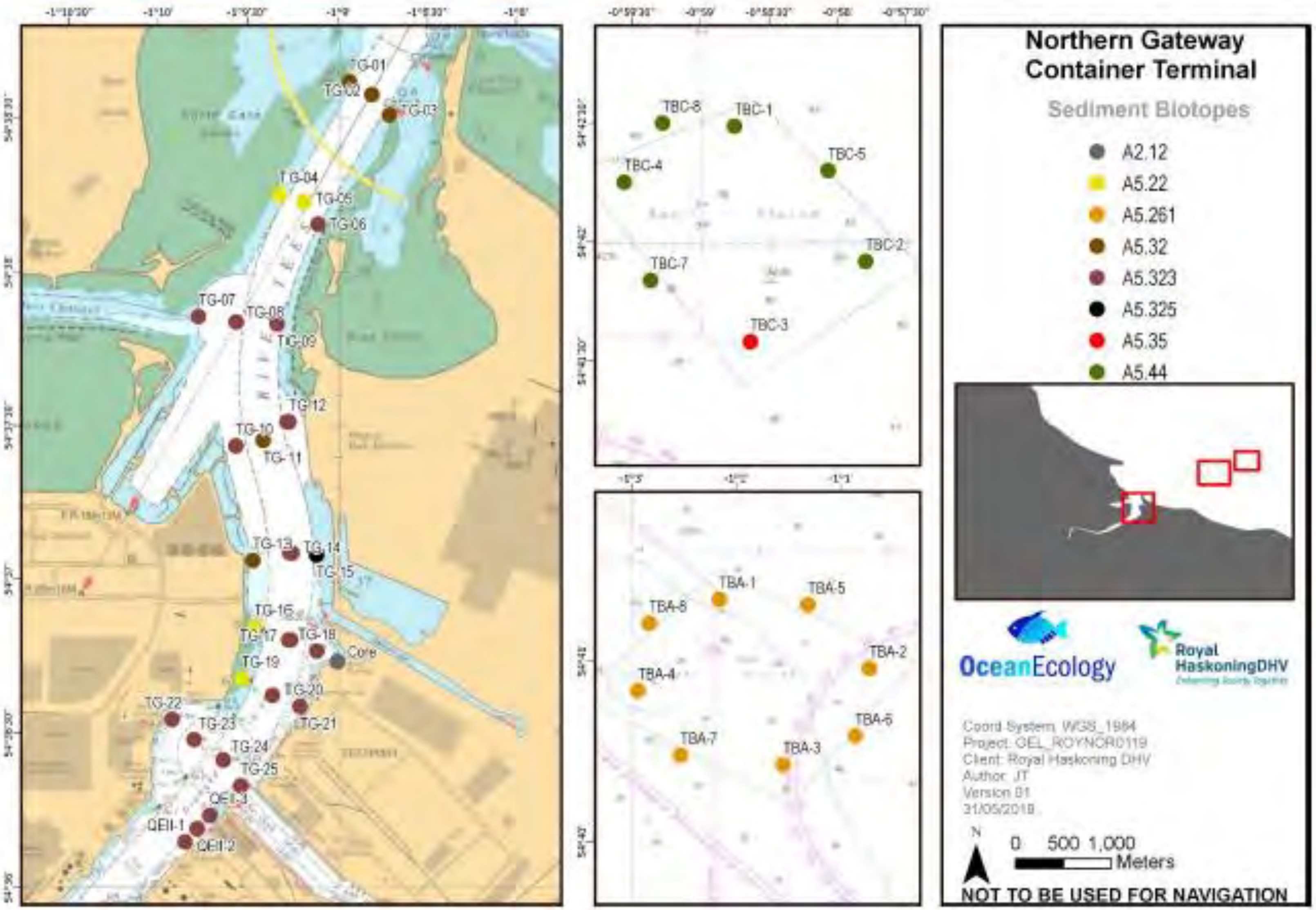


Figure 9.4 ***Distribution of biotopes determined from PSD and macrobenthic analysis of samples recovered during the NGCT sediment and marine ecology survey, 2019***

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**.

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10 MARINE MAMMALS

10.1 Introduction

A desk-based assessment has been undertaken to source current information on marine mammals in the area and a precautionary approach has been undertaken to assess the potential impacts from the proposed scheme to marine mammals.

The proposed new quay (and all piling works required to construct the quay) would be on land. Therefore, the potential impacts for marine mammals are primarily associated with the proposed capital and maintenance dredging, movement of vessels (including vessels associated with the demolition of the existing structures) and installation of rock blanket within the berth pocket. The potential impacts on marine mammals from the offshore disposal of dredged sediments are assessed in **Section 26**.

The potential impacts that have been assessed within this section are:

- injury and behavioural impacts from underwater noise;
- vessel interactions (collision risk);
- disturbance at seal haul-out sites;
- changes in water quality; and
- changes to prey resource.

10.2 Policy and consultation

10.2.1 Policy

The assessment of potential impacts to marine mammals 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 this section as presented within the NPS for Ports are summarised in **Table 10.1**.

Table 10.1 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
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 10.5** and **10.6**. 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, actual and potential Sites of Community Importance and Sites of Special Scientific Interest (SSSI).	Section 5.3.7	Impacts to designated sites (including SSSI and SACs) are addressed in **Sections 10.5** and **10.6** and **Section 29**.
The applicant should consult the Environment Agency and Natural England, or the Countryside Council for Wales, and the MMO in relation to marine protected species in England, as necessary and in particular with regard to assessment of noise on protected species or other wildlife.	Section 5.10.7	Impacts associated with underwater noise to marine mammals are addressed in **Section 10.5** and **10.6**.

NPS requirement	NPS reference	EIA Report reference
The results of any noise surveys and predictions may inform the ecological assessment.		

Marine mammal species which reside in UK waters are protected by national and international legislation. **Table 10.2** details the relevant legislation.

Table 10.2 Summary of national and international legislation relevant to marine mammals

Legislation	Level of protection	Species included	Details
Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas	International	Odontocetes	Under the Agreement, provision is made for the protection of specific areas, monitoring, research, information exchange, pollution control and increasing public awareness of small cetaceans.
The Berne Convention 1979	International	All cetaceans, grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*	The Convention conveys special protection to those species that are vulnerable or endangered. Although an international convention, it is implemented within the UK through the Wildlife and Countryside Act 1981 (with any aspects not implemented via that route brought in by the Habitats Directive).
The Bonn Convention 1979	International	All cetacean species	Protects migratory wild animals across all, or part of their natural range, through international co-operation, and relates particularly to those species in danger of extinction.
Oslo and Paris Convention for the Protection of the Marine Environment 1992	International	Various whale species and harbour porpoise *Phocoena phocoena*	OSPAR has established a list of threatened and/or declining species in the north-east Atlantic. These species have been targeted as part of further work on the conservation and protection of marine biodiversity under Annex V of the OSPAR Convention. The list seeks to complement, but not duplicate, the work under the EC Habitats and Birds Directives and measures under the Berne Convention and the Bonn Convention.
Convention on Biological Diversity 1993	International	All marine mammal species	Requires signatories to identify processes and activities that are likely to have impacts on the conservation and sustainable use of biological diversity, inducing the introduction of appropriate procedures requiring an EIA and mitigation procedures.
The Conservation of Habitats and Species Regulations 2017	National	All cetaceans, grey and harbour seal	All cetacean species are listed under Schedule 2 (EPS) and all seals are listed under Schedule 4 (animals which may not be captured or killed in certain ways).
Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 (as amended)	National	All cetaceans, grey and harbour seal	The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 (as amended) apply the Habitats Directive to marine areas within UK jurisdiction, beyond 12 nm, and provide further clarity on the interpretation of “disturbance” in relation to species protected under the Habitats Directive.
The Wildlife and Countryside Act 1981 (as amended)	National	All cetaceans	Schedule 5: all cetaceans are fully protected within UK territorial waters. This includes disturbance.

Legislation	Level of protection	Species included	Details
The Countryside and Rights of Way (CroW) Act 2000	National	All cetaceans	Under the CRoW Act 2000, it is an offence to intentionally or recklessly disturb any wild animal included under Schedule 5 of the Wildlife and Countryside Act.

Summary of comments received during the EIA scoping phase

Table 10.3 provides a summary of the comments received from the MMO and RCBC within their respective Scoping Opinions (**Appendix 3**) with regard to marine mammals, and signposts to the relevant section of the EIA Report where the comment has been addressed.

Table 10.3 Consultation responses relevant for marine mammals within the Scoping Opinions

Comment	Response / section of the EIA Report where comment has been addressed
The River Tees is important wildlife corridor and should remain as such and be enhanced where possible. The intertidal Tees estuary adjacent to the site is designated as a SSSI and pSPA.	Acknowledged and this has been taken into account in the assessments in **Sections 10.5** and **10.6**.
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 not limited to common seal and grey seal.	This point is acknowledged. The assessments in **Sections 10.5** and **10.6** include grey and harbour seal. **Section 9** assesses potential impacts on marine habitats.
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.	Acknowledged and this has been taken into account in the assessments in **Sections 10.5** and **10.6**, as well as **Section 29**.
The MMO would expect key marine mammal species to be scoped into the ES. In order to assess the potential impacts, detailed knowledge is required of the spatial and temporal distribution of species and their seasonal sensitivities in the area/River Tees.	A detailed review of marine mammal species that could be present in the area, including spatial and temporal distribution of species and their seasonal sensitivities, is presented in **Section 10.4**.
It will also be necessary to identify significant noise sources from the project (i.e. the noise generating activities) that may cause harm to aquatic fauna. For marine mammals, assessments should refer to the NOAA (NMFS, 2018) guidance.	This has been undertaken in **Section 10.5** and **10.6**, which identifies and assesses the potential impacts during the proposed activities which could generate underwater noise (note, piling would be conducted on land with no potential underwater noise impacts to marine mammals).

10.3 Methodology

10.3.1 Study area

The study area for the EIA is the area over which the direct and indirect effects of the proposed scheme may be detected during the construction and operational phases. Marine mammal species are wide-ranging and, therefore, occur over a wider area than the proposed scheme's study area. For conservation and management purposes, it is necessary to consider impacts at the population level; marine mammal populations are defined into areas that a population will generally remain in, with little or no movement and interaction between these populations. These are Management Units (MU) and they provide an indication of the spatial scales at which effects of plans and projects alone, and in-combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK (Inter-Agency Marine Mammal Working Group (IAMMWG), 2015). The study area for each marine mammal receptor has been based on the relevant MU for that species.

10.3.2 Existing environment

A number of publicly available datasets are available on marine mammal populations in the local area. It is considered that these are sufficient to assess the impact of the proposed scheme and therefore no further marine mammal surveys have been undertaken. The data sources included, but were not limited to:

- Special Committee on Seals (SCOS) reports (SCOS, 2019);
- Sea Mammal Research Unit reports (SMRU);
- At-sea usage maps for harbour and grey seals (Russell *et al.,*2017);
- Department of Energy and Climate Change (DECC) Offshore Energy Strategic Environmental Appraisal (OESEA) 3rd Report (DECC, 2016);
- Small Cetaceans of the Atlantic and North Sea Surveys (SCANS-III) (Hammond *et al.,*2017);
- Revised Phase III data analysis of Joint Cetacean Protocol (JCP) data resources (Paxton *et al.,*2016);
- The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area (Heinänen and Skov, 2015);
- Sea Watch Foundation sightings (Sea Watch Foundation, 2020);
- Tees Seals Research Programme (Industry Nature Conservation Association (INCA), 2019); and,
- Yorkshire Naturalist Union public sightings database (YNU, 2010).

10.3.3 Methodology for assessment of potential impact

The assessment methodology presented in **Section 5** has been used to inform this section of the EIA Report.

To inform the impact assessment of works during the proposed scheme for marine mammal species, underwater noise modelling that was carried out for similar local activities has been applied in order to estimate the noise levels likely to arise during the dredging works at the proposed scheme. More information on the methodology used in the underwater noise modelling for the dredging works in **Section 10.5.1**.

In addition to the methodology for the impact assessment outlined in **Section 5**, the magnitude of effect on marine mammals also took into account the criteria outlined in **Table 10.4**. The thresholds used to define the level of magnitude for each impact have been defined by expert judgement, current scientific understanding of marine mammal population biology and JNCC *et al.* (2010) draft guidance on disturbance to EPS species. For each effect, the assessment describes the magnitude in a qualitative or quantitative way.

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Table 10.4 Example definitions of the magnitude levels for marine mammals

Magnitude	Definition
High	Permanent irreversible change to exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 1% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (limited to phase of development or proposed scheme timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 10% of the reference population are anticipated to be exposed to the effect.
Medium	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.01% and 1% of the reference population anticipated to be exposed to effect. OR Temporary effect (limited to phase of development or proposed scheme timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 5% and 10% of the reference population anticipated to be exposed to effect.
Low	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.001% and 0.01% of the reference population anticipated to be exposed to effect. OR Intermittent and temporary effect (limited to phase of development or proposed scheme timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 1% and 5% of the reference population anticipated to be exposed to effect.
Negligible / very low	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that less than 0.001% of the reference population anticipated to be exposed to effect. OR Intermittent and temporary effect (limited to phase of development or proposed scheme timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that less than 1% of the reference population anticipated to be exposed to effect.

10.4 Existing environment

Annual marine mammal monitoring campaigns have been conducted by INCA in the Tees estuary since 1989. This monitoring focuses on the two seal species that are common in the UK; the harbour seal and the grey seal. The results of these surveys are presented in **Section 10.4.2.2** for grey seal and **Section 10.4.2.3** for harbour seal

A review of available information on marine mammals in the area, including but not limited to INCA monitoring (INCA, 2019), Sea Watch Foundation sightings (Sea Watch Foundation, 2020), Yorkshire Naturalist Union sightings (YNU, 2010), Joint Cetacean Protocol (JCP) data (e.g. Paxton *et al*., 2016) and SCANS surveys (Hammond *et al*.,2013, 2017) indicates that the species most likely to occur in the area are harbour seal and grey seal. However, there is also the potential for harbour porpoise *Phocoena phocoena* and minke whale *Balaenoptera acutorostrata* to be present in the estuary mouth and off the coast. Other species such as white-beaked dolphin *Lagenorhynchus albirostris* are more likely to occur further offshore, so have not been included in this assessment and bottlenose dolphin *Tursiops truncatus* are very infrequently recorded in this area, although are recorded along the north-east coast. Therefore, based on the most common and regular marine mammal species that could be present in the area, the species included within this section of the EIA Report are:

- harbour porpoise;
- minke whale;
- grey seal; and
- harbour seal.

10.4.1 Cetaceans

10.4.1.1 Conservation importance

All cetaceans in UK waters are classed as European Protected Species (EPS) under Annex IV of the Habitats Directive (EU Directive 92/43/EEC) and therefore are internationally important. Harbour porpoise are additionally listed under Annex II of the Habitats Directive and are afforded protection through the designation of Natura 2000 sites.

Member States report back to the EU every six years on the conservation status of marine EPS. In the UK, harbour porpoise have been assessed as having an 'favourable' conservation status and minke whales as classified as 'unknown' (based on the last 2013 to 2018 reporting (JNCC, 2019);**Table 10.5**).

Table 10.5 Favourable Conservation Status (FCS) assessment of harbour porpoise and minke whale in Annex IV of the Habitats Directive occurring in UK and adjacent waters (JNCC, 2019)

Species	FCS assessment
Harbour porpoise	Favourable
Minke whale	Unknown

10.4.1.2 Harbour porpoise

Distributions and abundance

There are three MUs for harbour porpoise around the UK: North Sea; West Scotland; and the Celtic and Irish Sea (IAMMWG, 2015). The SCANS-III estimate of harbour porpoise abundance in the North Sea MU was 345,373 (Coefficient of Variation (CV) = 0.52; 95% Confidence Interval (CI) = 246,526 - 495,752) with a density estimate of 0.52/km^2 (Hammond *et al*., 2017). The potential impacts for the EIA assessments are put into the context of the North Sea MU for harbour porpoise.

The proposed scheme is located in SCANS-III survey block O and the estimated abundance of harbour porpoise in SCANS-III survey block O is 53,485 harbour porpoise (CV=0.21; 95% CI = 37,413 – 81,695), with an estimated density of 0.888 harbour porpoise/km^2 (Hammond et al., 2017). The density estimate of 0.888 harbour porpoise/km^2 has been used to assess the number of harbour porpoise that could be impacted.

Heinänen and Skov (2015) provide the results of detailed analyses of 18 years of JCP survey data. The model results for the North Sea MU indicate that the most important factors for probability of presence of harbour porpoise in the North Sea MU is the water depth and hydrodynamic variables (Heinänen and Skov, 2015). Regarding water depth, high presence of harbour porpoise are in depths of 30 to 50m and over 200m in the summer, and a depth of 30 to 40m depth in winter. During the summer months, surface salinity and eddy potential are the important hydrodynamic determinants of presence, while stability of the temperature is the most important for the density. During the winter months, eddy activity is still of importance, while current speed also has an effect. The presence of vessels is an important factor in the abundance and presence of harbour porpoise; with lower abundance in areas with over 80 vessels per day within a 5km^2 area.

Modelled areas of persistent high densities within the North Sea MU show that there are no areas of high harbour porpoise persistent density near the proposed scheme (Heinänen and Skov, 2015; **Figure 10.1**).

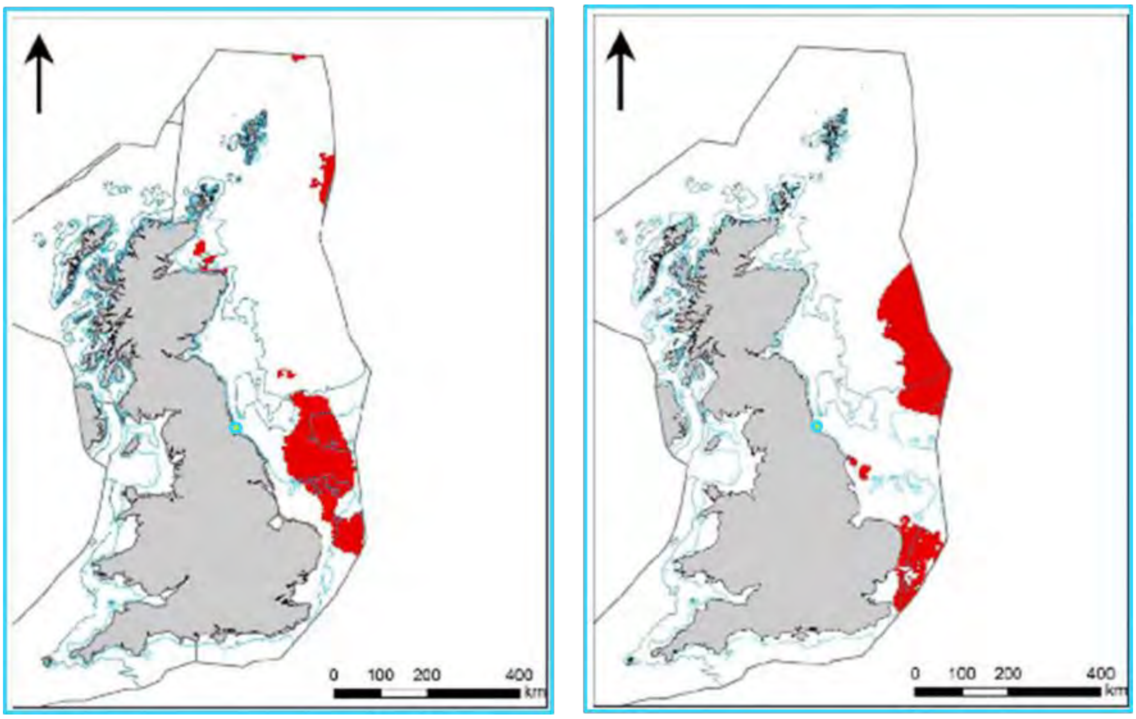

Figure 10.1 Persistent high-density areas identified during the summer months. The red colours mark areas with where persistent high densities as defined by the upper 90th percentile have been identified (Heinänen and Skov, 2015). The approximate location of the proposed scheme is indicated by the blue dot.

Diet and prey species

The distribution and occurrence of harbour porpoise and other marine mammals is most likely to be related to the availability and distribution of their prey species. For example, sandeels (Ammodytidae), which are known prey for harbour porpoise, exhibit a strong association with particular surface sediments.

The diet of the harbour porpoise consists of a wide variety of fish, including pelagic schooling fish, as well as demersal and benthic species, especially Gadoids, Clupeids and Ammodytes. Other prey species such as cephalopods, other molluscs, crustaceans and polychaetes have also been recorded. The diet varies geographically, seasonally and annually, reflecting changes in available food resources and differences in diet between sexes or age classes (Berrow and Rogan, 1995; Kastelein *et al*., 1997; Börjesson *et al.,* 2003; Santos and Pierce, 2003; Santos *et al.,* 2004).

10.4.1.3 Minke whale

Distributions and abundance

Minke whale are predominantly a seasonal visitor to UK waters, with sightings increasing from May to October, with sightings rare outside of this period (e.g. JCP data; Paxton *et al*., 2016).

For the SCANS-III survey block O, the abundance of minke whale in the summer of 2016 was estimated as 603 individuals (CV = 0.62, 95% CI 109 – 1,670) with an estimated density of 0.01 individuals per km^2 (Hammond *et al.,* 2017). This density estimate has been used to assess the number of minke whale that could be impacted by the proposed scheme.

The IAMMWG (2015) defined just one MU for minke whale, the Celtic and Greater North Seas MU, which has an estimated abundance of 23,528, based on the SCANS-II survey in 2005 and Cetacean Offshore Distribution and Abundance (CODA) survey in 2007 (95% CI = 13,989-39,572; IAMMWG, 2015; Hammond *et al*., 2013; Macleod *et al.,* 2009). The potential impacts are put into the context of the Celtic and Greater North Seas MU for minke whale.

Diet and prey species

Minke whales feed on a variety of fish species, including herring, cod and haddock. Minke whale feed by engulfing large volumes of prey and water, which they then 'sieve' out of through their baleen plates and swallow their prey whole. Sandeels and mackerel were found to be the most dominant prey species for minke whale in the northern North Sea (Windsland *et al.,* 2007).

10.4.2 Pinnipeds

There are two species of seals common to UK waters, the grey seal and harbour (or common) seal. Approximately 38% of the world's grey seals breed in the UK, of which 88% are from sites in Scotland, with the main colonies being in the Inner and Outer Hebrides and Orkney (SCOS, 2019). Approximately 30% of the European harbour seal population are found in the UK, which has declined from approximately 40% in 2002 (SCOS, 2019).

10.4.2.1 Conservation importance

As outlined in **Section 10.4.4.3**, breeding harbour seal are listed as a feature of the Teesmouth and Cleveland Coast SSSI.

Seal species within the UK are listed under a number of international and national legislations for their protection. Both grey and harbour seal are listed under Annex II and Annex V of the Habitats Directive. Annex V requires that their exploitation or removal from the wild may be subject to management measures, and Annex II requires member states of the EU to designate areas essential for their life and reproduction as SACs. The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 (as amended) provide the same level of protection for more than 12nm offshore.

Both grey and harbour seals are also listed under Appendix III of the Bern Convention, requiring appropriate and necessary legislative and administrative measures to ensure the protection of seal species. The Conservation of Seals Act 1970 provides protection for seals within the UK, where it is an offence to take or kill any seal except under licence. Following the outbreak of the Phocine Distemper Virus in 1988, a further protection was afforded to protect harbour and grey seal year-round along the east coast of England.

Favourable Conservation Status

The current conservation status, as assessed in the 4th UK report on implementation of the Habitats Directive (submitted to the European Commission in 2019), for both seal species is 'favourable' for grey seals and 'unfavourable-inadequate' for harbour seals (based on the last 2013 to 2018 reporting (JNCC, 2019) **Table 10.6**).

Table 10.6 FCS assessment of grey and harbour seals in Annex IV of the Habitats Directive occurring in UK and adjacent waters (JNCC, 2019)

Species	FCS assessment
Grey seal	Favourable
Harbour seal	Unfavourable – inadequate

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10.4.2.2 Grey seal

Distribution and abundance

Grey seal are found across the north Atlantic Ocean and the Baltic Sea. Although the number of pups born in UK water has been growing steadily since records began in 1960, the population growth is now steadying in all areas except for the central and southern North Sea where population growth remains high (SCOS, 2018).

Grey seal populations are assessed from the counts of pups born each year. Surveys are undertaken during the breeding season where females will congregate on land to give birth. The most recent counts available are from the 2016 autumn breeding season surveys around the UK. The 2016 surveys resulted in an estimate of 65,400 pups (95% CI = 58,200-72,200; SCOS, 2019). The pup counts can be used to determine actual population size through a mathematical model and have been projected forward to 2018. This model provides an estimated UK population for 2018 of 152,800 (95% CI = 135,300-173,800; SCOS, 2019). The most recent regional pup count from the 2016 surveys for the North Sea colonies was 14,600 (95% CI = 12,700-16,900) (SCOS, 2019). In addition to the high numbers of grey seal along the east coast of the UK, there are also high numbers within the North Sea close to sandbanks (such as Dogger Bank) and along the corridors that connect offshore foraging areas to haul-out sites (DECC, 2016).

The most recent counts of grey seal in the August 2017 surveys estimated that the total count of grey seals in the UK was 42,997 (SCOS, 2019). The grey seal MU within which the proposed scheme is located is the North-East England MU (**Figure 10.2**), which has an estimated population of 6,502 (SCOS, 2019). This includes 6,427 grey seals in Northumberland, 15 at the Tees and 60 at St Mary's Island, Ravenscar, Filey Brigg (SCOS, 2019). The potential impacts for the EIA assessments are put into the context of the North-East England MU of 6,502 grey seal.

The Tees Seals Research Programme (INCA, 2019) undertake yearly surveys for assessing the abundance and distribution of both grey and harbour seal species at Seal Sands which is located 3km from the closest point of the proposed dredge footprint. The 2019 surveys occurred for a period of 47 days throughout the year and 28 days from mid-June to mid-July 2019. The highest grey seal count for the 2019 period was 56; the mean numbers of grey seals across all months was down this year with very few large counts (INCA, 2019).

Marine Scotland commissioned the SMRU to produce maps of grey seal distribution in UK waters (Russell *et al.,* 2017). These maps were produced by combining information about the movement patterns of electronically tagged seals with survey counts of seals at haul-out sites. The resulting maps show estimates of mean seal usage (seals per 5km x 5km grid cell) within UK waters. The maps indicate that grey seal usage is relatively low in and around the proposed dredge footprint plus 1km buffer, with a grey seal density of 0.00008/km^2 (Russel *et al.,* 2017). However, in the area of the offshore disposal site (Tees Bay C), located approximately 9.5km from the coast, there is a higher grey seal density of 0.014km^2 (Russel *et al*., 2017). The density estimate of 0.00008/km^2 has been used to determine the potential impacts during dredging (**Section 10.5** and **10.6**). The density estimate of 0.014/km^2 has been used to determine the potential impacts at the offshore disposal site (**Section 26**).

Movements

Tracking of individual seals has shown that most foraging probably occurs within 100km of a haul-out site (Thompson *et al*., 1996), although they can feed up to several hundred kilometres offshore, with ranges of 1,088 to 6,400km recorded (Dietz *et al.,* 2003). Individual grey seals based at a specific haul-out site often make repeated trips to the same region offshore but will occasionally move to a new haul-out site and begin foraging in a new region (SCOS, 2019).

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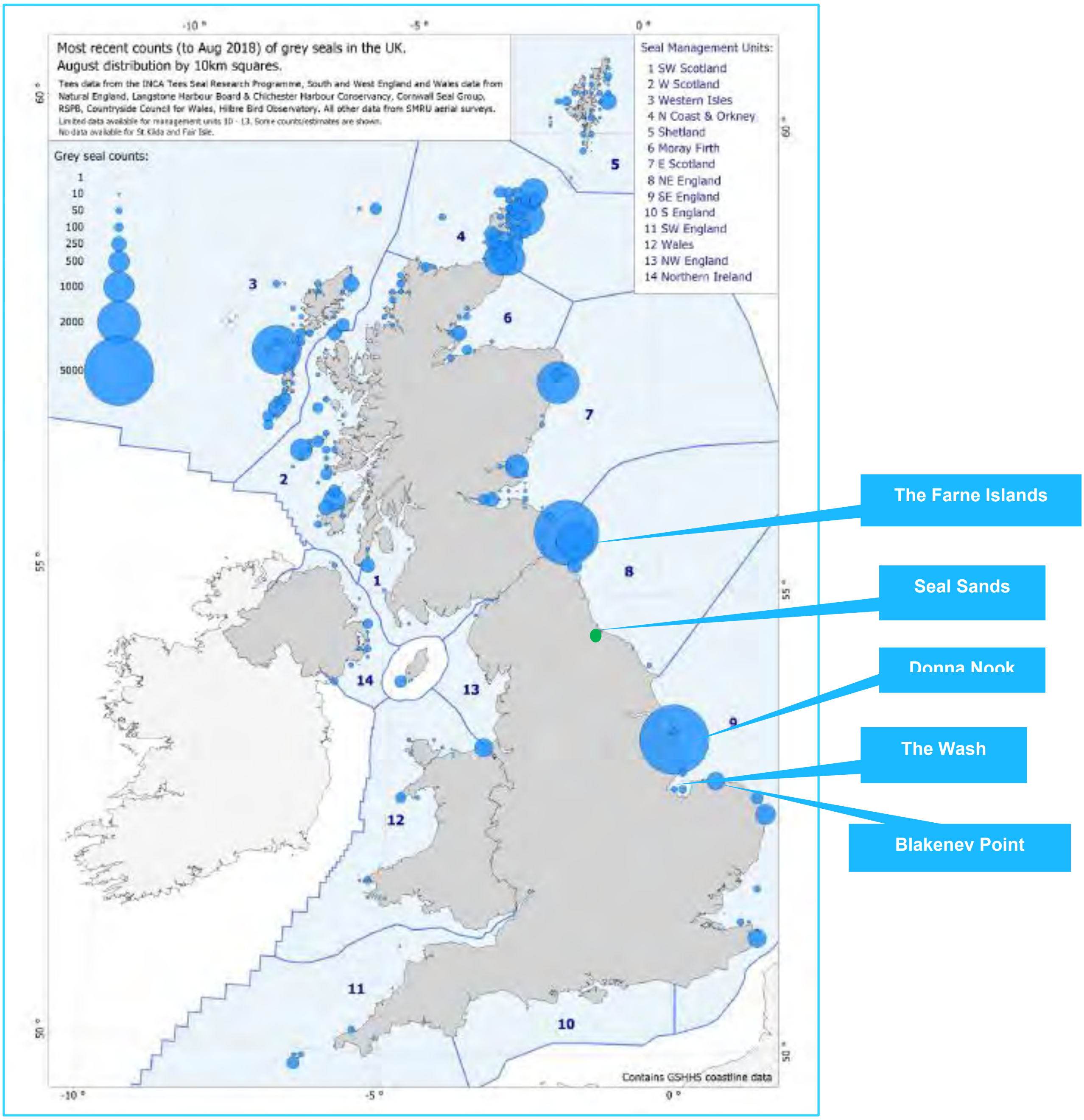

Figure 10.2 Locations of the main grey seal breeding sites around the UK (taken from SCOS, 2019). The location of the proposed scheme is indicated by the green dot.

Studies of regular foraging and dispersal between winter breeding sites, and summer foraging and haul out sites indicates ranges of 1,000km (e.g. McConnell et al., 1992). Movements have been recorded between haul-out sites on the east coast of England and the Outer Hebrides (SCOS, 2019).

Tags were deployed on grey seal at Donna Nook (11 individuals) and Blakeney Point (10 individuals) in May 2015, at the end of their moult periods (Russel, 2016). Of the 21 tagged individuals, 16 used multiple haul-outs sites; one hauling out in the Netherlands and one in northern France (this individual did not return within the tags duration) (Russel, 2016). The tagged grey seals travelled between haul-out sites along the east coast of England, as well as to the north of France and up to the Firth of Forth and across Fladden Ground and Dogger Bank (Russel, 2016).

Haul-out sites

Grey seal come ashore to give birth, for their annual moult period and to rest between foraging trips. Grey seal will often haul-out on outlying islands and remote coastlines exposed to the open sea. Generally, they are sensitive to disturbance by humans and will haul-out in remote areas and prefer remote breeding sites. However, Donna Nook has a population of grey seals that have become acclimatised to the presence of humans and the associated disturbance, where there are over 70,000 visitors to the site during the breeding season and no impact on the breeding seals or pups (SCOS, 2019).

Compared with other times of the year, grey seals in the UK spend longer hauled out during their annual moult (between December and April) and during their breeding season (SCOS, 2019). In eastern England, pupping occurs mainly between early November and mid-December (SCOS, 2019). Pups are typically weaned 17 to 23 days after birth, when they moult their white natal coat and then remain on the breeding colony for up to two or three weeks before going to sea (SCOS, 2019).

The main breeding and haul-out sites (**Figure 10.2**) for grey seal on the east coast of England are located at the Farne Islands (117km from proposed dredge area), Donna Nook in the Humber Estuary (173km from proposed dredge area), the Wash (233km from proposed dredge area) and at Blakeney Point (244km from proposed dredge area). With smaller haul-out sites located at Ravenscar (57km from proposed dredge area), Filey Brigg (81km from proposed dredge area) and at Seal Sands (3km from the proposed dredge footprint).

Diet and prey species

Grey seal are generalist feeders and will prey upon a variety of species. The most common food sources for grey seal are sandeels, gadoid species (such as cod, haddock, whiting and ling *Molva molva*) as well as flatfish species (such as plaice *Pleuronectes platessa*, sole *Soleidae sp.*, flounder and dab *Limanda limanda*), however this does vary from season and by location (Hammond and Grellier, 2006). Food requirements for grey seal will depend on a number of factors, such as its size and fat content of the prey, but a general estimate is that a typical grey seal requires four to seven kilograms of prey a day, depending on the prey species (SCOS, 2019).

Grey seals typically forage in the open sea and foraging trips can last anywhere between one and 30 days (SCOS, 2019).

10.4.2.3 Harbour seal

Distributions and abundance

On the east coast of Britain, the distribution of harbour seal is generally restricted with concentrations in the major estuaries of the Thames, The Wash and the Moray Firth. Approximately 16% of the UK harbour seal population is in England, with the majority (81%) in Scotland (SCOS, 2019).

Harbour seals are counted on land during their August moulting period, which gives a minimum population estimate. Combining the most recent counts available (2014 to 2018) gives a total count of 33,000 harbour seals in the UK (26,864 of which are in Scotland), and scaling this to reflect the number of seals missed by not being hauled-out, gives a total UK population estimate of 45,800 (95% CI = 37,500-61,100) in 2018 (SCOS, 2019).

The most recent harbour seal count (2015 to 2018) for the North-East of England MU is 79 (SCOS, 2019). Seal Sands is the only major haul-out location for harbour seal in this MU. The potential impacts arising from the proposed scheme are put into the context of the North-East England MU of 79 harbour seal.

Seals Sands is located approximately 3km from the proposed dredge footprint at its closest point. The Tees Seals Research Programme 2019 surveys occurred within the pupping season and covered a period of 28 days from mid-June to mid-July 2019. A total of 24 harbour seal pups were counted in the 2019 season; the highest count over previous years. The number of harbour seals at the site has been steadily increasing over previous years, with the 11% increase over the previous three years. The maximum count of harbour seal in 2019 was 139, while the 2018 count was 112 (INCA, 2019). The potential impacts of the proposed scheme on harbour seal are also put into the context of the Seal Sands count of 139.

The seal at-sea seal usage maps produced by SMRU (Russel *et al.,* 2017) indicate that the harbour seal usage is relatively low in and around the proposed dredge footprint plus a 1km buffer, with a harbour seal density of 0.0003/km^2, decreasing to 0.00009/km^2 at the offshore disposal area (Russel *et al.,* 2017). The density estimate of 0.0003/km^2 has been used to determine the potential impacts of the proposed scheme (**Section 10.5 and10.5**). The density estimate of 0. 00009/km^2 has been used to determine the potential impacts at the offshore disposal site (**Section 26**).

Movements

SMRU, in collaboration with others, has deployed around 344 telemetry tags on harbour seals around the UK between 2001 and 2012 (Russell and McConnell, 2014). The tracks indicate that very few tagged harbour seals have been recorded in the Tees estuary area, with most tracks moving in and out of the Wash and along the coast between the Wash and the Thames estuaries.

Haul-out sites

Harbour seals come ashore in sheltered waters, often on sandbanks and in estuaries, but also in rocky areas. Harbour seals haul out on land regularly in a pattern that is often related to the tidal cycle (SCOS, 2019).

Harbour seal give birth to their pups in June and July and pups can swim almost immediately after birth (SCOS, 2019). Harbour seals moult in August and spend a higher proportion of their time on land during the moult than at other times (SCOS, 2019).

Figure 10.3 shows the location of the major harbour seal haul-out sites around the UK, based on the most recent seal counts for each site. There are principal harbour seal haul-out sites are at the Wash (233km from the proposed scheme), Donna Nook in the Humber Estuary (173km from the proposed scheme), Blakeney Point (244km from the proposed scheme) and at Scroby Sands (309km from the proposed scheme). Smaller haul-out sites are located at Seal Sands (approximately 3km from the proposed scheme footprint at its closest point). It should be noted that these sites are located within a different MU to that which the proposed scheme is within (with the exception of the Seal Sands site) (**Figure 10.3**).

Diet and prey species

Harbour seal take a wide variety of prey including sandeels, gadoids, herring and sprat, flatfish and cephalopods. Diet varies seasonally and regionally, prey diversity and diet quality also showed some regional and seasonal variation (SCOS, 2019). It is estimated that harbour seals eat three to five kilograms per adult seal per day depending on the prey species (SCOS, 2019).

Harbour seals generally make smaller foraging trips than grey seal, typically travelling 40 to 50km from their haul-out sites to foraging areas (SCOS, 2019). Tagging studies undertaken on harbour seal at The Wash have shown that this population will travel a larger distance for their foraging trips than for other harbour seal populations. Some individuals from the Wash travelled repeatedly over 200km to foraging areas, however there was a large variation in the distance travelled and the average was lower at 80km (Sharples *et al.,* 2012).

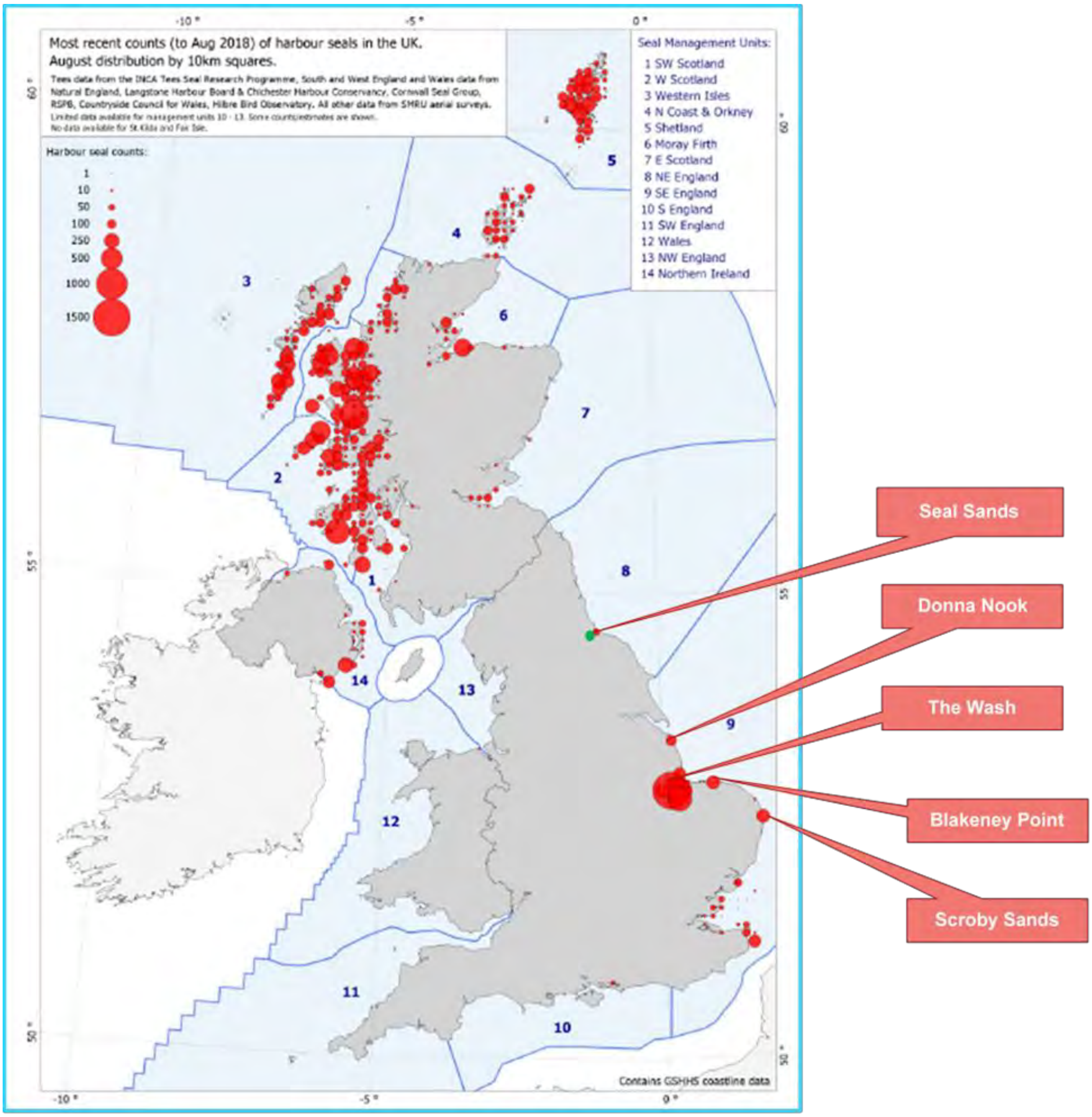

Figure 10.3 Location of the major harbour seal haul-out sites and the populations around the UK coasts (SCOS, 2019). The location of the proposed scheme is indicated by the green dot.

10.4.3 Summary of reference populations and density estimates

Table 10.5 below summarises the reference populations and density estimates that are used to inform the assessment for harbour porpoise, minke whale, grey seal and harbour seal.

Royal HaskoningDHV

Table 10.5 Reference populations and density estimates to inform the impact assessment for marine mammals

Species	Density estimate (per km^2)	Reference population
Harbour porpoise	0.888/km^2 (SCANS-III Block O; Hammond *et al.*, 2017)	345,373 (North Sea MU population estimate based on SCANS-III; Hammond *et al.*, 2017).
Minke whale	0.01/km^2 (SCANS-III Block O; Hammond *et al.*, 2017)	23,528 (Celtic and Greater North Seas MU population; Hammond *et al.*, 2017).
Grey seal	0.00008/km^2 for dredge footprint plus 1km buffer 0.014/km^2 for offshore disposal area plus 1km buffer (calculated from Russel *et al.*, 2017)	6,502 (North East England MU; SCOS, 2018).
Harbour seal	0.0003/km^2 for dredge footprint plus 1km buffer 0.00009/km^2 for offshore disposal site plus 1km buffer (calculated from Russel *et al.*, 2017)	79 (North East England MU; SCOS, 2018). 139 (Seal Sands harbour seal count; INCA, 2019).

10.4.4 Designated sites

10.4.4.1 Harbour porpoise

The nearest designated site for harbour porpoise is the Southern North Sea SAC. The summer area of the Southern North Sea SAC is located 98km from the proposed scheme footprint and 92km from the offshore disposal site. The winter area of the Southern North Sea SAC is located 127km from the proposed dredge footprint and 116km from the offshore disposal site.

There is no potential for any direct impacts on the Southern North Sea SAC, however there is the potential for harbour porpoise from the SAC to be affected if they are foraging or moving through the area that could be impacted by the proposed scheme. Therefore, this has been assessed in **Section 29**.

10.4.4.2 Grey seal

The nearest designated site where grey seal are a qualifying feature is the Berwickshire and North Northumberland Coast SAC, which is located 89km from the proposed scheme footprint and 82km from the offshore disposal site. There is no potential for any direct impacts on the Berwickshire and North Northumberland Coast SAC, however there is the potential for grey seal from the SAC to be affected if they are foraging or moving through the area that could be impacted by the proposed scheme. Therefore, this has been assessed in **Section 29**.

10.4.4.3 Harbour seal

The proposed dredge area is located within the Teesmouth and Cleveland Coast SSSI. Breeding harbour seal are listed as a feature of the Teesmouth and Cleveland Coast SSSI. 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 (3km from the proposed dredge footprint at its closest point). The potential impacts have therefore been assessed for harbour seal from the Teesmouth and Cleveland Coast SSSI.

The nearest SAC where harbour seal is a qualifying feature is The Wash and North Norfolk SAC, which is located 212km from the proposed scheme footprint and 201km from the offshore disposal site. There is no potential for any direct impacts on The Wash and North Norfolk SAC, however there is the potential for harbour seal from the SAC to be affected if they are foraging or moving through the area that could be impacted by the proposed scheme. Therefore, this has been assessed in **Section 29**.

10.5 Potential impacts during the construction phase

The potential impacts that have been assessed for marine mammals during the construction phase include:

- Underwater noise;
- Vessel interactions (collision risk);
- Disturbance at seal haul-out sites;
- Changes in water quality; and
- Changes to prey resource.

The underwater noise impact assessments for marine mammal species for the proposed scheme has been based on the recent underwater noise modelling conducted for the nearby consented Hartlepool approach channel scheme, located approximately 9km from the proposed scheme footprint. The assessment undertaken for the Hartlepool approach channel was undertaken using the most recent noise exposure criteria for marine mammals (National Marine and Fisheries Service (NMFS), 2018; Southall *et al*., 2019).

NMFS (2018) and Southall et al. (2019) presents unweighted peak criteria (SPLpeak) and cumulative (i.e. more than a single sound impulse), weighted sound exposure criteria (SELcum) for both permanent auditory injury (Permanent Threshold Shift; PTS) where unrecoverable hearing damage may occur and temporary auditory injury (Temporary Threshold Shift; TTS) where a temporary reduction in hearing sensitivity may occur in individual receptors. Marine mammals are categorised into hearing groups and weighting filters applied to approximate for the specific hearing abilities and sensitivities of each group. The NMFS (2018) and Southall et al. (2019) metrics and criteria used in the assessments are summarised in **Table 10.7**.

Table 10.7 NMFS (2018) and Southall et al. (2019) metrics and threshold criteria

Species or species hearing group	Impact	SPL_{peak} Unweighted (dB re 1 µPa)	SEL_{cum} Weighted (dB re 1 µPa²s)
Harbour porpoise High Frequency Cetaceans (HF)*	Auditory injury (PTS)	202	155
	TTS and fleeing response	196	140
Minke whale Low Frequency Cetaceans (LF)	Auditory injury (PTS)	219	183
	TTS and fleeing response	213	168
Grey seal and harbour seal Pinnipeds in water (PW)	Auditory injury (PTS)	218	185
	TTS and fleeing response	212	170

**Referred to as Very High Frequency cetaceans (VHF) by Southall et al. (2019)*

The Sound Pressure Level (SPL) is normally used to characterise noise and vibration of a continuous nature. The variation in sound pressure can be measured over a specific time period to determine the root mean square (RMS) level of the time varying acoustic pressure, therefore SPL (i.e. SPLRMS) can be considered as a measure of the average unweighted level of the sound over the measurement period. Peak SPLs (SPLpeak) are often used to characterise sound transients from impulsive sources. A peak SPL is calculated using the maximum variation of the pressure from positive to zero within the wave. This represents the maximum change in positive pressure (differential pressure from positive to zero) as the transient pressure wave propagates. The Sound Exposure Level (SEL) sums the acoustic energy over a measurement period, and effectively takes account of both the SPL of the sound source and the duration the sound is present in the acoustic environment.

To determine cumulative SEL (SELcum) ranges, a fleeing animal model has been used. This assumes that the animal exposed to high noise levels will swim away from the noise source. A constant fleeing speed of 1.5m/s has been used for harbour porpoise, grey seal and harbour seal (Otani *et al.,* 2000), with a swimming speed of 3.25m/s for minke whale (Blix and Folkow, 1995). This is considered a 'worst-case' scenario as marine mammals are expected to be able to swim faster. For example, the swimming speed of a harbour porpoise during playbacks of pile driving sounds (SPL of 154 dB re 1µPa) was 1.97m/s (7.1km/h) (Kastelein *et al.,* 2018).

Caution should be applied when interpreting the cumulative 'fleeing animal' modelling results. Due to the enclosed nature of the study area, some of the resultant modelling points within the results indicate 'extended' distances and some irregularly shaped impact areas. This is due to the assumption used within the fleeing animal model that when a transect line reaches the coastline or other blocking infrastructure, the receptor will travel along the transect until it reaches the end and from then on will remain in that location through the noise exposure event (dredging activity). This is a highly conservative approach, and likely has resulted in over-estimated impact ranges. However, the approach is necessary as it is not possible to accurately determine what a marine mammal may do in this situation. For loud sound sources, or for sources that are present for an extended period, this method can cause anomalous results in the calculated impact ranges. However, as stated above, this is considered the worst-case and has therefore been used to inform this assessment.

A study commissioned by PDT for the consented Hartlepool approach channel scheme (Subacoustech, 2018) determined the baseline noise levels for the Hartlepool approach channel. This identified that the majority of underwater noise present in the area was associated with weather, specifically noise from wave interactions, and the noise levels followed a pattern that correlated with the tidal water depth within the harbour (higher background noise levels were recorded at low tide and lower background noise levels were recorded in high tide). A number of 'noisier' events were also recorded; these consisted of mooring noise (from the movement of ropes and chains) and passing vessels. The loudest ambient noise recorded did not exceed 130 dB re 1µPa. It was therefore considered for the Hartlepool approach channel project that where the modelled noise levels for dredging works fell below 130 dB re 1µPa, they were of the order of ambient noise levels present within the area (Royal HaskoningDHV, 2018). It should be noted that the ambient noise survey undertaken at Hartlepool channel demonstrated that the threshold criteria for marine mammals used within the modelling would not be affected by pre-existing natural or anthropogenic noise sources typical of the region, and so is not considered further within this assessment.

10.5.1 Potential permanent auditory injury

PTS can occur instantaneously from acute exposure to high noise levels or as a result of prolonged exposure to increased noise levels (SELcum).

All species of cetaceans rely on sonar for navigation, finding prey and communication; they are therefore highly sensitive to permanent hearing damage (Southall *et al.,* 2007). As such, sensitivity to PTS is assessed as high for harbour porpoise and minke whale. Pinnipeds use sound both in air and water for social and reproductive interactions (Southall *et al.,* 2007), but not for finding prey. Therefore, Thompson *et al*. (2012) suggest damage to hearing in pinnipeds may not be as sensitive as it could be in cetaceans; however, using the precautionary approach, both seal species are given a sensitivity of high to the impact of PTS exposures. The effect would be permanent and marine mammals within the potential impact area are considered to have very limited capacity to avoid such effects, and unable to recover from the effects.

Underwater noise modelling undertaken for the consented Hartlepool approach channel project which is publicly available (Subacoustech, 2018) has been used to assess the impact ranges of dredging works required for the proposed scheme on marine mammals.
However, given the location of the modelling for Hartlepool approach channel scheme, the impact ranges are predicted to be greater with noise propagating over a wider area, due to the more open location compared to the location of the proposed scheme, which is located within the Tees estuary.

The Hartlepool approach channel underwater noise propagation modelling was undertaken using a parabolic equation being used for low frequencies (of 12.5Hz to 250Hz) and the ray tracing solver being used for high frequencies (of 315Hz to 100kHz) (Subacoustech, 2018). The activities that were assessed include:

- TSHD with an estimated sound source of 175.6 dB re 1µP SPL_{RMS} @ 1m; and.
- Backhoe dredger with an estimated sound source of 165.0 dB re 1 µPa SPL_{RMS} @ 1m.

The impact ranges are based on those modelled for the Hartlepool approach channel scheme using the NMFS (2018) and Southall *et al*. (2019) criteria. The maximum impact areas have been calculated for the proposed scheme, based on the maximum impact ranges for the worst-case location (closest point of the proposed dredging in the Tees Dock turning circle to the coast).

The results of the underwater noise modelling undertaken for Hartlepool approach channel show that at the source levels predicted for the dredging activities, any marine mammal would have to remain in close proximity (i.e. less than 10m) of the sound source for 24 hours to be exposed to levels of sound that are sufficient to induce PTS, based on the NMFS (2018) and Southall *et al*. (2019) threshold criteria. **Table 10.8** shows the modelled impact ranges and calculated areas of impact.

The number of harbour porpoise, minke whale, grey seal and harbour seal that could be at risk of PTS, as a result of underwater noise during dredging activities (**Table 10.9**) has been assessed based on the maximum number of animals that could be present in the maximum impact areas for dredging (**Table 10.8**).

Other potential underwater noise sources, including vessels and the placement of any rock armour in the berth pocket, would be the same or less than those modelled for dredging activities.

Table 10.8 Maximum predicted impact ranges (and areas) for any permanent auditory injury (PTS) from dredging activities based on Hartlepool approach channel underwater noise modelling (Subacoustech, 2018) and areas calculated for proposed scheme

Potential impact	Receptor	Criteria and threshold (NMFS, 2018 and Southall *et al*., 2019)	Modelled impact range (km) and area (km^2) for dredging
Risk of PTS from cumulative SEL during dredging	Harbour porpoise	173 dB re 1 µPa HF SEL_{cum}	<0.01km 0.003km^2
	Minke whale	199 dB re 1 µPa MF SEL_{cum}	<0.01km 0.003km^2
	Grey and harbour seal	201 dB re 1 µPa PW SEL_{cum}	<0.01km 0.003km^2

Table 10.9 Maximum number of individuals (and % of reference population) that could be at risk of any PTS as a result of underwater noise associated with dredging activities

Potential impact	Receptor	Estimated number of individuals in impact area (% of the reference population)	Magnitude
Risk of PTS from cumulative SEL during dredging	Harbour porpoise	0.0003 harbour porpoise (0.00000009% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Minke whale	0.000003 minke whale (0.00000001% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Grey seal	0.00000024 grey seal (0.000000004% of the NE England MU) based on density of 0.00008/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Harbour seal	0.0000009 harbour seal (0.000001% of the NE England MU; 0.0000007% of the Seal Sands haul-out site) based on density of 0.0003/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).

The magnitude of the potential impact of PTS as a result of dredging noise is negligible / very low for harbour porpoise, minke whale, grey seal and harbour seal, with less than 0.001% of the reference population likely to be affected for any PTS (**Table 10.9**).

The potential risk of any PTS that could result from underwater noise during the dredging works or other activities would be limited to the immediate vicinity of the dredging works while they are taking place only. The number of harbour porpoise, minke whale, grey seal and harbour seal that could be impacted (as shown in **Table 10.9**) are the maximum number of animals that could potentially be at risk of any auditory injury. However, it should be noted that only grey and harbour seal are likely to be in the area of the proposed dredging works.

Taking into account the high receptor sensitivity for PTS and the potential magnitude of the effect, the impact significance for any auditory injury as a result of underwater noise on harbour porpoise, minke whale, grey seal and harbour seal, has been assessed as **negligible** (**Table 10.10**).

Table 10.10 Assessment of impact significance for any PTS in marine mammals from underwater noise during construction

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
Auditory injury (PTS) from cumulative SEL during dredging	Harbour porpoise	High	Negligible / very low	Negligible	No mitigation required.	Negligible
	Minke whale		Negligible / very low	Negligible		Negligible
	Grey seal		Negligible / very low	Negligible		Negligible
	Harbour seal		Negligible / very low	Negligible		Negligible

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

10.5.2 Temporary auditory injury (TTS) and fleeing response

The dredging process emits continuous, broadband sound into the marine environment. SPLs can vary widely, dependent on the dredger type, operational stage, or environmental conditions (e.g. sediment type, water depth, salinity and seasonal phenomena such as thermoclines; Jones and Marten, 2016). These factors will also affect the propagation of sound from dredging activities and along with ambient sound already present, will influence the distance at which sounds can be detected.

Sound sources from a TSHD include the drag head on the seabed, material going through the underwater pipe, as well as sound sources from the vessel, such as inboard pump, thrusters, propeller and engine noise (CEDA, 2011; WODA, 2013). Noise measurements indicate that the most intense sound emissions from a TSHD are typically low frequencies, up to and including 1kHz (Robinson et al., 2011). Underwater noise from a TSHD is comparable to those for a cargo ship travelling at modest speed (between 8 and 16 knots) (Theobald *et al.,* 2011).

Based on reviews of published sources of underwater noise during dredging activities (e.g. Thomsen *et al.,* 2006; CEDA, 2011; Theobald *et al.,* 2011; WODA, 2013; Todd *et al.,* 2014), sound levels that marine mammals may be exposed to during dredging activities are usually below auditory injury thresholds or PTS exposure criteria. However, TTS cannot be ruled out if marine mammals are exposed to noise for prolonged periods (Todd *et al.,* 2014), although marine mammals remaining in close proximity to such activities for long periods of time is unlikely. Therefore, the potential risk of any auditory injury (permanent or temporary) in marine mammals as a result of dredging activity is highly unlikely.

Underwater noise has the potential to disturb marine mammals (Pirotta *et al*., 2013). Therefore, there is the potential for short, perhaps medium-term behavioural reactions and disturbance to marine mammals in the area during dredging activities. Marine mammals may exhibit varying behavioural reactions intensities as a result of exposure to noise (Southall *et al.,* 2019).

Other potential underwater noise sources, including use of vessels and the placement of any rock armour in the berth pocket, would be the same or less than those modelled for dredging activities.

Harbour porpoise, minke whale, grey seal and harbour seal are assessed as having medium sensitivity to TTS onset. The sensitivity of each receptor to TTS is assumed to be the same as fleeing response / likely disturbance. For harbour porpoise, minke whale, grey seal and harbour seal, a fleeing response is assumed to occur at the same noise levels as TTS and the potential impact is also described as ‘likely disturbance’. The behavioural response of individuals to a noise stimulus will vary, and not all individuals will respond at all, or in the same way, however, for the purpose of this assessment, it is assumed that at the ‘likely disturbance’ range (of TTS onset), 100% of the individuals exposed to the noise stimulus will respond and flee the area.

As a precautionary approach, marine mammals within the potential disturbance area are considered to have limited capacity to avoid such effects, although any disturbance to marine mammals would be temporary and they would be expected to return to the area once the disturbance had ceased or they had become habituated to the sound.

The predicted impact ranges are based on those modelled for the Hartlepool approach channel scheme (Subacoustech, 2018) using the NMFS (2018) and Southall *et al.* (2019) criteria. The maximum impact areas have been calculated for the proposed scheme, based on the maximum impact ranges and worst-case location (closest point of the proposed dredging in the Tees Dock turning circle to the coast).

The number of harbour porpoise, minke whale, grey seal and harbour seal that could be at risk of TTS or display a fleeing response, as a result of underwater noise during dredging activities (**Table 10.12**) has been assessed based on the number of animals that could be present in the maximum potential impact area (**Table 10.11**) for proposed dredging activities.

Table 10.11 Maximum predicted impact ranges (and areas) for any TTS and for fleeing response during dredging activities based on Hartlepool approach channel underwater noise modelling (Subacoustech, 2018) and areas calculated for proposed scheme

Potential Impact	Receptor	Criteria and threshold (NMFS, 2018 and Southall *et al.*, 2019)	Modelled Impact Range (km) and area (km^2) for dredging
TTS or fleeing response from cumulative SEL during dredging	Harbour porpoise	153 dB re 1 µPa HF SEL_{cum}	0.7km 0.61km^2
	Minke whale	179 dB re 1 µPa MF SEL_{cum}	<0.01km 0.003km^2
	Grey and harbour seal	181 dB re 1 µPa PW SEL_{cum}	<0.01km 0.003km$^{2)}$

Table 10.12 Maximum number of individuals (and % of reference population) that could be impacted as a result of underwater noise associated with proposed dredging activities

Potential Impact	Receptor	Estimated number of individuals in impact area (% of the reference population)	Magnitude
TTS or fleeing response to underwater noise during dredging	Harbour porpoise	0.5 harbour porpoise (0.0002% NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Minke whale	0.000003 minke whale (0.00000001% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Grey seal	0.00000024 grey seal (0.000000004% of the NE England MU) based on density of 0.00008/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Harbour seal	0.0000009 harbour seal (0.000001% of the NE England MU; 0.0000007% of the Seal Sands haul-out site) based on density of 0.0003/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).

The magnitude of the potential impact of TTS and fleeing response as a result of dredging noise, is negligible / very low for harbour porpoise, minke whale, grey seal and harbour seal, with less than 1% temporary disturbed (TTS and fleeing response) (**Table 10.12**).

The potential risk of any TTS or fleeing response that could result from underwater noise during the dredging works would be limited to the immediate vicinity of the dredging works while they are taking place only. The number of harbour porpoise, minke whale, grey seal and harbour seal that could be impacted are the maximum number of animals that could potentially be at risk of any TTS or fleeing response (**Table 10.12**).

However, it should be noted that only grey and harbour seal are likely to be in the area of the proposed dredging works.

Taking into account the medium receptor sensitivity for TTS and fleeing response and the potential magnitude of the effect, along with the temporary nature of the disturbance, the impact significance for any temporary auditory injury or behavioural impact as a result of underwater noise on harbour porpoise, minke whale, grey seal and harbour seal, has been assessed as **negligible** (**Table 10.13**).

Table 10.13 Assessment of impact significance for underwater noise on marine mammals during construction

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
TTS or fleeing response from cumulative SEL during dredging	Harbour porpoise	Medium	Negligible / very low	Negligible	No mitigation required.	Negligible
	Minke whale		Negligible / very low	Negligible		Negligible
	Grey seal		Negligible / very low	Negligible		Negligible
	Harbour seal		Negligible / very low	Negligible		Negligible

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

10.5.3 Vessel interactions (collision risk)

The vessels to be used during the proposed construction phase results in increased potential for collision risk to marine mammals. However, marine mammals present within or near to the proposed scheme footprint would be habituated to the presence of vessels given the existing levels of marine traffic through the estuary and would therefore be able to detect and avoid vessels. For this reason, harbour porpoise, minke whale, grey seal and harbour seal are considered to have a low sensitivity to the risk of a vessel strike.

Marine mammals are able to detect and avoid vessels. However, vessel strikes are known to occur, possibly due to distraction whilst foraging and socially interacting, or due to the marine mammals' inquisitive nature (Wilson et al., 2007). Therefore, increased vessel movements, especially those out-with recognised vessel routes, can pose an increased risk of vessel collision to harbour porpoise, minke whale, grey seal and harbour seal.

Studies have shown that larger vessels are more likely to cause the most severe or lethal injuries, with vessels over 80m in length causing the most damage to marine mammals (Laist *et al.,* 2001). Vessels travelling at high speeds are considered to be more likely to collide with marine mammals, and those travelling at speeds below 10 knots would rarely cause any serious injury (Laist *et al.,* 2001).

Harbour porpoise are small and highly mobile and given their responses to vessel noise (e.g. *Thomsen et al.,* 2006; Evans *et al.,* 1993; Polacheck and Thorpe, 1990), are expected to largely avoid vessel collisions. The Heinänen and Skov (2015) report indicates a negative relationship between the number of ships and the distribution of harbour porpoise in the North Sea, suggesting that the species could exhibit avoidance behaviour which reduces the risk of strikes.

The UK Cetacean Strandings Investigation Programme (CSIP) investigated the strandings of 22 species, over 12,000 cetaceans between 1990 to 2014. Cause of death was determined for 3,380 cetaceans of which 32 (0.95%) were a result of vessel strike[8].

Of the 274 reported harbour porpoise strandings in 2015 (latest UK CSIP Report currently available), 53 were investigated at post-mortem. A cause of death was established in 51 examined individuals (approximately 96% of examined cases). Of these, four (8%) had died from physical trauma of unknown cause, which could have been vessel strikes (CSIP, 2015). Approximately 4% of all harbour porpoise post-mortem examinations from the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS area) are thought to have evidence of interaction with vessels (Evans *et al.,* 2011). The UK CSIP report for 2015 reported a total of 18 minke whale strandings; four of which were investigated at post-mortem with none showing signs of vessel strike (CSIP, 2015). A total of 20 minke post-mortem undertaken through the ASCOBANS area revealed that three (15%) showed signs of physical trauma (Evans *et al*., 2011).

Although the risk of collision is likely to be low, as a precautionary worse-case scenario, the number of harbour porpoise, minke whale, grey seal and harbour seal that could be at increased collision risk with vessels during the proposed dredging has been assessed based on a very precautionary worst-case of up to 5% of the number of individuals that could be present in the area potentially being at increased collision risk (**Table 10.14**). The proposed dredge footprint is approximately 0.38km^2 in size (based on the dredge footprint of both the main site and turning circle). This is a highly precautionary assumption, as it is unlikely that marine mammals present in the area would be at increased collision risk with vessels, considering the minimal number of vessel movements compared to the existing number vessel movements in the area.

Table 10.14 Estimated number of harbour porpoise, minke whale, grey seal and harbour seal that could be present in the dredge footprint that could be at potential increased vessel collision risk

Potential impact	Receptor	Maximum number of individuals (% of reference population)	Magnitude
Potential increased collision risk during dredging (5% of animals in dredge area)	Harbour porpoise	0.02 harbour porpoise (0.000005% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Minke whale	0.0002 minke whale (0.0000009% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Grey seal	0.000002 grey seal (0.00000002% of the NE England MU) based on density of 0.00008/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Harbour seal	0.000005 harbour seal (0.000006% of the NE England MU; 0.000004% of the Seal Sands haul-out site) based on density of 0.0003/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).

Taking into account the receptor sensitivity of low for all species and the potential magnitude of the impact of negligible for harbour porpoise, minke whale, grey seal and harbour seal, the impact significance for any potential increase in collision risk with vessels during dredging has been assessed as **negligible** (not significant) for harbour porpoise, minke whale, grey seal and harbour seal (**Table 10.15**).

[8] *https://www.zsl.org/science/research/uk-cetacean-strandings-investigation-programme-csip*

Table 10.15 Assessment of impact significance for increased collision risk from vessels during dredging

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
Potential for increased collision risk from vessels during dredging	Harbour porpoise	Low	Negligible / very low	Negligible	No mitigation required, other than good practice.	Negligible
	Minke whale	Low	Negligible / very low	Negligible		
	Grey seal	Low	Negligible / very low	Negligible		
	Harbour seal	Low	Negligible / very low	Negligible		

Mitigation measures and residual impact

No mitigation measures are required beyond the implementation of good practice during construction works. The residual impact would be of **negligible** significance for harbour porpoise, minke whale, grey seal and harbour seal.

10.5.4 Disturbance at seal haul-out sites

The proposed scheme is within the Teesmouth and Cleveland Coast SSSI and breeding harbour seal are listed as a feature. Pupping tends to occur in June and July on the intertidal mud of Seal Sands.

As piling for the proposed new quay is to be undertaken on land, it is concluded that risks to marine mammals from underwater noise in the vicinity of the seal haul out sites would not be significant. In addition, although the proposed demolition activities would take place in the marine environment, these would be more than 4km from the Seal Sands haul-out site, therefore any airborne noise is unlikely to result in any disturbance to seals at this site. Such impacts are therefore not considered further and the assessment below focusses on potential airborne noise disturbance to hauled out seals as a result of vessel movements.

Harbour seals are present in the Tees estuary and the tidal Tees throughout the year, with regular haul outs at Greatham Creek and Seal Sands. As outline in **Section 10.4.2.2**, grey seal also haul-out at these sites. Harbour seals haul-out, typically on sandbanks and in estuaries, regularly in a pattern that is often related to the tidal cycle (SCOS, 2018). Harbour seals hauled out can be more sensitive during the breeding season (June and July), however, unlike grey seal, harbour seal pups can swim almost immediately after being born (SCOS, 2018).

Hauled-out seals are sensitive to disturbance, particularly if they are in their breeding or moult periods. As a worst-case scenario, it is assumed that the proposed construction works could be undertaken during the most sensitive periods.

The response of seals to disturbance at haul-out sites can range from increased alertness to moving into the water (Wilson, 2014). The potential impact on pupping groups can include temporary or permanent pup separation, disruption of suckling, energetic costs and energetic deficit to pups, physiological stress and sometimes enforced move to distant or suboptimal habitat. Potential impacts on moulting groups can include energy loss and stress, while impacts on other haul-out groups can cause loss of resting and digestion time and stress (Wilson, 2014). The potential impacts will be determined by the response of the seals, the duration and proximity of the disturbance to the seals.

Research has shown that harbour seals will flee from their haul-out sites if a vessel comes within 560m to 850m of their location, or if a pedestrian comes within 200 to 425m (Anderson *et al*., 2012). However, a study was carried out by SMRU (Paterson *et al.,* 2015) using a series of controlled disturbance tests at harbour seal haul-out sites, which consisted of regular (every three days) disturbance through direct approaches by vessel and effectively 'chasing' the seals into the water. The seal behaviour was recorded via GPS tags and found that even intense levels of disturbance did not cause seals to abandon their haul-out sites more than would be considered normal (for example seals travelling between sites), and they were found to haul-out again or to undertake a foraging trip in response to the disturbance (but would later return).

The closest seal haul-out site for both species is Seal Sands, approximately 3km from the closest point of the proposed dredge footprint. Due to the distance of the haul-out site from the proposed scheme, there is no potential for the dredge vessels to cause any disturbance to seals hauled out at the site, including the breeding and moult periods. Any vessels passing the seal haul-out sites, for example, as they take the dredged material offshore, would maintain the same distance from the sandbanks as vessels currently moving up and down the estuary. Vessel traffic is a regular occurrence in this area, meaning the seals present at the haul-out sites would be habituated to the presence of vessels. As a result, there would be no significant or additional disturbance of seals hauled out at the site.

The magnitude of the impact of vessel disturbance to seal haul-out sites is defined as negligible / very low due to the intermittent and temporary nature of the vessel disturbance and the already busy nature of vessel movements in the area. Seal species are highly protected and as such have a very high value. However, their sensitivity to the small increase in vessel disturbance and their habituation to the already high vessel use in the area, gives a sensitivity of low. Therefore, the overall sensitivity is considered to be medium, resulting in an overall impact significance of **negligible**.

Mitigation measures and residual impact

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

10.5.5 Changes in water quality

The proposed dredging and other underwater activities (namely demolition and removal of existing infrastructure and placement of rock into the berth pocket) would result in an increase in suspended sediment within the water column. However, marine mammals often inhabit turbid environments. Cetaceans utilise sonar to sense the environment around them and there is little evidence that turbidity affects cetaceans directly (Todd *et al*., 2014). Seals are not known to produce sonar for prey detection purposes; however, it is likely that other senses are used instead of, or in combination with, vision. Studies have shown that vision is not essential to seal survival, or ability to forage (Todd *et al.,* 2014).

Increased turbidity is unlikely to have a substantial direct impact on marine mammals that often inhabit naturally turbid or dark environments. This is likely because other senses are utilised, and vision is not relied upon solely. Therefore, any increases in suspended sediments during dredging or other activities will have a **negligible** impact on marine mammals.

Mitigation measures and residual impact

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

10.5.6 Changes to prey resource

Potential impacts on fish species during dredging and other underwater activities can result from the physical disturbance and temporary loss of seabed habitat; increased suspended sediment concentrations and sediment re-deposition; smothering and underwater noise.

As outlined in **Section 10.4**, harbour porpoise, minke whale, grey seal and harbour seal feed on a range of prey species and their diet can vary geographically and seasonally depending on available prey resources. Therefore, there sensitivity to any changes in prey availability as a result of the proposed dredging is considered to be low.

The potential impacts to marine ecology have been assessed in **Section 9** and potential impacts to fish are assessed in **Section 13**. However, as a very precautionary worst-case scenario, the potential changes to prey availability during the proposed dredging has been based on the dredge footprint of 0.38km^2 and the maximum number of harbour porpoise, minke whale, grey seal and harbour seal, that could be in the area and temporary impacted (**Table 10.16**).

Table 10.16 Estimated number of harbour porpoise, minke whale, grey seal and harbour seal that could be present in the dredge area that could be impacted by any changes to prey availability

Potential impact	Receptor	Maximum number of individuals (% of reference population)	Magnitude
Changes to prey resources in dredge area	Harbour porpoise	0.34 harbour porpoise (0.0001% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Minke whale	0.004 minke whale (0.00002% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Grey seal	0.00003 grey seal (0.0000005% of the NE England MU) based on density of 0.00008/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Harbour seal	0.0001 harbour seal (0.0001% of the NE England MU; 0.00007% of the Seal Sands haul-out site) based on density of 0.0003/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).

Taking into account the low receptor sensitivity, the negligible potential magnitude of the impact and the temporary nature of any changes to prey resources, the impact significance has been assessed as **negligible** for harbour porpoise, minke whale, grey seal and harbour seal (**Table 10.17**).

Table 10.17 Assessment of impact significance for any changes in prey resources for marine mammals

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
Changes to prey resource in dredge area	Harbour porpoise	Low	Negligible / very low	Negligible	No mitigation required.	Negligible
	Minke whale	Low	Negligible / very low	Negligible		
	Grey seal	Low	Negligible / very low	Negligible		
	Harbour seal	Low	Negligible / very low	Negligible		

Mitigation measures and residual impact

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

10.6 Potential impacts during the operational phase

The potential impacts that have been assessed for marine mammals during the operational phase include:

- Underwater noise during dredging;
- Vessel interactions (collision risk) during dredging and operational use of the quay;
- Disturbance at seal haul-out sites during dredging;
- Changes in water quality during dredging; and,
- Changes to prey resource during dredging.

It is important to note that there will be no changes to the overall maintenance dredging strategy currently undertaken by PDT during operation, with maintenance dredging currently undertaken virtually daily within the estuary. Therefore, there will be no increased risks or impacts associated with the maintenance dredging during the operational phase of the proposed scheme.

10.6.1 Underwater noise during maintenance dredging

Underwater noise predicted to be generated from maintenance dredging is considered to be the same or less as the underwater noise predicted to occur from the capital dredging activities. Therefore, the impact of maintenance dredging will be the same or less as that assessed for the construction phase (see **Section 10.5.1** and **10.5.2**). The magnitude of effect in all species is assessed to be negligible / very low based on the maximum number of animals that could be impacted as a result of underwater noise during the dredging works. The impact significance for harbour porpoise, minke whale, grey seal and harbour seal during maintenance activities has been assessed as **negligible** (**Table 10.10** and **Table 10.13**).

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

10.6.2 Vessel interactions (collision risk) during maintenance dredging

The potential for any increased collision risk during the maintenance dredging operations is considered to be the same or less as for vessel interactions during the construction phase, and therefore the impact of maintenance dredging will be the same or less as that assessed for the construction phase (see **Section 10.5.3**). The magnitude of effect in all species is assessed to be negligible / very low based on the maximum number of animals that could be at increased collision risk during the maintenance dredging. The impact significance for harbour porpoise, minke whale, grey seal and harbour seal during maintenance dredging has been assessed as **negligible** (**Table 10.15**).

Mitigation measures and residual impact
No mitigation measures are required beyond the implementation of best practice during maintenance dredging activities. The residual impact would be of **negligible** significance.

10.6.3 Disturbance at seal haul-out sites during maintenance dredging

The potential for any disturbance at seal haul-out sites during maintenance dredging is considered to be the same or less as that assessed for the dredging activities during the construction phase, and therefore the impact of maintenance dredging will be the same or less as that assessed for the construction phase. The impact significance for any disturbance at seal haul-out sites during maintenance dredging has been assessed as **negligible** (see **Section 10.5.4**).

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

10.6.4 Changes in water quality during maintenance dredging

The potential impact of any changes to water quality during maintenance dredging is considered to be the same or less as that assessed for the dredging activities during the construction phase, and therefore the impact of maintenance dredging will be the same or less as that assessed for the construction phase. The impact significance for any changes to water quality during maintenance dredging has been assessed as **negligible** (see **Section 10.5.5**).

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

10.6.5 Changes to prey resource during maintenance dredging

The potential impact of any changes to prey resources during maintenance dredging is considered to be the same or less as that assessed for the dredging activities during the construction phase, and therefore the impact of maintenance dredging will be the same or less as that assessed for the construction phase. The impact significance for any changes to prey resources during maintenance dredging has been assessed as **negligible** (see **Section 10.5.6**).

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

10.6.6 Increase in vessels during operational phase

As the existing quays within the proposed scheme footprint are unused, the proposed scheme would result in an increased number of vessels in the area during the operational phase. The potential implications of such an increase in vessels is considered further below.

It has been estimated that up to 390 vessel calls would take place at the facility on an annual basis. However, this a relatively small increase in relation to the number of vessels currently using the Tees Estuary. There are between 800 and 950 vessel movements per month (approximately 9,600 to 11,400 per year) within the Tees estuary (see **Section 14**). Therefore, it is considered unlikely that there would be increase in disturbance to marine mammals as a result of the increase in vessels during the operational phase.

There is also unlikely to be any increase in collision risk, as vessels would be slow moving and using established vessel routes. The magnitude of effect in all species is assessed to be negligible / very low based on the maximum number of animals that could be at increased collision risk. The impact significance for harbour porpoise, minke whale, grey seal and harbour seal has been assessed as **negligible** (**Table 10.15**).

Mitigation measures and residual impact
No mitigation measures are required beyond the implementation of good practice. The residual impact would be of **negligible** significance.

11 TERRESTRIAL ECOLOGY

11.1 Introduction

This section of the EIA Report considers the following potential environmental impacts:

- impacts to nature conservation designated sites;
- direct loss of habitat; and,
- death, injury or disturbance of legally protected and/or notable species.

As reported in **Section 3**, invasive species have been identified within the landward parts of the proposed scheme footprint, namely Japanese rose and Japanese knotweed. **Section 3** also defines the works which are proposed to manage the presence of such invasive species and minimise the risk of them spreading. Potential impacts associated with invasive species are therefore not considered further within this section of the EIA Report.

11.2 Policy and consultation

Information on the relevance of the legislation, planning policy and guidance is presented in **Section 4** of this EIA Report. The information presented in this section relates to terrestrial ecology only.

11.2.1 Policy

Natural Environment White Paper (2011)
The paper was the first White Paper produced by the Government in 20 years. The paper contains plans to reconnect nature, connect people and nature for better quality of life and capture and improve the value of nature.

Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services
The Strategy sets out how England will implement the 2010 Aichi Biodiversity Targets, the European Commission's 2011 EU Biodiversity Strategy and the recommendations of the 2011 Natural Environment White Paper. It contains the following relevant targets:

- Better wildlife habitats with 90% of priority habitats in favourable or recovering condition and at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition.
- More, bigger and less fragmented areas for wildlife, with no net loss of priority habitat and an increase in the overall extent of priority habitats by at least 200,000 ha.
- By 2020, at least 17% of land and inland water in England, especially areas of importance for biodiversity and ecosystem services, conserved through effective, integrated and joined up approaches to safeguard biodiversity and ecosystem services including through management of our existing systems of protected areas and the establishment of nature improvement areas.
- Restoring at least 15% of degraded ecosystems as a contribution to climate change mitigation and adaptation.
- By 2020, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced extinctions of known threatened species.
- By 2020, significantly more people will be engaged in biodiversity issues, aware of its value and taking positive action.

Table 11.1 provides detail on key pieces of International and UK legislation which are relevant to terrestrial ecology.

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Table 11.1 Key international and UK legislation relevant to ecology and nature conservation

Legislation	Relevance
The Conservation of Habitats and Species Regulations 2017 (or 'The Habitats Regulations 2017') (Conservation of Habitats and Species Regulations, 2017)	These Regulations provide protection for specific habitats listed in Annex I and species listed in Annex II of the Habitats Directive. The Directive sets out decision making procedures for the protection of Special Areas of Conservation (SAC) and Special Protection Areas (SPA), implemented in the UK through The Conservation of Habitats and Species Regulations 2017. The Regulations make it an offence (subject to exceptions) to deliberately capture, injure, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 5. The Regulations require competent authorities to consider or review planning permission, applied for or granted, affecting a European site, and, subject to certain exceptions, restrict or revoke permission where the integrity of the site would be adversely affected.
The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.	Makes changes to the Conservation of Habitats and Species Regulations 2017 following the UK's exit from the European Union (EU).
Wildlife and Countryside Act 1981 (as amended) (WCA, 1981)	This Act makes it an offence (subject to certain exceptions) to intentionally: kill, injure, or take any wild bird; take, damage or destroy the nest of any wild bird while that nest is in use or being built; and take or destroy an egg of any wild bird. The Act makes it an offence to intentionally kill, injure or take any animal listed in Schedule 5 of the act and protects occupied and unoccupied places used for shelter or protection by such animals. The Act makes it an offence (subject to exceptions) to intentionally pick, uproot or destroy any wild plant listed in Schedule 8 of the Act. The Act makes it an offence to plant or otherwise cause to grow any non-native, invasive species listed under Part 2 of Schedule 9 of the Act. The Act makes provision for the notification and confirmation of Sites of Special Scientific Interest (SSSI).
The Protection of Badgers Act 1992 (Protection of Badgers Act, 1992)	The Act makes it an offence to wilfully kill, injure or take, or attempt to kill, injure or take a badger *Meles meles*; and to cruelly ill-treat a badger. The Act makes it an offence to intentionally or recklessly damage, destroy or obstruct a badger sett, or to disturb a badger whilst in a sett.
Natural Environment and Rural Communities (NERC) Act 2006 (NERC, 2006)	Section 41 of the Act requires the Secretary of State (SoS) to compile a list of habitats and species of principal importance for the conservation of biodiversity in England (herein 'S41 species'). Decision makers of public bodies, in the execution of their duties, must have regard to the conservation of biodiversity in England, and the list is intended to guide them.
The Hedgerow Regulations 1997 (Hedgerow Regulations, 1997)	The Regulations make it an offence to remove or destroy certain hedgerows without permission from the local planning authority and the local planning authority is the enforcement body for such offences.
Countryside and Rights of Way Act (CRoW)2000 (CRoW, 2000)	The Act amends the law relating to public rights of way including making provision for public access on foot to certain types of land. Amendments are made in relation to SSSIs to improve their management and protection, as well as to the Wildlife and Countryside Act 1981, to strengthen the legal protection for threatened species.

11.2.2 Guidance

The ecological impact assessment presented below has been based upon the following guidance and standards:

- Chartered Institute of Ecology and Environmental Management (CIEEM) (CIEEM, 2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal;
- British Standard 42020:2013 – Biodiversity. Code of Practice for planning and development;
- Construction Industry Research and Information Association (CIRIA) C648 (2006) Control of water pollution from linear construction projects (CIRIA, 2006); and,
- CIRIA Guidance note C692 Environmental Good Practice on Site Guide (3rd Edition – CIRIA, 2010).

The following species-specific guidance and standards have been used during the assessment process:

- Standing advice on protected species (bats (all species), great crested newts *Triturus cristatus*, badgers, water voles *Arvicola amphibius*, otters *Lutra lutra*, reptiles, protected plants, invertebrates, white-clawed crayfish *Austropotamobius pallipes*, ancient woodlands and veteran trees) (Natural England, 2015);
- British Standard 5837: 2012 – Trees in relation to design, demolition and construction;
- Bat Conservation Trust and Institute of Lighting Engineers (2018) Bats and Artificial Lighting in the UK (ILE, 2018);
- The Water Vole Mitigation Handbook (The Mammal Society Guidance Series) (Dean et al, 2016);
- Reptile Habitat Management Handbook (Edgar et al, 2010);
- Great Crested Newt Mitigation Guidelines (English Nature, 2001);
- Herpetofauna Worker's Manual (Joint Nature Conservation Committee (JNCC), 2003);
- Otters: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2014);
- Badgers: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2015);
- Bats: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2015);
- Great crested newts: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2015);
- Invertebrates: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2015);
- Reptiles: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2015);
- Water voles: surveys and mitigation for development projects. Natural England Standing Advice (Natural England, 2015);
- Water Vole Conservation Handbook, 3rd Edition (Strachan and Moorhouse, 2011); and,
- Great Britain (GB) Non-native Species Information (GB Non-native secretariat, 2015).

11.2.3 Consultation

To inform this Ecological Impact Assessment (EcIA), Tees Valley Combined Authority has undertaken planning consultation with relevant stakeholders. Consultation responses relevant to terrestrial ecology are presented in **Table 11.2**.

Table 11.2 Consultation comments and responses

Date	Comment	Response
24/07/2020	Natural England advised on Priority Habitat as identified on Section 41 list of the Natural Environmental and Rural Communities (NERC) Act 2006, noting that the development will result in a loss of open mosaic, lowland calcareous grassland, open waters, broad leaved woodland, coastal saltmarsh, intertidal mud and reedbed priority habitats, which will be subsequently mitigated for through measures in the forthcoming Environmental and Biodiversity Strategy for the wider South Tees Development Corporation area.	Terrestrial habitats and associated species present within the footprint of the proposed scheme are detailed in **Section 11.5.**
	Natural England advised reference to their standing advice on Protected Species	As detailed in **Section 11.2**, the Natural England standing advise relevant to the proposed scheme has been used to inform this EcIA.
	Natural England requested considering the impacts of the proposed development on any local wildlife or geodiversity sites, in line with paragraphs 171 and 174 of the NPPF and any relevant development plan policy.	Impacts on Local Wildlife Sites (LWS) are considered in **Section 11.5.**
	Natural England requested consideration be given to the potential environmental value of brownfield sites, often found in urban areas and former industrial land, including open mosaic habitat.	Open mosaic habitat has not been recorded within the footprint of the proposed scheme during the surveys undertaken to date. The habitats and species that have been recorded within the footprint of the proposed scheme are assessed in **Section 11.5**.
	Natural England advised following the mitigation hierarchy as set out in paragraph 175 of the NPPF, with consideration for off-site measures where onsite measures are not possible.	STDC is in the process of developing a South Tees Regeneration Masterplan Environment & Biodiversity Strategy (the 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 which is the subject of this report). The extent and location of compensatory habitat creation and enhancements will be agreed with Natural England and RCBC. It is anticipated that the measures outlined in the Strategy will mean that the proposed scheme results in a biodiversity net gain.
14/08/2020	Environment Agency advised the following on Biosecurity - 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.	Biosecurity protocols are discussed in **Section 11.5**.

11.3 Methodology

11.3.1 Study area

The study area for this section of the EIA Report comprises the area which has the potential to be both directly and indirectly impacted by the proposed scheme. In this case, the maximum extent of the potential impact has been determined to be the area over which the potential effects of the proposed scheme on terrestrial ecology receptors could occur. Different study areas have been used for different receptors (**Table 11.3**) depending on their sensitivity and their habitat preferences. These study areas were selected according to standard industry guidance (CIEEM, 2018), as well as using professional judgement and experience.

Table 11.3 Study areas used for terrestrial ecology receptors considered in this EIA Report

Data/survey	*Study area*
Protected and notable species (excluding great crested newts, birds and bats)	Within and up to 2km from the proposed scheme footprint.
Great crested newts	Within and up to 250m from the proposed scheme footprint.
Bats and birds	Within and up to 5km from the proposed scheme footprint.
Statutory and non-statutory designated sites	Within and up to 2km from the proposed scheme footprint.
UK Habitats of Principle Importance (UKHIP) and Forestry habitats	Within and up to 2km from the proposed scheme footprint.
Statutory sites and associated impact risk zones (IRZ)	Within and up to 2km from the proposed scheme footprint.
Extended Phase 1 Habitat Survey	Within and up to 50m from the proposed scheme footprint.

11.3.2 Methodology used to describe the existing environment

11.3.2.1 Desk study

A desk study was undertaken to obtain information on terrestrial ecology receptors. The data sources that have been used to inform this EcIA are summarised in **Table 11.4**.

Table 11.4 Summary of data sources used to inform this EcIA

Data source	*Date reviewed*	*Data contents*	*Coverage*
Joint Nature Conservation Committee (JNCC)	July 2020	European designated sites (SPA, SAC, Ramsar sites)	Within and up to up to 2km from the proposed scheme footprint.
JNCC/MAGIC Natural England	July 2020	UK designated sites (SSSI), National Nature Reserve (NNR), Local Nature Reserve (LNR)	Within and up to up to 2km from the proposed scheme footprint.
JNCC/MAGIC Forestry Commission	July 2020	UK Habitats of Principle Importance, Ancient Woodland, Woodland categories	Within and up to up to 2km from the proposed scheme footprint.

Data source	*Date reviewed*	*Data contents*	*Coverage*
Environmental Records Information Centre North East (ERIC NE)	May 2020	Locally designated sites (LWS). Protected and notable species including: • Wildlife and Countryside Act 1981 Schedules 1, 5, 8 & 9; • The Conservation of Habitats & Species Regulations 2017 Schedules 2 & 5; • Protection of Badgers Act 1992; • Bonn Convention Appendix 1 & 2; • Bern Convention Annex 2, 4, & 5; • Habitats Directive Annex 2, 4 & 5; • NERC Act 2006 Section 41 species; • UK BAP (Biodiversity Action Plan) species (both local and national); • IUCN (International Union for Conservation of Nature), Red List Species; • Nationally Notable species; • Locally rare species.	Within and up to up to 2km (5km for bats and birds) from the proposed scheme footprint.
Ordnance Survey (OS)	July 2020	Large-scale mapping to determine the presence of ponds that may be suitable for great crested newts.	Within and up to up to 250m from the proposed scheme footprint.

11.3.2.2 Site specific surveys

An Extended Phase 1 Habitat Survey (EP1HS) was undertaken in 2019 (on behalf of Arup as part of the adjacent landside EIA development) and 2020 (for the proposed scheme which is subject of this report) by the Industry Nature Conservation Association (INCA). The footprint surveyed during the 2019 EP1HS overlapped with the proposed scheme footprint, and this data has therefore been used to inform the baseline. The 2020 EP1HS recorded the broad habitat types within the proposed scheme footprint and up to 50m from its boundaries. The potential for and/or evidence of protected or otherwise notable species to be present within the proposed scheme footprint was also noted as part of the EP1HS.

Both the 2019 and 2020 EP1HS was undertaken by Ian Bond and Mike Leaky from INCA, who are both experienced ecologists and competent botanists. The habitats were described using the Joint Nature Conservation Committee (JNCC) Phase 1 habitat survey methodology (JNCC, 2010) and the UK Habitat Classification Version 1.1 (Butcher *et al*, 2020). The habitat assessments were confined to the terrestrial areas within the proposed scheme footprint (they did not extend into the intertidal area).

The findings from both the 2019 and 2020 EP1HS have been used to establish the baseline conditions that are presented in **Section 11.4** and in turn used to inform the EcIA that has been undertaken and presented in **Section 11.5** and **Section 11.6**.

11.3.3 EcIA methodology

The EcIA methodology for this section of the report is based on the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2018). These guidelines aim to predict the residual impacts on important ecological features affected, either directly or indirectly by a development, once all the appropriate mitigation has been implemented.

The approach to determining the significance of an impact follows a systematic process for all impacts. This involves identifying, qualifying and, where possible, quantifying the sensitivity and value of all ecological receptors and magnitude of effects which have been scoped into this assessment. Using this information, the significance of each potential impact has been determined. Each of these steps is set out in the remainder of this section.

The EcIA has used professional judgement to ensure the assessed significance level is appropriate for each individual receptor, taking account of local values for biodiversity to avoid a subjective assessment wherever possible, as per the CIEEM guidelines. As a result, the assessed significance level may not always be directly attributed to the guidance matrix detailed below.

11.3.3.1 Importance

The first stage of an EcIA is determining the 'importance' of ecological features or 'receptors'. CIEEM identifies the important ecological features as those key sites, habitats and species which have been identified by European, national and local governments and specialist organisations as a key focus for biodiversity conservation in the UK. These include:

- Statutory and non-statutory designated sites for nature conservation;
- Species occurring on national biodiversity lists;
- UK HPIs; and,
- Red listed, rare or legally protected species.

Importance is also qualified by the geographic context of an ecological receptor; for example, a species which may not be recognised on a national biodiversity list may be locally in decline, and therefore its local importance would be greater than its national importance in this instance.

For this EcIA, the guidelines outlined in **Table 11.5** will be followed to provide the relative importance of different ecological features.

CIEEM places the emphasis on using professional judgement when considering importance of ecological receptors, based on available guidance, information and expert advice (CIEEM, 2016). Various aspects of ecological importance should be taken into account, including designations, biodiversity value, potential value, secondary or supporting value, social value, economic value, legal protection and multi-functional features.

Table 11.5 Definition of terms relating to receptor value and/or importance

Ranking	Habitats
Very high	Habitats or species that form part of the cited interest within an internationally protected site, such as those designated under the Conservation of Habitats and Species Regulations (e.g. SPAs) or other international convention (e.g. Ramsar site). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in an international/national context, such that the site is likely to be designated as a site of European importance (e.g. SAC or SPA).
High	Habitats or species that form part of the cited interest within a nationally designated site, such as a SSSI or NNR. A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a national context for which the site could potentially be designated a SSSI. Species that are protected under the Wildlife and Countryside Act 1981 (as amended) or Conservation of Habitats and Species Regulations (2017).

Ranking	Habitats
	Presence of habitats or where the action plan states that all areas of representative habitat or individuals of the species should be protected.
Medium	A feature (e.g. habitat or population), which is either unique or sufficiently unusual to be considered as being of nature conservation value from a county to regional level. Habitats or species that form part of the cited interest of an LNR, or some local-level designated sites, such as a local wildlife site (LWS), also referred to as a non-statutory Site of Importance for Nature Conservation or the equivalent (e.g. Ancient Woodland). Presence of habitats or species listed under Natural Environment and Rural Communities (2006) Schedule 41. LBAP habitats or species, where the action plan states that all areas of representative habitat or individuals of the species should be protected.
Low	A feature of importance at local level. A feature (e.g. habitat or population) that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation.
Negligible	A feature of importance at a local level. Commonplace feature of little or no habitat/historical significance. Loss of such a feature would not be seen as detrimental to the ecology of the area.

11.3.4 Sensitivity

Sensitivity is not an inherent characteristic of a receptor or resource. Receptor or resource sensitivity is the degree to which it is tolerant of, adaptable to and able to recover from a change in its environment. Therefore, in addition to considering the importance/quality/value of the affected receptor or resource, its response (or sensitivity) to a particular impact is also considered. This is typically informed by literature review and the baseline environment evidence base. Detail regarding the definition of terms relating to receptor sensitivity is provided in **Table 11.6**.

Table 11.6 Definition of terms relating to receptor sensitivity

Ranking	Tolerance	Adaptability	Recoverability / reversibility
High	Receptor unable to tolerate effect resulting in permanent change it its abundance or quality.	Receptor unable to avoid impact.	Receptor unable to recover resulting in permanent or long-term change (e.g. > 10 years).
Medium	Receptor has some ability to tolerate this effect but a detectable change (e.g. a change in distribution) will occur.	Receptor has some ability to avoid the most negative consequences of the impact or can partially adapt to it (e.g. by moving to other suitable areas).	Receptor recovers to an acceptable status over the short term to medium term (e.g. 1-10 years).
Low	Receptor unaffected.	Receptor can completely avoid the impact or adapt to it with no detectable changes.	Receptor recovers full within the short-term (e.g. 1 year).

11.3.5 Magnitude

The magnitude of the impact is assessed according to:

- the extent of the area subject to a predicted impact;
- the duration the impact is expected to last prior to recovery or replacement of the resource or feature;

- whether the impact is reversible, with recovery through natural or spontaneous regeneration, or through the implementation of mitigation measures or irreversible, when no recovery is possible within a reasonable timescale or there is no intention to reverse the impact; and,
- the timing and frequency of the impact, i.e. conflicting with critical seasons or increasing impact through repetition.

Table 11.7 summarises the definitions of magnitude that have been used for the ecological receptors.

Table 11.7 Definition of terms relating to magnitude of an impact

Ranking	Habitat	Environmental factors (e.g. presence, ambient air quality, noise)
High	Widespread and/or permanent disturbance or loss of a habitat, threatening the long-term viability or function of the habitat.	Change over a large area that lasts over the medium to long term, likely to cause secondary effects on ecology and/or routine exceedance of benchmark limits. A long-term physical change that affects a large area or introduces a permanent physical barrier.
Medium	Localised disturbance and/or loss of habitat that does not threaten the long-term viability or function of the habitat.	Temporary or localised change and/or occasional exceedance of benchmark limits. A physical change in the medium term over a relatively large area.
Low	Minimal disturbance and/or loss of habitat, such that there is no loss of viability or function of the habitat.	Slight change expected over a limited area and returning to background levels within a few metres or tens of metres. No exceedances of benchmark limits. A temporary and localised physical change/source of disturbance.
Negligible	Immeasurable, undetectable or within the range of normal natural variation change to the extent and condition of habitat.	Change is within the normal range of natural variation.

11.3.6 Duration

The definitions of duration used within this EcIA are dependent on the individual ecological receptor, and how sensitive it is to effects over different timescales. However, in general terms the following definitions have been used:

- Short term – effects which at most occur over a part of – or over a part of a key period of – a species' active season or a habitat's growing season, i.e. typically effects which occur over a matter of days or weeks.
- Medium term – effects which occur over the full duration of a species' active season or a habitat's growing season, i.e. typically effects which occur over a matter of months or one year.
- Long term – effects which occur over the multiple active or growing seasons, i.e. typically effects which occur over more than one year.

11.3.7 Impact significance

Following the identification of receptor importance and magnitude of the effect, it is possible to determine the significance of the impact. Ecologically significant impacts are defined as:

> *'…impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)'* (CIEEM 2016a).

Impacts are unlikely to be significant where features of low importance are subject to small scale or short-term effects. If an impact is not significant at the level at which the resource or feature has been valued, it may be significant at a more local level.

CIEEM recommends that the following factors are taken into account when determining significance for selected ecological receptors:

- Designated sites – is the proposed scheme and associated activities likely to undermine the site's conservation objectives, or positively or negatively affect the conservation status of species or habitats for which the site is designated, or may it have positive or negative effects on the condition of the site or its interest/qualifying features?
- Ecosystems – is the project likely to result in a change in ecosystem structure and function?
- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area (CIEEM 2016a).

Following the identification of receptor importance and magnitude of effect, the significance of the impact has been considered using the matrix presented in **Table 11.8** below and knowledge of the ecological features affected.

The assessment of potential impacts has been undertaken assuming implementation of embedded mitigation and project commitments made as part of the design process. Where, following this assessment, likely significant impacts are identified, additional mitigation measures are then proposed. A final assessment of the residual impacts remaining following implementation of these additional mitigation measures is then made.
For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

Table 11.8 Matrix used for the assessment of the significance of the effect

		Negative magnitude				Beneficial magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Importance	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	**Minor**	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Minor**

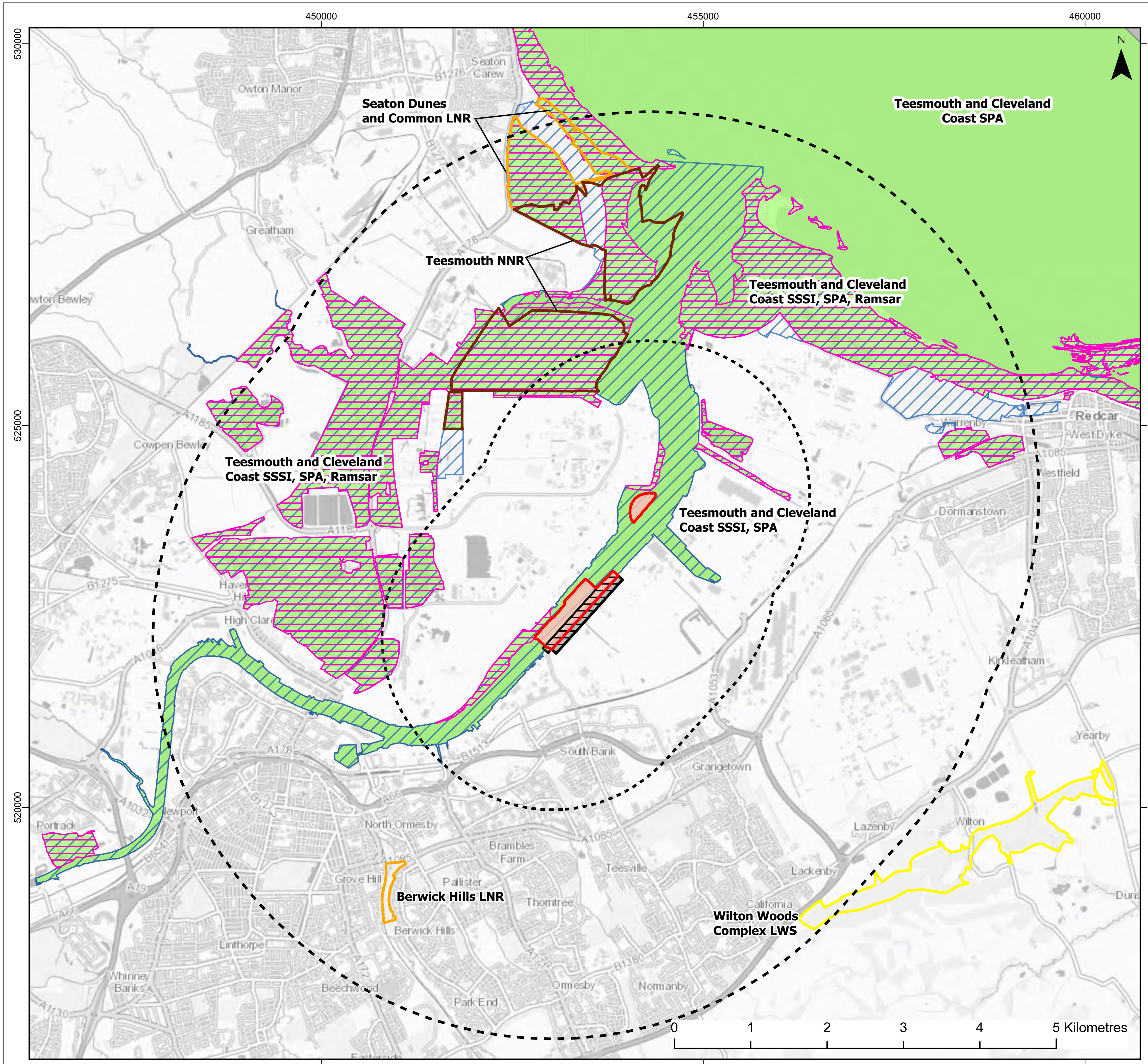
Following initial assessment, if the impact does not require additional mitigation (or none is possible) the residual impact will remain the same. If, however, additional mitigation is proposed there will be an assessment of the post-mitigation residual impact.

11.4 Existing environment

11.4.1 Designated sites

As shown on **Figure 11.1** and detailed in **Table 11.9**, there is one statutory designated site within 2km from the proposed scheme, namely the Teesmouth and Cleveland Coast SPA, SSSI and Ramsar site. Two LNRs, an NNR and an LWS are all present within the 5km buffer (detailed in **Table 11.9**).

As detailed in **Table 11.9**, some of the designated sites are protected for reasons which are not solely applicable to this section of the EIA Report (which concentrates on terrestrial ecology). Cross reference to the assessment presented in **Section 8**, **9**, **10** and **12** should be made to fully understand the significance of potential impacts to these sites.



Legend

- 5km Search Area
- 2km Search Area
- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Special Protection Area (SPA): Teesmouth and Cleveland Coast
- Sites of Special Scientific Interest (SSSI): Teesmouth and Cleveland Coast
- Ramsar Site: Teesmouth and Cleveland Coast
- National Nature Reserve (NNR): Teesmouth
- Local Nature Reserve (LNR)
- Local Wildlife Site (LWS)

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Designated Sites

Figure: 11.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	27/10/2020	TC	CAS	A3	1:50,000

Co-ordinate system: British National Grid

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Table 11.9 Nature conservation sites within 2km of the proposed scheme

Site name	Designation	Approximate distance from the proposed scheme footprint	Reason for designation
Teesmouth and Cleveland Coast	SPA	Within the footprint of the proposed scheme	The extensions to the Teesmouth and Cleveland Coast SPA were formally classified on 16 January 2020. This site supports internationally important population of breeding little tern *Sterna albifrons*, common tern *Sterna hirundo*, and pied avocet *Recurvirostra avosetta*. This site also supports internationally important population of non-breeding Sandwich tern *Thalasseus sandvicensis*, ruff *Calidris pugnax*, red knot *Calidris canutus* and common redshank *Tringa totanus*. This site is known to support an internationally important seabird assemblage, regularly used by more than 20,000 wintering waterbirds.
Teesmouth and Cleveland Coast	Ramsar	Immediately adjacent	The extensions to the Teesmouth and Cleveland Coast Ramsar site were formally classified on 16 January 2020. This site is designated as a Wetland of international importance under Ramsar criterion 5 for assemblages of international important numbers of waterbirds and Criterion 6 for regularly supporting 1% of the individuals in a population of more than one species of waterbird. This site is also designated for peak counts of common redshank in spring and autumn and wintering red knot.
Teesmouth and Cleveland Coast	SSSI	Within the footprint of the proposed scheme	Teesmouth and Cleveland Coast SSSI was formally adopted on 18 April 2019, expanding the previous extent of the same SSSI, and absorbing seven SSSIs previously present within the region Site incorporates a mosaic of coastal and freshwater habitats, with the following designated features: i. Jurassic geology; ii. Quaternary geology; iii. Sand dunes; iv. Saltmarshes; v. Breeding harbour seals *Phoca vitulina*; vi. A diverse assemblage of breeding birds of sand dunes, saltmarsh and lowland open waters and their margins; vii. Non-breeding shelduck *Tadorna tadorna*, shoveler *Spatula clypeata*, gadwall *Mareca strepera*, ringed plover *Charadrius hiaticula*, red knot, ruff, sanderling *Calidris alba*, purple sandpiper *Calidris maritima*, common redshank, and Sandwich tern; viii. An assemblage of more than 20,000 waterbirds during the non-breeding season; and ix. A diverse assemblage of invertebrates associated with sand dunes.
Teesmouth	NNR	1.5 km	Site is designated for its sand dunes, marsh habitats, and intertidal sand and mudflat habitats. The reserve is split into two main sections, namely North Gare and Seal Sands. North Gare is an area of dunes and grazing marsh, supporting lapwing *Vanellus vanellus* and curlew *Numenius arquata*. Seal Sands is one of the largest areas of intertidal mudflat along the North East England coastline. As reported in **Section 6**, the zone of influence in terms of hydrodynamic and sedimentary plume effects would not extend to these areas and therefore no impact on these features would occur.

Site name	Designation	Approximate distance from the proposed scheme footprint	Reason for designation
Seaton Dunes and Common	LNR	3.3 km	Seaton Common covers approximately 75ha and its primary importance is as a wet grassland which attracts vast numbers of passage migrants over winter and as a breeding ground for birds in the summer months. Seaton Dunes covers approximately 32ha and forms one of the largest sand dune systems between Lindisfarne and the Humber, with associated dune flora. As reported in **Section 6**, the zone of influence in terms of hydrodynamic and sedimentary plume effects would not extend to these areas and therefore no impact on these features would occur.
Berwick Hills	LNR	3.3 km	Berwick Hills contains wildflower meadows, woodlands and ponds.
Wilton Woods Complex	LWS	4.7 km	This is afforded protection as an Ancient Woodland.

11.4.2 Habitats

The Priority Habitats within and up to 2km of the proposed scheme footprint are shown on **Figure 11.2**. The only Priority Habitat within the proposed scheme footprint is reported as mudflat which is limited to the intertidal area and therefore discussed in detail in **Section 9.**

The EP1HS divided the terrestrial habitat within the proposed scheme footprint into habitat types which comprised areas noted to be similar in both their habitat type and condition. Habitats were recorded and mapped during the EP1HS, as shown on **Figure 11.3,** including the habitat data provided by Arup for the adjacent land EIA development. The main terrestrial habitat within the footprint of the Proposed Scheme was recorded as modified grassland, with some neutral grassland, ephemeral / ruderal and mixed scrub also present. Approximately one third of the proposed scheme footprint is classed as urban / developed land with a sealed surface and of no ecological value. Further information relating to each habitat is provided below and presented in **Table 11.10**.

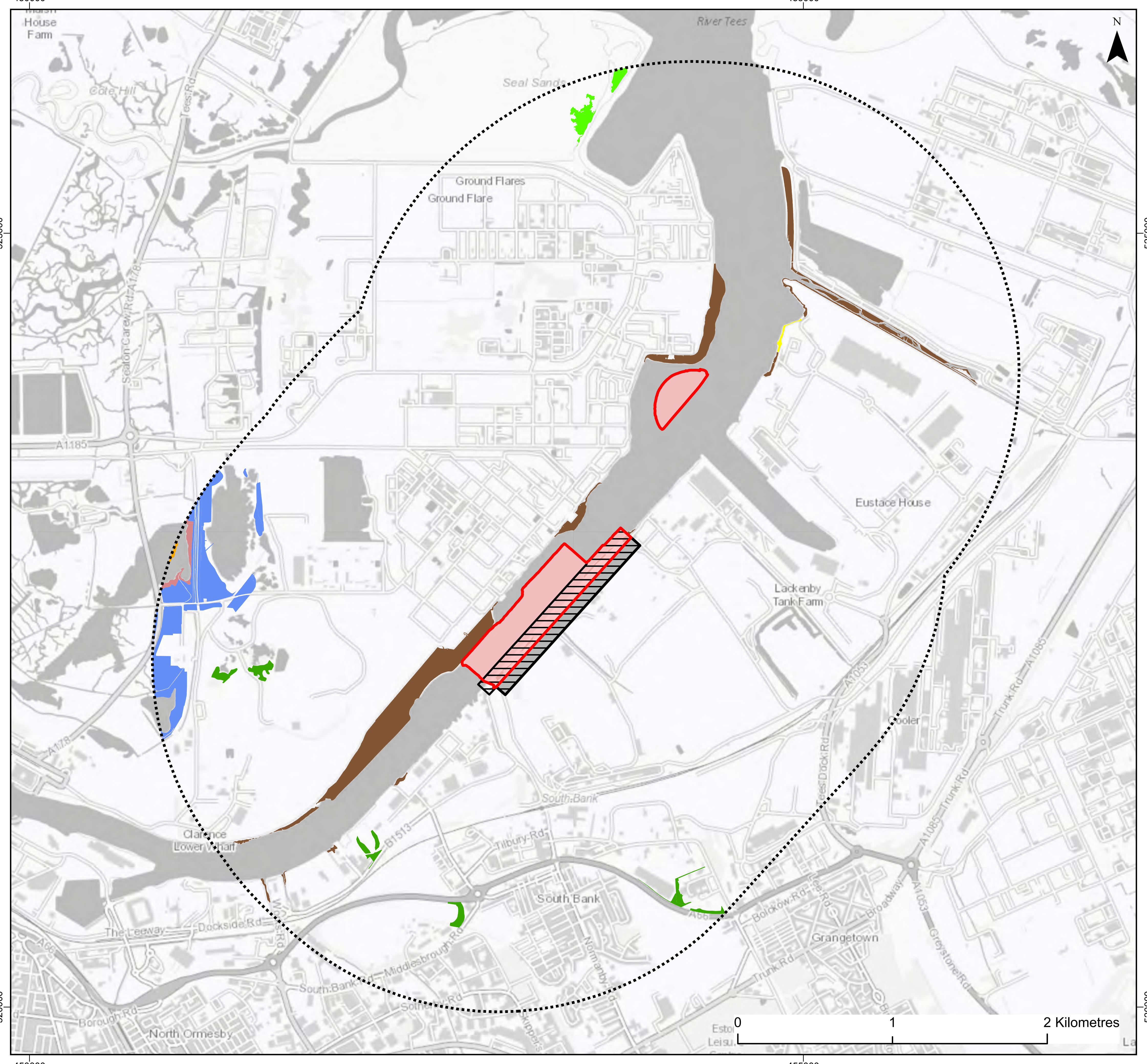
Table 11.10 Areas of habitat within the proposed scheme footprint

Habitat type	Area (ha)
Grassland - Other modified grassland	4.69
Grassland - Other neutral grassland	1.33
Heathland and shrub - Mixed scrub	0.19
Other woodland, broadleaved	0.04
Sparsely vegetated land - Ruderal/Ephemeral	2.05
Urban - Developed land; sealed surface	4.64

UK Habitat Classification: g4 Modified Grassland; JNCC Habitat: Poor Semi-improved

This habitat type is assumed to be present where a layer of soil covers coal or other substrates. The EP1HS noted that circa 50% of the proposed scheme footprint comprises this habitat type. A series of mounds of tipped material line the side of the road. These were sparsely vegetated and therefore classified as artificial and unsealed surfaces.

450000 455000



525000 520000

Legend

- 2km Search Area
- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Priority Habitat Inventory

- Coastal and floodplain grazing marsh
- Coastal saltmarsh
- Deciduous woodland
- Lowland fens
- Mudflats
- Saline lagoons
- No main habitat but additional habitats present

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: Priority Habitats

Figure: 11.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	27/10/2020	TC	CAS	A3	1:25,000

Co-ordinate system: British National Grid

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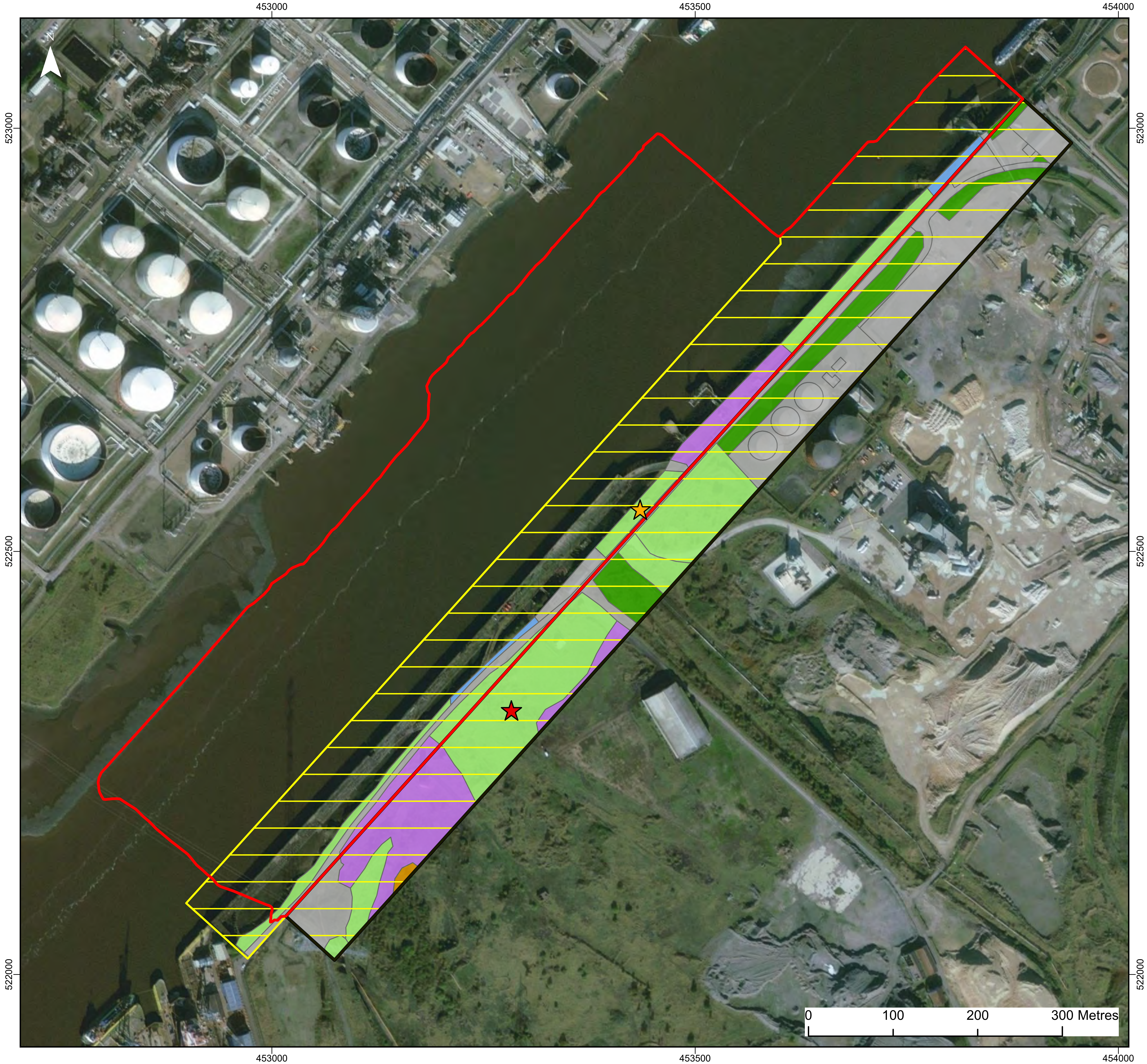
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Habitat Types

- Grassland - Other modified grassland
- Grassland - Other neutral grassland
- Heathland and shrub - Mixed scrub
- Other woodland, broadleaved
- Sparsely vegetated land - Ruderal/Ephemeral
- Urban - Developed land; sealed surface
- Japanese Knotweed
- Japanese Rose

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: UK Habitat Survey Map (terrestrial habitats only)

Figure: 11.3

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/10/2020	TC	CAS	A3	1:4,500

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

The key vegetation within this habitat was noted to be predominately false oat grass *Arrhenatherum elatius* (i.e. typically characteristic of MG1 habitat). Small areas of bramble *Rubus fructicosus* agg and bracken *Pteridium aquilinum* were also recorded, as was a scattering of tall ruderals such as creeping thistle *Cirsium arvense*, wild parsnip *Pastinaca sativa* common ragwort *Senecio jacobaea* and rosebay *Chamerion angustifolium*. Occasional areas of elder *Sambucus nigra*, and other young trees were also present. The sward was predominately species-poor although birds foot trefoil *Lotus corniculatus*, fennel *Foeniculum vulgare* and mouse eared hawkweed *Hieracium pilosella* were occasionally recorded throughout this Habitat.

There are two stands of Japanese rose *Rosa rugosa* bushes that were recorded at the time of the EP1HS. The locations of which are shown on **Figure 11.3**.

The habitat and species recorded are not considered to be of high ecological value and therefore modified grassland is concluded as being of **negligible ecological value**.

UK Habitat Classification: g3c Neutral Grassland; JNCC Habitat: Poor Semi-improved

A small amount of neutral grassland was recorded during the EP1HS; however, it was noted as being predominately species poor. Common floral species were recorded during the EP1HS and these were not considered to be of high ecological value and therefore the area of neutral grassland is concluded to be of **negligible ecological value**.

UK Habitat Classification h3h Mixed scrub; JNCC Habitat: Scattered scrub, occasional trees and neutral grassland

A mixture of scrub/young trees and grassland were present within the proposed scheme footprint, which are fringed by grassland. The key species noted during the EP1HS was black knapweed *Centaurea nigra*.

The habitat and species recorded are not considered to be of high ecological value and therefore mixed scrub habitat is concluded as being of negligible ecological value.

UK Habitat Classification: w1g7 Broadleaved woodland; JNCC Habitat: semi natural broadleaved woodland

The proposed scheme footprint includes the edge of an area of young broadleaved woodland. The woodland is almost exclusively birch *Betula sp*. and is thought to be the natural regenerative woodland of no more than 10 years old. No scrub layer is present. No ground layer species are present other than the remnants of typical brownfield flora in low abundance. No ancient woodland indicator species were noted at the time of the survey. Lowland mixed deciduous woodland is a Habitat of Principal Importance and it is considered that this habitat is of local importance and **low ecological value**. The remainder of the woodland lies within the footprint of the adjacent landside development EIA and is fully assessed as part of those proposals.

UK Habitat Classification: Sparsely vegetated land – Ephemeral/ Ruderal; JNCC Habitat: Ephemeral/ short perennial

The area of this habitat type comprised circa 50% grass cover (key species being red fescue *Festuca rubra)*.

A large number of brownfield indicator plants were recorded during the EP1HS, with the dominant species being Ladies bedstraw *Galium verum* and hedge bedstraw *Galium mollugo*. Other species such as vipers bugloss *Echium vulgare*, birds foot trefoil and stonecrop, *Sedum* spp were also recorded, albeit less frequent than others.

The habitat and species recorded are not considered to be of high ecological value and therefore ephemeral and ruderal habitat is concluded as being of **negligible ecological value**.

Existing South Bank Wharf
The South Bank Wharf which is proposed to be demolished as part of the proposed scheme was recorded to be largely devoid of vegetation to the extent that it was noted as being an artificial sealed surface. Areas of occasional shrub were also recorded within and surrounding the wharf structure.

Buildings
There are existing structures present within the proposed scheme footprint which would be demolished in advance of works commencing or following receipt of planning permission for the proposed scheme. Information relating to the ecological potential of these features is discussed in **Section 11.4.3**. It should be noted that in terms of buildings specifically, only the brick built electrical substation is proposed to be demolished as part of the proposed scheme.

11.4.3 Protected and notable species

Notable flora
No records of protected or notable plant species were identified from the desk study or recorded during the EP1HS. Consequently, these are considered to be absent and no further surveys and/or mitigation measures are required. Therefore, protected and/or notable flora is not considered further in this EcIA.

Bats
No records of roosting and/or foraging/commuting bats were identified during the desk study. However, habitats are present within and surrounding the proposed scheme footprint for which common species such as common pipistrelle *Pipistrellus pipistrellus* could use, if present, for foraging and commuting purposes.

The buildings and structures within the proposed scheme footprint are limited to sealed and open-sided metal structures, which have been assessed as being of negligible value for roosting bats due to the lack of potential roosting features. In addition, there are no mature trees within the proposed scheme footprint. Therefore, roosting bats are considered to be absent and no further surveys and/or mitigation measures for roosting bats are required. Therefore, roosting bats are not considered further in this EcIA.

The habitats within the proposed scheme footprint are limited in terms of them providing a food source for foraging/commuting bats. Therefore, the proposed scheme footprint is assessed as providing low potential to support foraging and commuting bats due to the invertebrate assemblage on the ephemeral / ruderal habitat. Consequently, it is considered that the bat assemblage of the proposed scheme footprint is of local value, for foraging and commuting bats, and limited to common bat species.

Badger
The desk study has shown no historical records of badger *Meles meles* within the proposed scheme footprint and its immediate surroundings.

The EP1HS did not record evidence of badger activity and/or presence within the proposed scheme footprint. Furthermore, it is considered unlikely that badgers are present as the habitats are dominated by unsuitable habitats as well as being surrounded by urban, industrial areas and main roads which would prevent badger colonising the area.

The habitat within the proposed scheme footprint would not support sett building and would also not provide a significant foraging resource for badgers.

Consequently, badgers are considered to be absent from the proposed scheme footprint and no further surveys and/or mitigation measures are required. Therefore, badgers are not considered further in this EcIA.

Water vole

Water voles *Arvicola amphibius* have not been recorded within or up to 2km from the proposed scheme footprint. Furthermore, there is no suitable habitat for water vole within the footprint of the proposed scheme and this species is considered to be absent. Therefore, no further surveys and/or mitigation measures are required, and water voles are not considered further in this EcIA.

Otter

Otters *Lutra lutra* have been recorded upstream of the proposed scheme footprint and along the River Tees. INCA recorded otter spraints within The Slems (approximately 1km from the proposed scheme footprint) during survey works for the adjacent land-side EIA in the summer of 2020.

During the EP1HS, vantage points along the shore and sea wall were checked for signs of otter presence and/or activity. Areas of rocks and logs above high tide were checked using binoculars for spraints. No evidence (e.g. spraints, holts etc) of otter was recorded during the EP1HS.

It is considered unlikely that otter are present within the proposed scheme footprint due to its isolation from other suitable otter habitat, however there is potential for them to be using the wider area and network of watercourse. Therefore, the proposed scheme may give rise to indirect impacts to foraging/commuting otters and as such, these possible indirect effects on otter are considered further in **Section 11.5** and **Section 11.6**. Otter are considered to be of local value.

Brown hare

Brown hare *Lepus europaeus* may be present within the areas of grassland habitats within the proposed scheme footprint. A significant brown hare population is present within the footprint of the adjacent land-side EIA scheme; however the amount of suitable habitat within the footprint of the proposed scheme is limited in extent and is unlikely to support significant numbers. Nevertheless, the proposed scheme may result in impacts to the local brown hare population and these are considered further in **Section 11.5** and **Section 11.6** .

Brown hare are a Species of Principal Importance and are also listed as a priority species on the Tees Valley Local Biodiversity Species list. Therefore, brown hares are of local value.

Hedgehog

Hedgehog *Erinaceus europaeus* may be present within the proposed scheme footprint and may use the habitat within the proposed scheme footprint for foraging and/or commuting purposes. The proposed scheme may result in impacts to the local hedgehog population and these are considered further in **Section 11.5** and **Section 11.6**.

Hedgehog are a Species of Principal Importance and are also listed as a priority species on the Tees Valley Local Biodiversity Species list. Therefore, hedgehogs are of local value.

Amphibians

The desk study has shown a low number of amphibians within and up to 2km from the proposed scheme footprint. The closest of these records relates to common frog *Rana temporaria*, which is approximately 1.8km south-east at its closest point. There are no records of great crested newt *Triturus cristatus* within or up to 250m of the proposed scheme footprint.

There are no open water features within the footprint of the proposed scheme which could support amphibians. Furthermore, there is a lack of terrestrial habitat available for which amphibians may use to colonise. Consequently, no further surveys and/or mitigation measures are required, and amphibians (including great crested newts) are not considered further in this EcIA.

Reptiles

One record of common lizard *Zootoca vivipara* is approximately 1.6km north-west of the proposed scheme footprint. This location is north of the River Tees, and hence disconnected from the proposed scheme. There is no or limited suitable habitat within the proposed scheme footprint for which reptiles could use for basking, shelter, foraging and/or refuge. Consequently, no further surveys and/or mitigation measures are required, and reptiles are not considered further in this EcIA.

Breeding birds

A breeding bird survey was undertaken for the adjacent land-side development which provides records for a number of species of birds nesting within the footprint of the proposed scheme. Results from this survey effort is shown in Appendix D6 and D7 of the South Industrial Zone Environmental Statement (Lichfields, July 2020). Marine and coastal birds are considered in **Section 12** of this report.

No qualifying species of the Teesmouth and Cleveland Coast SPA and Ramsar sites were recorded breeding within the proposed scheme footprint, either from the desk study data or the land-side breeding bird survey effort. However, **Table 11.11** presents the bird species that were recorded within the proposed scheme footprint during the surveys undertaken to inform the landside EIA.

Table 11.11 Breeding bird species recorded within the footprint of the proposed scheme

BoCC Green Status	BoCC Amber Status
White throat *Sylvia communis*	Stock dove *Columba oenas*
Feral pigeon Columba *livia domestica*	
Wren *Troglodytes troglodytes*	
Wheatear *Oenanthe oenanthe*	
Pied wagtail *Motacilla alba*	
Woodpigeon *Columba palumbus*	
Blue tit *Cyanistes caeruleus*	

Several red listed birds were recorded nearby within the land-side EIA development, including linnet *Linaria cannabina*, lapwing *Vanellus vanellus*, song thrush *Turdus philomelos* and skylark *Alauda arvensis*.

The two metal clad buildings, a brick-built building and the brick-built staithes within the footprint of the proposed scheme have potential to support nesting birds, as does the bramble, scrub and young trees. All buildings except the live substation are to be demolished in advance of the proposed scheme under approvals notices issued by RCBC. The only Schedule 1 bird species they buildings on site could potentially support is Barn Owl but the closest area of suitable habitat that is sufficiently large to support that species are a minimum of 2km away. Barn owl is therefore unlikely to be present due to the lack of connective habitat. The breeding bird assemblage of the proposed scheme footprint is therefore concluded to be of county value.

Invertebrates
The desk study has shown historical records of several notable invertebrates within the last 10 years within and up to 2km of the proposed scheme footprint. These recorded include small heath *Coenonympha pamphilus*, dingy skipper *Erynnis tages* and grayling *Hipparchia semele* butterflies.

Studies undertaken as part of the adjacent landside EIA record habitats of regional significance for dingy skipper and local significance for grayling in areas that overlap with the proposed scheme footprint. The areas of ephemeral/ruderal habitat within the proposed scheme footprint contains birds foot trefoil which is a food plant for dingy skipper young but as the habitat is so small it is unlikely to support significant numbers. The invertebrate assemblage within the footprint of the proposed scheme is of local value and not part of the invertebrate assemblage associated with sand dunes designated under the Teesmouth and Cleveland Coast SSSI.

Invasive non-native species
Japanese rose was recorded within the proposed scheme footprint (**Figure 11.3**), with further stands recorded within the adjacent footprint of the landsite development which was subject to a separate EIA and planning application. Japanese knotweed *Fallopia japonica* was also recorded within the footprint of the proposed scheme (**Figure 11.3**). Invasive non-native species are considered to negatively affect the biodiversity value of the proposed scheme footprint in its baseline condition and are scoped into this assessment as holding local importance.

11.4.4 Summary of terrestrial ecology receptors

Table 11.12 presents a summary of the terrestrial ecology receptors that have or have not been considered further in the EcIA presented in **Section 11.5** and **Section 11.6**.

Table 11.12 Summary of receptors taken forward to the EcIA

Receptor	*Ecological value in relation to the proposed scheme*	*Considered further in this EcIA (yes/no)*
Designated sites	High	No (impacts to European sites are considered in **Section 29** and the zone of influence of the proposed scheme would not extend to the terrestrial ecological interest features of the national sites).
Modified grassland	Low	No
Sparsely vegetated land – ephemeral / ruderal	Low	No
Mixed scrub	Low	No
Broadleaved woodland	Low	Yes
Wharf	Negligible	No
Buildings	Negligible	No
Priority Habitats	Low	No
Notable Flora	Negligible	No
Bats	Local (foraging and commuting)	No (roosting bats) Yes (foraging/commuting bats)
Badger	Negligible	No
Water vole	Negligible	No

Receptor	Ecological value in relation to the proposed scheme	Considered further in this EcIA (yes/no)
Otter	Local	Yes (foraging/commuting)
Brown hare	Local	Yes
Hedgehog	Local	Yes
Amphibians	Negligible	No
Reptiles	Negligible	No
Breeding birds	County	Yes
Invertebrates	Local	Yes
Invasive non-native species	Local	Yes

11.5 Potential impacts during the construction phase

11.5.1 Removal of broadleaved woodland

An area (0.04ha) of the broadleaved woodland will be permanently removed during the construction phase. The trees are not mature (young birch trees), and are present in low numbers, with low ecological value and no indicator species of ancient woodland present. The remainder of the woodland falls within the footprint of the adjacent landside EIA and is fully assessed within the documents supporting that application. Due to the small area (0.04ha) of woodland that will require removal to facilitate the proposed scheme, the magnitude is considered to be low but permanent. As such, a **minor adverse** impact to local woodland resource is anticipated.

Mitigation measures and residual impact
No mitigation measures are required. The residual impact is of **minor adverse** significance.

11.5.2 Disturbance or loss of foraging and commuting habitats for bats

Habitats within the footprint of the proposed scheme provide some, albeit limited, potential foraging/commuting opportunities for bats. This is primarily linked to the food source (invertebrates) for bats which is restricted to the small area of ephemeral/ruderal habitat. The local bat assemblage is of local value, and as European Protected Species (EPS), bats are considered to be of high importance.

Although there are no licencing requirements relating to foraging/commuting bats, potential impacts to foraging and commuting bats could result from night-time working or night-time lighting requirements associated with the construction phase of the proposed scheme. The use of night-time lighting may disrupt foraging and commuting routes which bats may be using to cross the proposed scheme footprint, which in turn has the potential to impair their ability to survive. This would occur if bats must avoid lit areas and thus travel further to reach the same areas for roosting or foraging; or else must forage in poorer quality areas. The coastal habitat within the proposed scheme footprint is of low importance for foraging bats and furthermore existing lighting is already in place within this area associated with ongoing commercial activities adjacent to the proposed scheme footprint. The potential impact to foraging and commuting bats is considered to be negative, temporary and of long duration (across an approximately three-year construction programme). The magnitude of the impact is assessed to be low due to the exposure, limited habitat potential and low activity of bat species. A **moderate adverse** impact is predicted.

Mitigation measures and residual impact
Night-time lighting of construction working areas will be avoided where possible. If night-time working is necessary, then lighting will be designed in accordance with Bats and artificial Lighting in the UK (BCT, ILE, 2018); and Guidance Notes for the Reduction of Obtrusive Light ILE (2011). This is likely to require:

- No direct lighting of the water's edges, or nearby scrub habitats and use of dark buffer zones; and
- Consideration of appropriate luminaire specifications, sensitive light configuration, screening, glazing, dimming and part-night lighting to minimise impacts.

Following the implementation of the mitigation measures, the magnitude of impact will be reduced and the impacts to foraging bats are considered to be **negligible**.

11.5.3 Indirect disturbance (e.g. light, noise, pollution) or injury to commuting otter

Otter are a highly mobile species, with a potential home range of up to 5km in coastal areas. The species is known to occur within the river however no suitable holt or resting site habitat has been recorded within the footprint of the proposed scheme.

The proposed scheme is committed to maintaining a strict footprint of works throughout the construction phase. Specific otter toolbox talks will be provided to all construction staff by a suitably qualified ecologist prior to works commencing, to ensure the protection afforded to otters, the agreed mitigation measures and what to do in the event of encountering an otter is clearly understood by all site personnel. The working methodology will also follow construction industry good practice guidance, as detailed in **Section 11.4.5**, such as having spill kits on site at all times, checking equipment regularly to ensure leakages do not occur, and limiting refuelling of construction plant to designated impermeable areas.

There are no designated nature conservation sites (i.e. SAC) for which otter are a qualifying feature which have direct connectivity with the proposed scheme. Any otters in the vicinity of the proposed scheme are unlikely to be associated with a designated population. As an EPS, otters are considered to be of high importance, but the site is considered to be of low value for the species. Otters are considered to have medium tolerance to disturbance. Disturbance impacts will occur during construction, but these will be temporary only.

There is potential for foraging/commuting otters using the adjacent river channel to be hit by construction vessels or disturbed by underwater noise or dredging activities. The vessels used in construction activities are generally slow moving with noise emitted at a low frequency. This risk of collision is anticipated to be low, as otters will be used to the numerous high levels of shipping traffic within the river, and the low speeds that construction vessels would be travelling at. Otters are considered to be of low sensitivity to underwater noise. Overall, the potential impacts associated with vessels is anticipated to be of **minor adverse** significance.

Potential effects arising from changes in noise are considered in **Section 17**, including embedded mitigation measures to minimise effects from construction phase noise and best practice and policy measures to minimise effects of construction noise. Measures to reduce the impacts of noise and vibration will be included in the CEMP, and with the implementation of such measures, any impacts will be **negligible** in significance, temporary, short term and local and there is not anticipated to be a significant impact to commuting otters.

Negligible impacts on water quality are anticipated during construction of the proposed scheme (**Section 7**). The potential impact of a pollution event to fish (otter prey) has been assessed in **Section 13** as being of no adverse significance following embedded mitigation of development of a Marine Pollution Contingency

Plan and Vessel Management Plan, and implementation of the EAP. Should a pollution event occur, it is likely to be localised, short-term, temporary, and potentially reversible. This impact could have a secondary effect on otter's food resource, however due to the short term/localised nature of any spill event and limited time otters are anticipated to spend in the area, an impact of negligible magnitude is anticipated. Given the unlikeliness of the impact occurring, an impact of **minor significance** is predicted on prey resource.

Section 18 discusses potential impacts from dust and particulate matter from construction activities. With implementation of the mitigation outlined in **Section 18**, there is not anticipated to be a significant impact to otter from air-borne sources during construction.

There is potential for light disturbance of commuting otters, which may create a barrier when attempting to pass the proposed scheme footprint. These impacts are considered to be low in magnitude, constituting an impact of **moderate adverse** significance.

Mitigation measures and residual impact

The following mitigation is proposed to minimise disturbance of otters from construction activities:

- Screening will be used (where possible and feasible to do so) against the river edge to reduce the visual and noise impacts from construction works on foraging/commuting otters.
- Where artificial light is required, lights will be directed away from the river to allow otters to migrate through the area undisturbed. Any lighting required at these areas will be of low intensity.

The following mitigation will be implemented to prevent injury or death to otter should any animal roam in the vicinity of the proposed scheme during construction:

- All otter mitigation measures for the site will be agreed with Natural England prior to construction;
- Given otters are very mobile species, a pre-construction survey eight weeks (to allow time for a Natural England disturbance licence application, if required) before construction commences will be undertaken, to re-assess otter activity. Prior to the commencement of operations an otter survey will be undertaken, within the proposed footprint of construction plus a 250m buffer zone, to determine current use at the time of construction (otters may increase their use of the site in the interim period between the current survey and the commencement of construction). The surveys will be undertaken in appropriate weather condition and following guidance in the 'New Rivers and Wildlife Handbook' (Holmes et al, 1994), Chanin (2003) and Strachan & Jefferies (1996).
- Should an active resting site be found, an EPS Licence is likely to be required to undertake work within this area. Consultation will be required with Natural England to discuss the mitigation measures required, which will subsequently form the basis of the otter licence. This is likely to include the following:
  - Construction vehicles and equipment should not be active on, or stored by the riverbank for longer than is essential;
  - The risks can be further reduced by following best practice and guidance produced by Design Manual for Roads and Bridges (DMRB Volume 10 section 4);
  - An Ecological Clerk of Works (ECoW) will be present during the works. Work should stop should an otter holt or resting place be found within 250m, and Natural England consulted, as a licence may be necessary before works can continue;
  - A temporary ramp will be placed in trenches over 0.5 m deep in order to allow a potentially trapped animal to exit the trench;
  - Any open pipes will be capped to prevent animals gaining access; and
  - All excavations and pipe systems will be checked at the start of each working day.

Following the implementation of the mitigation measures outlined above, the potential effects to otter are assessed to be of **negligible** significance.

11.5.4 Disturbance / harm to breeding birds or destruction of nests

The proposed scheme requires the demolition of the dilapidated wharf, jetties, an electrical substation and clearance of areas of bramble scrub and young trees. These features have potential to support nesting birds and a number of ground nesting bird species have also been recorded utilising the terrestrial habitats within the footprint of the proposed scheme, including an amber list species.

Breeding birds are considered to be of county value in the footprint of the proposed scheme and are of medium importance. Permanent habitat loss will occur within the footprint of the proposed scheme, although this is considered to be small in extent and is relatively localised. Birds will have some ability to tolerate this change by transiting to more preferable areas to breed in future years. The loss of this area will not cause habitat fragmentation. The magnitude of impact is anticipated to be low. Overall an impact of **minor adverse significance** is anticipated on breeding birds.

Mitigation measures and residual impact
The removal of trees, scrub, buildings, structures or other habitat with the potential to support breeding bird nests will be undertaken outside the breeding bird season where possible (which is typically March to August inclusive) to remove the risk of damage or destruction of active nests. Should this not be possible, a nesting bird survey will be undertaken by a suitably experienced ecologist immediately prior to works commencing.

With the implementation of the above measures, the residual impact is of **negligible** significance.

11.5.5 Loss of foraging and breeding resource for invertebrates

Limited habitat occurs within the footprint of the proposed scheme for invertebrate assemblage, notably dingy skipper and grayling. There is likely to be a loss of foraging and breeding habitat for these species, but the area of suitable habitat is small in extent and on the periphery of suitable habitat for these species and unlikely to support significant numbers of invertebrates. The invertebrate assemblage is considered to be of local (grayling) and (dingy skipper) significance, and negligible importance within the footprint of the proposed scheme, with the potential to adapt to more suitable areas and is therefore assessed as being of medium sensitivity. The impact is considered to be of medium magnitude with localised habitat loss in the long term (permanently). Overall, the impact significance of loss of habitat and breeding resource is assessed to be **minor adverse**.

Mitigation measures and residual impact
No mitigation measures are required. The residual impact is of **minor adverse** significance.

11.5.6 Disturbance and habitat loss of brown hare / hedgehog

The footprint of the proposed scheme provides a small extent of habitat potential for hedgehog and brown hare. The construction phase is likely to cause permanent habitat loss for these species and has potential to result in temporary disturbance/ injury or death to these species. Both are considered to be of local value. Due to the limited extent of habitat potential, the magnitude of impact is assessed to be low. Any potential impact is considered to be **minor adverse** in significance.

Mitigation measures and residual impact
As additional mitigation for hedgehog, any individuals found within the works area will be moved to a safe and sheltered location. This process will be described in a CEMP and reviewed by a suitably qualified

ecologist. Assistance will be sought from a suitably qualified ecologist for any injured hedgehog found during the works.

As a precaution, deep trenches and excavations dug across the proposed scheme footprint will be covered overnight or be left with a plank or similar material with a slope no more than 45°, in order to allow hedgehog and small mammals to exit trenches or excavations if they fall in. This will also be detailed in the CEMP.

The residual impact to brown hare and hedgehog is **minor adverse**.

11.6 Potential impacts during the operational phase

The proposed scheme will result in the complete loss of habitat, with permeant effects. The land parcels will become an operational quay. As such, there will be no habitat potential during the operation phase and therefore **no impact** for the following ecological receptors:

- INNS;
- Invertebrates;
- Brown hare; and
- Hedgehog.

11.6.1 Light pollution impacts on foraging/commuting otters and bats

There is potential for commuting otters and bats to be disturbed by light pollution during the operational phase, however there will be no habitat potential for either species within the footprint of the proposed scheme itself. There is limited habitat potential for bats and otters within the proposed scheme footprint and the impact magnitude is anticipated to be low, albeit permanent. As such potential disturbance impacts are anticipated to be of **minor - moderate adverse** significance.

Mitigation measures and residual impact
Operational lighting will be designed in accordance with Bats and artificial Lighting in the UK (BCT, ILE, 2018); and Guidance Notes for the Reduction of Obtrusive Light ILE (2011). Light spill will be minimised where possible and a lighting strategy will be developed and reviewed by a suitably qualified ecologist.

Following the implementation of mitigation, the impact to commuting bats and otters is anticipated to be of **minor adverse** significance.

12 MARINE AND COASTAL ORNITHOLOGY

12.1 Introduction

The proposed scheme footprint is located within and adjacent to sensitive areas for seabirds and waterbirds, namely the Teesmouth and Cleveland Coast SPA, Ramsar site and SSSI (see **Figure 12.1**).

A desk-based assessment has been combined with site-specific bird survey data to provide a description of the baseline environment on which the impact assessment can be based.

Potential impacts on waterbirds and seabirds assessed in this section of the EIA Report are broadly categorised into the following:

- direct and indirect impacts on supporting habitat;
- impacts on prey resources; and,
- acoustic and visual disturbance of birds.

The assessment of potential impacts has been informed by the following sections of this EIA Report:

- hydrodynamic and sedimentary regime (**Section 6**);
- marine sediment and water quality (**Section 7**);
- marine ecology (**Section 9**);
- fish and fisheries (**Section 13**);
- noise (**Section 17**); and,
- air quality (**Section 18**).

12.2 Policy and consultation

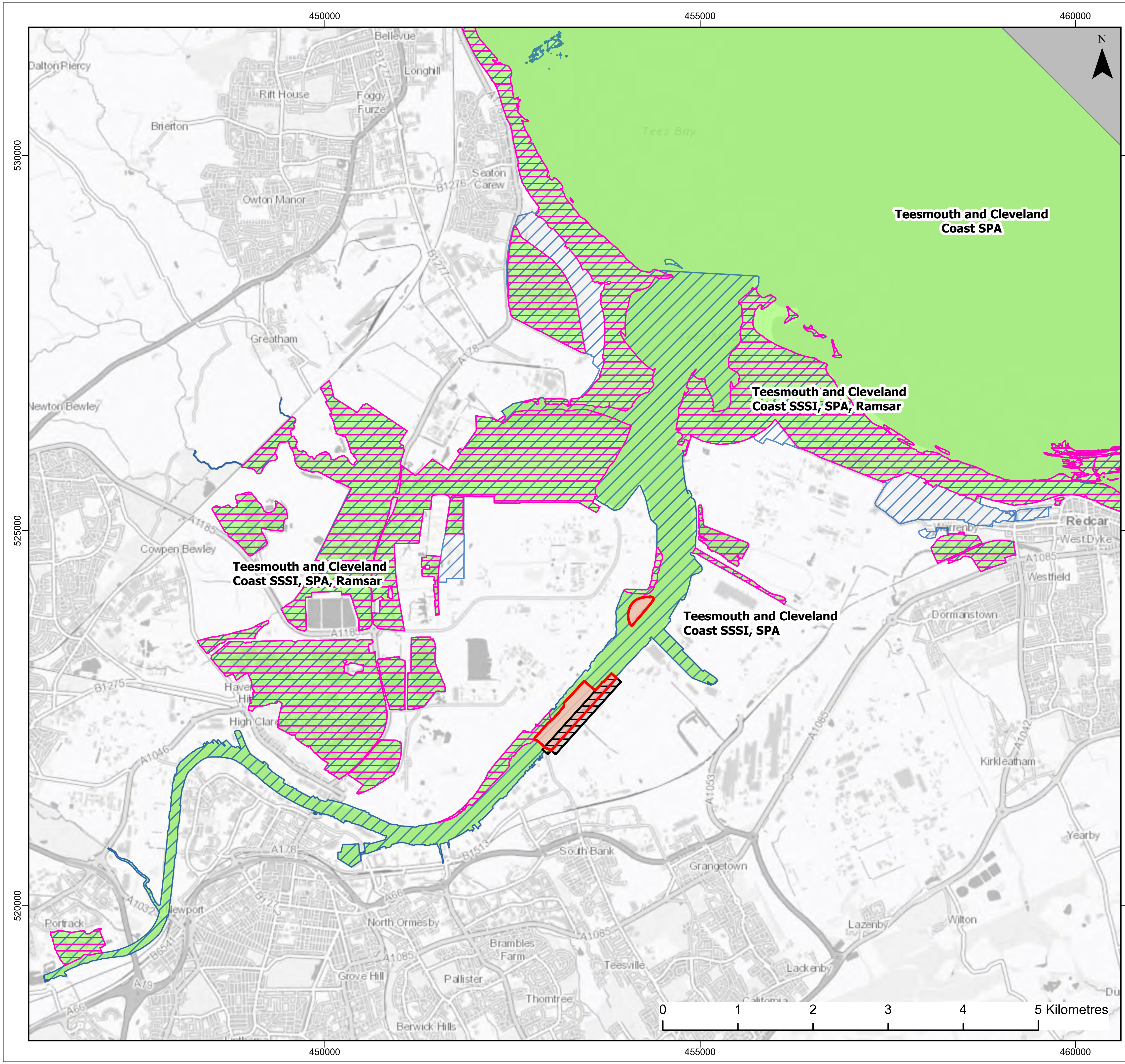
12.2.1 Policy

National Policy Statement for Ports

The assessment of potential impacts to marine and coastal ornithology has been made with reference to the policy guidance contained within the NPS for Ports (Department for Transport, 2012). The assessment requirements relevant to marine and coastal ornithology, as presented in the NPS for Ports, are summarised in **Table 12.1**.

Table 12.1 Summary of NPS for Ports requirements with regard to marine and coastal ornithology

NPS requirement	NPS reference	Section of EIA report where requirement has been addressed
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 or geological interests.	Section 5.1.4	**Section 12.4**.
The applicant should be particularly careful to identify any effects on the integrity and special features of MCZs, SACs and candidate SACs, SPAs and potential SPAs, Ramsar sites, actual and potential Sites of Community Importance and Sites of Special Scientific Interest (SSSI).	Section 5.3.7	**Section 29** presents the HRA (note that there are no MCZs relevant to the assessment).



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Special Protection Area (SPA): Teesmouth and Cleveland Coast
- Sites of Special Scientific Interest (SSSI): Teesmouth and Cleveland Coast
- Ramsar Site: Teesmouth and Cleveland Coast

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Nature conservation designations for birds

Figure: 12.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	BH	A3	1:50,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Marine Policy Statement and the North East Draft Inshore and Offshore Marine Plan

The UK MPS (HM Government, 2011) (adopted in March 2011) provides the framework for marine planning and decisions affecting the UK marine area. The MPS facilitates and supports the formulation of marine plans, ensuring that marine resources are used in a sustainable way in high level marine objectives, thereby:

- promoting sustainable economic development;
- enabling the UK to move towards a low carbon economy, in order to mitigate the causes of climate change and ocean acidification and adapting to their lives;
- ensuring a sustainable marine environment which promotes healthy, functioning marine habitats, species and our assets; and,
- contributing to the societal benefits of the marine area, including the sustainable use of marine resources to address local and social economic issues.

The MPS requires that all public authorities taking authorisation or enforcement decisions that affect, or might affect, the UK marine area do so in accordance with the MPS, unless relevant considerations indicate otherwise.

Full details of the draft North East Inshore and Offshore Marine Plan are provided in **Section 4.9**. **Table 12.2** signposts relevant objectives and policies within the draft Marine Plan when considering the potential effects of the proposed scheme on ornithological receptors.

Table 12.2 Marine plan policies relevant to ornithological receptors

Marine Policy Statement / Marine Plan Objectives	- *Biodiversity is protected, conserved and, where appropriate, recovered, and loss has been halted;* - *Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse communities and the functioning of healthy, resilient and adaptable ecosystems;* - *Our oceans support viable populations of representative, rare, vulnerable, and valued species.*	
Marine policies relevant to this chapter		Where addressed in this Chapter
NE-MPA-1	*Proposals that may have adverse impacts on the objectives of marine protected areas must demonstrate that they will, in order of preference:* *a) Avoid;* *b) Minimise;* *c) Mitigate significant adverse impacts, with due regard given to statutory advice on an ecologically coherent network.*	**Sections 12.5** and **12.6**, with an HRA provided in **Section 29**.
NE-BIO-1	*Proposals that may have significant adverse impacts on the distribution of priority species must demonstrate that they will, in order of preference:* *a) Avoid;* *b) Minimise;* *c) Mitigate;* *d) Compensate for significant adverse impacts.*	As above.
NE-BIO-2	*Proposals that may cause significant adverse impacts on native species adaptation or connectivity, or native species migration must demonstrate that they will, in order of preference:* *a) Avoid;* *b) Minimise;* *c) Mitigate;* *d) Compensate for significant adverse impacts.*	As above.
NE-BIO-3	*Proposals must take account of the space required for coastal habitats where important for ecosystem functioning and provision of ecosystem services, and demonstrate that they will, in order of preference:* *a) Avoid;* *b) Minimise;* *c) Mitigate;*	As above.

Marine Policy Statement / Marine Plan Objectives	- *Biodiversity is protected, conserved and, where appropriate, recovered, and loss has been halted;* - *Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse communities and the functioning of healthy, resilient and adaptable ecosystems;* - *Our oceans support viable populations of representative, rare, vulnerable, and valued species.*	
Marine policies relevant to this chapter		Where addressed in this Chapter
	d) Compensate for net habitat loss and deliver environmental net gain.	

12.2.2 Consultation

A summary of the comments relevant to ornithological receptors that were received during the EIA scoping process are detailed in **Table 12.3**, which also signposts to the relevant section where the comment has been addressed.

Table 12.3 Relevant ornithology-specific comments received from stakeholders during the scoping process

Consultee	Comment	Response / section of the EIA Report where the comment is addressed
MMO (Scoping Opinion issued to a third party in 2019)	Incorrect reference to the Tees and Hartlepool Foreshore and Wetlands Site of Special Scientific Interest (SSSI), as this site has been subsumed into the newly designated Teesmouth and Cleveland Coast SSSI.	Reference in this Section is made to Teesmouth and Cleveland Coast SSSI.
	There should be particular interest in the vicinity of intertidal mudflat opposite the proposal site. Birds feeding here are particularly sensitive to noisy activities, particularly during winter months and consideration should be given to suitable mitigation. The river channel is also important for foraging common tern from the Saltholme colony.	Impacts on wintering birds using the North Tees Mudflat and common terns using the Tees are assessed in **Sections 12.5** and **12.6**.
	The environmental impacts of noise generated during construction should be carefully considered, especially in relation to the impact of noise on birds, fish and marine mammals. Noise modelling at sensitive locations should be included in the ES, for both construction and operation.	Impacts of construction noise disturbance, with reference to noise levels at modelled ecological receptors, are assessed in **Section 12.5.4**.
	The visual disturbance caused by the project (on site staff, vessels and equipment (including cranes)), must be considered for sensitive bird species. This should also include the impact of lighting during construction and operation.	Impacts of construction- and operation-phase visual disturbances are assessed in **Sections 12.5.4** and **12.6.2**.
Natural England (informal consultation outside of the formal scoping process during August 2020)	Natural England have identified the North Tees Mudflat as a potential significant site for wintering waterbirds foraging on the intertidal mudflat. Survey of the wintering bird usage of the site is recommended since low tide count data from WeBS is outdated.	Given the timescales for submission of the marine licence and planning application (November 2020), it has not been possible to recover a full year of wintering bird data at the North Tees Mudflat. Liaison with Natural England in August 2020 confirmed that in lieu of up-to-date low tide count data for North Tees Mudflat, the assessment can proceed using the assumption that the mudflat provides supporting habitat for a number of SPA / Ramsar site species and other waterbirds.

12.3 Methodology

12.3.1 Study area

The study area for this section of the EIA Report comprises the area within the Tees estuary that has the potential to be directly and/or indirectly influenced by the proposed scheme. In this case, the study area is limited to the areas that may be affected by noise and visual disturbance during the construction and operational phase of the proposed scheme, and the intertidal/subtidal areas that may be affected by morphological or hydrodynamic changes.

The North Tees Mudflat represents an important area of intertidal within the study area; the mudflat is approximately 1.5km in length and the most downstream section of mudflat, approximately 300m in length, is located directly adjacent to the proposed scheme footprint.

12.3.2 Existing environment

Wetland Bird Survey

Information on waterbird populations within the Tees estuary is available from the Wetland Bird Survey (WeBS) counts. WeBS is a partnership between the British Trust for Ornithology (BTO), the Royal Society for the Protection of Birds (RSPB) and the Joint Nature Conservation Council (JNCC) in association with the Wildfowl and Wetlands Trust (WWT). Data from WeBS are routinely used when assessing the ornithological interest of estuarine areas such as the Tees estuary.

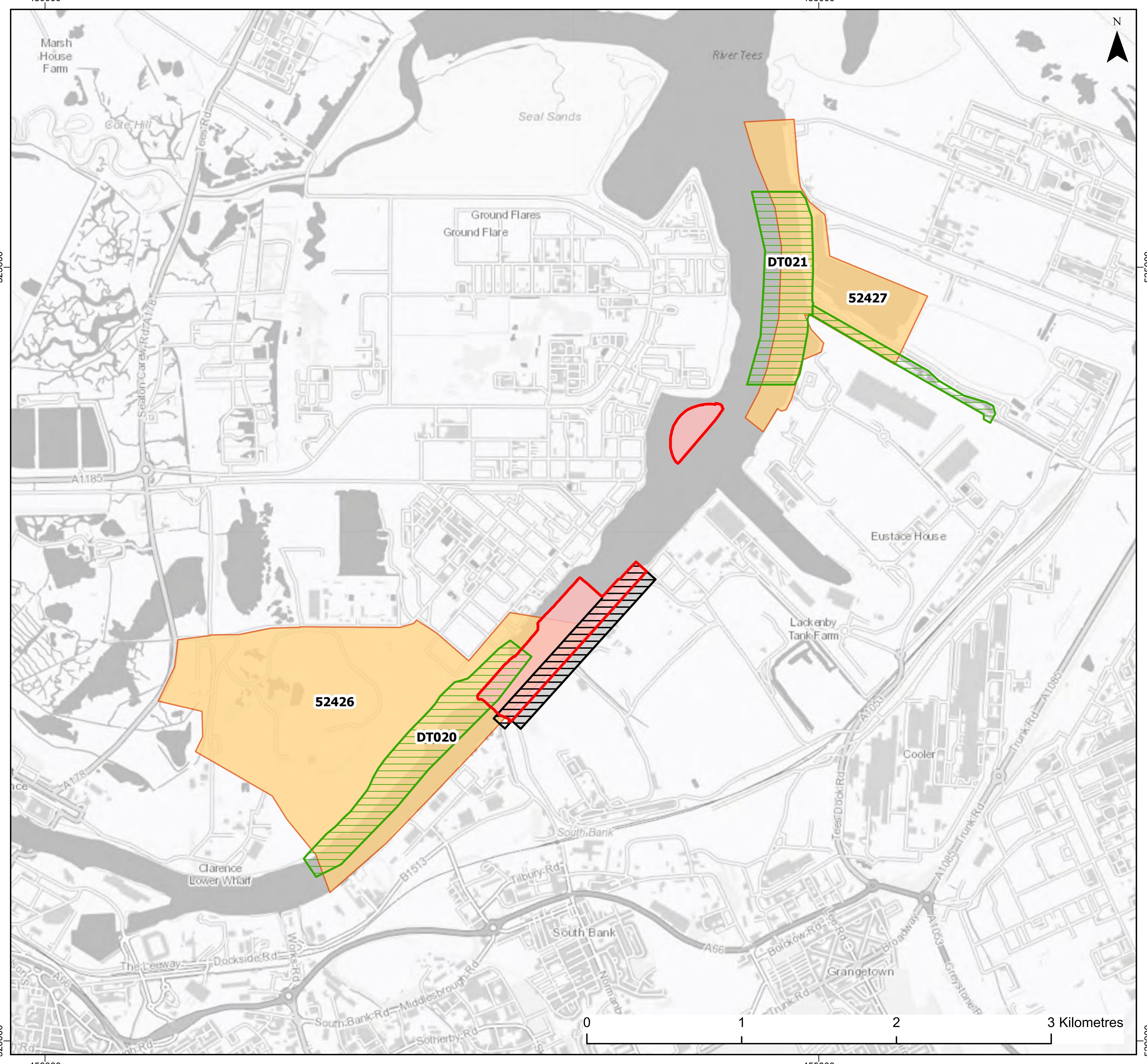
WeBS core counts are population counts undertaken within a given site, usually on a monthly basis but with particular focus on winter months when waterbird populations are at a peak. Core counts are typically undertaken over a high tide, when birds are most easily counted at roosts (BTO, 2010). The following WeBS core count data has been used to describe the existing environment (see **Section 12.4.2**):

- Data from the Tees estuary WeBS core count site (2014/15 to 2018/19), which is comprised of individual sectors and encompasses the coastline from Hartlepool Bay to Redcar plus estuarine, intertidal and wetland areas within (and in close proximity to) the lower Tees, as far upstream as Saltholme Nature Reserve.
- Data from the individual sectors 52426 (Tees Estuary opposite Smith Dock and Hargreaves Quarry) (2012/13 to 2016/17) and 52427 (Bran Sands South) (2014/15 to 2018/19), both of which are located within 1km of the proposed scheme and contribute towards the overall site count for the Tees estuary.

Low tide counts are also undertaken periodically in large estuaries, generally over at least one winter in six, and are designed to complement the core count data and illustrate the distribution of birds within the estuary, thus helping to identify specific parts of the estuary, inlets or bays that are of notable importance for bird activity (see **Section 12.4.2**). Low tide counts are of particular importance for understanding how water bird species use intertidal areas, such as those present within and adjacent to the footprint of the proposed scheme. The most recent WeBS low count data for the Tees estuary has been sourced and summarised below. The data comprises that from:

- Low count sector DT021 (2018/19), which incorporates Bran Sands South and encompasses intertidal areas just north of the turning circle.
- Low count sector DT020 (2012/13), which incorporates the North Tees Mudflat.

The locations of the WeBS core count and low count sectors referred to above are presented in **Figure 12.2**.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- WeBS low count sector
- WeBS core count sector

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

WeBS count sectors

Figure: 12.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Site-specific surveys

Given that the most recent low tide count data from the North Tees Mudflat (WeBS low count sector DT020) was from the winter of 2012/13, INCA commenced a site-specific non-breeding estuarine bird survey in July 2020 which will continue until March 2021 (see **Section 12.4.3**). The scope of the survey was agreed through discussion with Natural England in June 2020 and comprises two low tide counts and two high tide counts per month at each of the following four sectors (see **Figure 12.3**):

- Sector 1: South Bank Wharf (i.e. the site of the timber quay demolition and new quay construction);
- Sector 2: on and over the subtidal river adjacent to the site of the proposed quay;
- Sector 3: North Tees Mudflat (north); and,
- Sector 4: North Tees Mudflat (south).

Given the requirement to submit the marine licence application and planning application in November 2020, it was not possible to recover low tide count data from the above sectors across the full 2020/2021 over winter period. It was therefore agreed with Natural England that, for the purpose of this EIA, the assessment would be based on the assumption that the North Tees Mudflat is used by a significant proportion of the overall Tees estuary wintering population. With this in mind, a precautionary approach has been taken to the assessment of impacts on waterbird activity at North Tees Mudflat.

As well as the non-breeding waterbird survey, INCA conducted a tern species survey at South Bank during July and August 2020 (see **Section 12.4.4**). The survey covered an area within a 300m semi-circular arc from a point on the South Bank within the footprint of the proposed scheme, approximately 100m downstream of the existing wharf (near to the jetty structures due for demolition). It should be noted that this did not encompass the entire study area, but it was considered to be sufficient to capture the majority of movements up- and downstream by commuting or foraging terns.

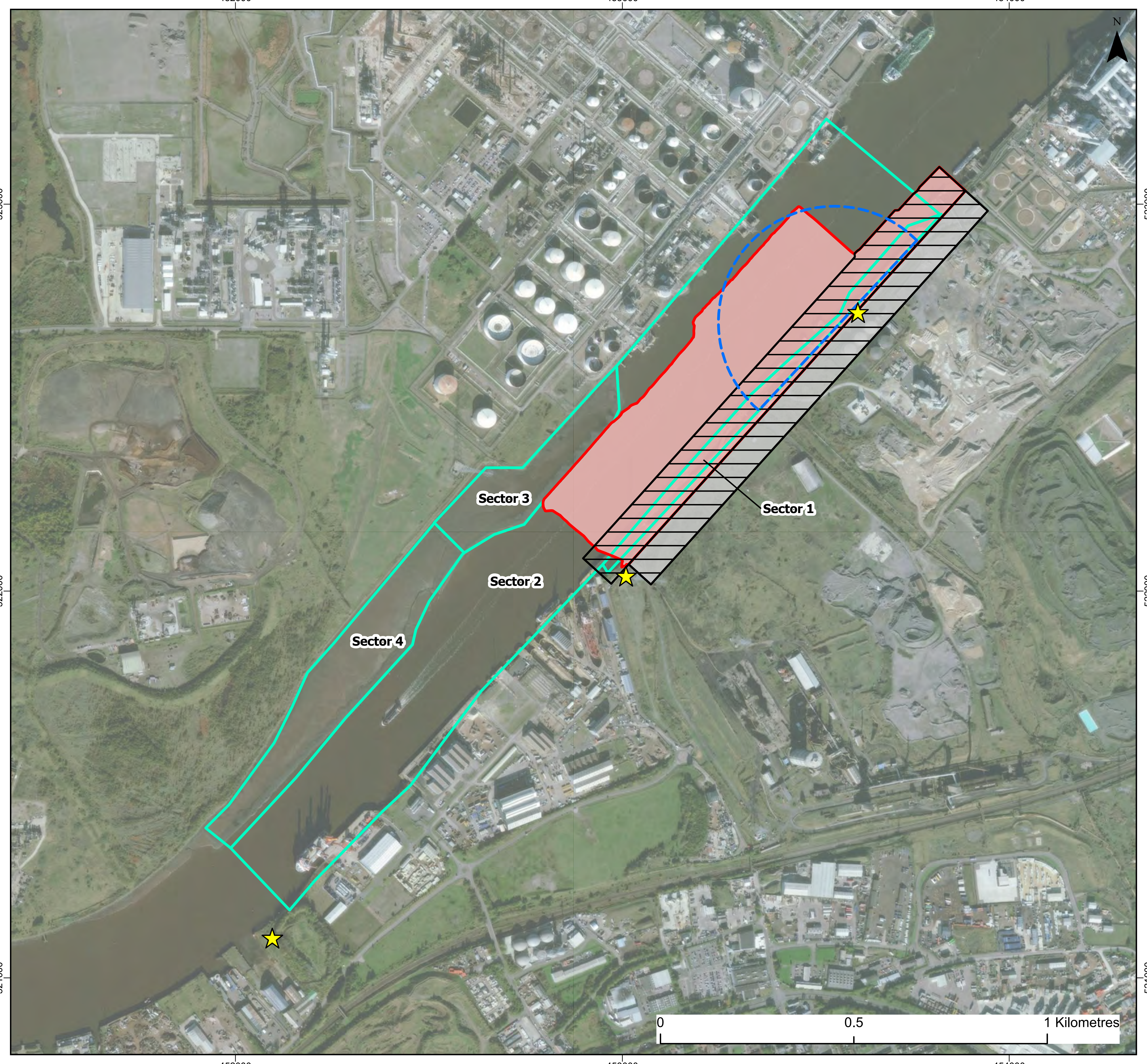
Other data sources

Data from the following surveys within the Tees estuary were also reviewed to inform the understanding of the existing environment (see **Section 12.4.5**):

- Wintering Bird Surveys 2014-15 at Teesside, undertaken by Ecology Consulting as part of a Natural England review of the Teesmouth and Cleveland Coast SSSI (Ecology Consulting, 2015); and,
- Vantage point monitoring survey at the Vopak Foreshore (*c.*200m north of the turning circle) undertaken by Vopak in 2013-14 (INCA, 2014).

The locations of the above survey areas with reference to the proposed scheme footprint are presented in **Figure 12.4**.

The Defra MAGIC website has also been reviewed to confirm the location of SPAs, Ramsar sites and other designated sites for ornithological interest (shown on **Figure 12.1**). The most up-to-date information on the designations within the study area, including SPA / Ramsar site reference populations, has been taken from Natural England's scientific brief to Defra *"Departmental Brief: Teesmouth and Cleveland Coast potential Special Protection Area (SPA) and Ramsar"* (Natural England, 2018a) and the site citations.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Vantage Point
- South Bank Tern Survey 2020 survey area
- Estuarine Bird Survey 2020 sectors

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Site-specific survey areas

Figure: 12.3

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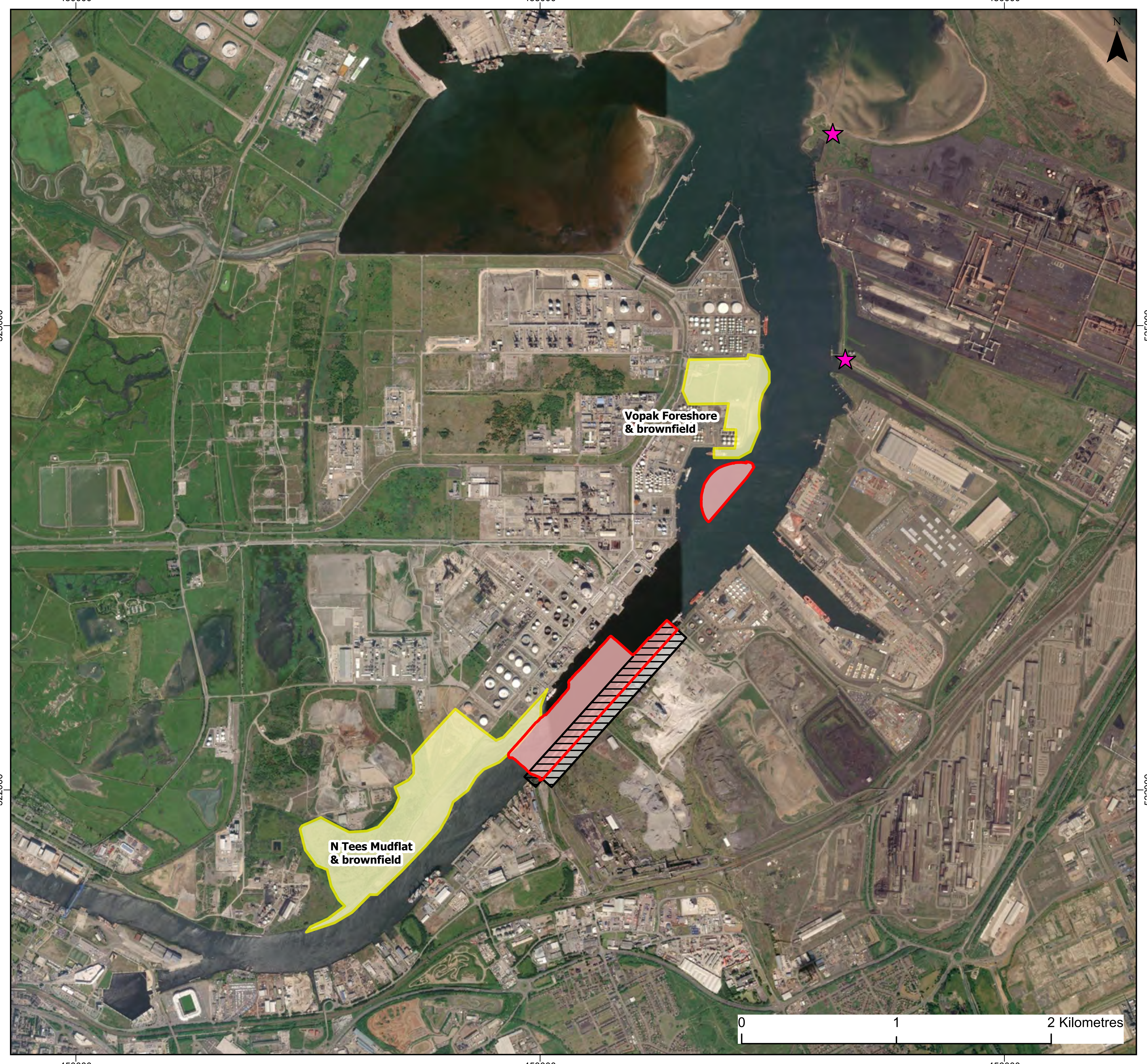
ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Teesside Wintering Bird Survey 2014/15 survey areas (Ecology Consulting, 2015)
- Vopak Foreshore Survey 2013/14 vantage points (INCA, 2014)

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: Tees Estuary survey locations

Figure: 12.4

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	BH	A3	1:25,000

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ROYAL HASKONINGDHV
Marlborough House
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12.3.3 Methodology for assessment of potential impacts

The methodology used to assess potential environmental impacts on ornithological receptors follows that described in **Section 5** of this report. The overarching environmental assessment process and methodology follows a matrix approach to inform the impact assessment, using best practice, best available scientific understanding and relevant guidance (e.g. CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2016)).

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, waterbird receptors and the conservation value of the species that may be affected. Since the proposed scheme is located within areas of conservation importance for birds and their supporting habitats, for the purpose of this assessment the conservation value of the species that may be affected is assumed to be high. Furthermore, and in consultation with Natural England (see **Table 12.2**), in the absence of a complete over-winter site-specific survey, for the purpose of this assessment it is assumed that North Tees Mudflat supports significant numbers of SPA / Ramsar and SSSI features during the important wintering months.

Cross reference has been made, where relevant, to the findings of the hydrodynamic and sedimentary regime assessment (**Section 6**), the marine water quality assessment (**Section 7**), noise and vibration assessment (**Section 17**) and the assessments on marine benthic ecology and fisheries receptors (**Sections 9 and 13**, respectively) when assessing potential impacts to ornithological receptors, to avoid duplication of information.

12.4 Existing environment

12.4.1 Statutory designated and non-statutory sites

Teesmouth and Cleveland Coast SPA and Ramsar site

The extent of the Teesmouth and Cleveland Coast SPA and Ramsar site is indicated in **Figure 12.1**. The subtidal and intertidal parts of the proposed scheme footprint are located within the Teesmouth and Cleveland Coast SPA, whilst the Teesmouth and Cleveland Coast Ramsar site is immediately adjacent to the proposed scheme footprint.

The SPA / Ramsar site is designated for its qualifying populations of the following species:

- Breeding Annex I species little tern *Sternula albifrons*, common tern *Sterna hirundo* and avocet *Recurvirostra avosetta*;
- Non-breeding Annex I species Sandwich tern *Thalasseus sandvicensis* and ruff *Calidris pugnax*; and,
- Non-breeding migratory species redshank *Tringa totanus* and knot *Calidris canutus*.

The SPA / Ramsar site is also designated for its regularly occurring assemblage of more than 20,000 waterbirds, the major component species of which are (in addition to those above) gadwall *Anas strepera*, shoveler *Spatula clypeata*, wigeon *Anas penelope*, sanderling *Calidris alba*, lapwing *Vanellus vanellus*, herring gull *Larus argentatus* and black-headed gull *Chroicocephalus ridibundus*.

The SPA includes the North Tees Mudflat, an area of intertidal foreshore directly across the river from the proposed scheme, plus other intertidal areas further downstream (e.g. Seal Sands and Bran Sands). It also incorporates grassland / wetland habitats north of the Tees and coastal habitats beyond the estuary. An extension to the SPA, classified in January 2020, encompasses subtidal areas of the Tees (and adjoining coast), encompassing offshore areas of key importance for foraging for the qualifying tern species, plus additional terrestrial and wetland habitat suitable for supporting other qualifying species and assemblages. The Ramsar site does not extend into the subtidal marine environment but does encompass all terrestrial and intertidal areas within the SPA.

Full details of the qualifying features of the SPA / Ramsar site are summarised in **Table 12.4**, with information on the distribution of features within the site taken from the SPA and Ramsar site citations plus Natural England's scientific brief to Defra (Natural England, 2018a), which details the rationale and scientific evidence behind the January 2020 extension.

Teesmouth and Cleveland Coast SSSI

The Teesmouth and Cleveland Coast SSSI (see **Figure 12.1**) underpins the SPA and Ramsar site designations, and at North Gare Sands and Seal Sands also forms the Teesmouth National Nature Reserve (NNR). The SSSI notification (Natural England, 2018b) states that the SSSI is of special interest for the following nationally important ornithological features that occur within (and are supported by) the wider mosaic of coastal and freshwater habitats:

- breeding avocet, little tern and common tern;
- a diverse assemblage of breeding birds of sand dunes, saltmarsh and lowland open waters and their margins;
- non-breeding shelduck, shoveler, gadwall, ringed plover *Charadrius hiaticula*, knot, ruff, sanderling, purple sandpiper *Calidris maritima*, redshank and Sandwich tern; and,
- an assemblage of more than 20,000 waterbirds during the non-breeding season.

Avocets were first confirmed breeding on the Tees estuary in 2008 and numbers have subsequently increased. They nest at a range of locations within the SSSI, as described in **Table 12.4**. Little terns formerly nested in the SSSI in large numbers, but since the late 1990s they have largely relocated to a colony at Crimdon Dene, in the adjacent Durham Coast SSSI. However, small numbers of little tern have been recorded breeding at South Gare in recent years, and the SSSI site remains a foraging area for little tern and supports important pre- and post-breeding gatherings.

The majority of breeding common terns in the SSSI nest on islands and artificial rafts within the RSPB Saltholme reserve, with small numbers scattered at a number of other locations around the estuary as indicated in **Table 12.4**. Common tern feed out at sea as well as along the tidal Tees and its main tributaries.

The extensive sand dunes, saltmarsh and wetlands across the site support a diverse assemblage of breeding birds. In addition to avocet, little tern and common tern, this includes a number of scarce and declining species, such as shoveler, pochard *Aythya ferina*, ringed plover and little ringed plover *Charadrius dubius*.

The extensive areas of open water, grazing marsh and intertidal habitat provide safe feeding and roosting sites for large numbers of non-breeding waterbirds throughout the year. The SSSI is of special interest for ten species (shelduck, shoveler, gadwall, ringed plover, knot, ruff, sanderling, purple sandpiper, redshank and Sandwich tern) and an assemblage of over 20,000 waterbirds in the non-breeding season. The assemblage comprises a wide variety of waterbirds, including (in addition to the aforementioned species that are reasons for notification in their own right) large numbers of wigeon, lapwing, black-headed gull and herring gull.

Table 12.4 Status of the qualifying features of the Teesmouth and Cleveland Coast SPA / Ramsar

Qualifying feature	SPA population in 2000 (English Nature, 2000)	Current SPA population (Natural England, 2018a)	Usage of the SPA / Ramsar (Natural England, 2018a)	Approximate distance from proposed scheme
Nationally important populations of Annex I species				
Avocet (breeding)	Avocet was not an original feature of the SPA	Between 2010 and 2014, the SPA / Ramsar supported an average of 18 pairs (1.2% of the GB breeding population).	The majority of birds breed on No.4 Brinefield, mainly on the saline lagoon south of Greatham Creek, with smaller numbers on Greenabella Marsh,	Brinefield: ~2km Greenabella Marsh: ~3km
Ruff (non-breeding)	Ruff was not an original feature of the SPA	Between 2011/12 and 2015/16, the SPA / Ramsar supported an average of 19 individuals (2.4% of the GB non-breeding population).	Ruff occur at shallow waterbodies across the site, in particular on the pools at RSPB Saltholme.	RSPB Saltholme: ~1.2km
Common tern (breeding)	Common tern was not an original feature of the SPA.	Between 2010 and 2014, the SPA / Ramsar supported an average of 399 pairs (4% of the GB breeding population).	Nesting birds are typically concentrated on islands within the various waterbodies at Saltholme, with variable and smaller numbers of nests on the saline lagoon in No.4 Brinefield south of Greatham Creek, and on rafts at Cowpen Marsh. Two pairs also bred on Portrack Marsh in 2014.	RSPB Saltholme: ~1.2km Brinefield: ~2km Cowpen Marsh: ~4km Portrack Marsh: ~6.5km
Sandwich tern (passage)	When the SPA was originally extended in 2000, the site supported 1,900 individuals (1988 to 1992)	Between 2011/12 and 2015/16, the SPA / Ramsar supported an average of 134 individuals (0.3% of the GB passage population), though the reference population remains 1,900 individuals.	Highest numbers occur in mid-July to September using roosts at Coatham Sands, Seal Sands, North Gare Sands/Seaton Snook and Bran Sands. They feed in shallow inshore waters in and around the estuary mouth.	Coatham Sands: ~3.5km Seal Sands: ~1.5km North Gare Sands: ~3km Bran Sands: ~0.9km
Little tern (breeding)	When the SPA was originally extended in 2000, the site supported an average of 40 pairs (1995-1998).	Between 2010 and 2014, the SPA / Ramsar supported an average of 81 pairs (4.3% of the GB breeding population).	Virtually all breeding birds are located at Crimdon Dene, north of Hartlepool, with foraging grounds in marine areas within 5km alongshore and 3.5km offshore of the colony.	Crimdon Dene: 15km
Internationally important population of regularly occurring migratory species				
Knot (non-breeding)	At designation, the site supported an average of 5,509	Between 2011/12 and 2015/16, the SPA / Ramsar supported an average of 876 individuals	Formerly present in large numbers on the estuary at Seal Sands, the birds are now increasingly located outside the	Coatham Sands: ~3.5km Redcar Rocks: ~6.5km Hartlepool Headland: ~9km

Qualifying feature	SPA population in 2000 (English Nature, 2000)	Current SPA population (Natural England, 2018a)	Usage of the SPA / Ramsar (Natural England, 2018a)	Approximate distance from proposed scheme
	individuals (1991/92 to 1995/06).	(0.2% of the NE Canada and Greenland/Western Europe population), though the reference population remains 5,509 individuals.	estuary, on Coatham Sands, Redcar Rocks and around Hartlepool Headland.	
Redshank (non-breeding)	At designation, the site supported an average of 1,648 individuals (1987 to 1991).	Between 2011/12 and 2015/16, the SPA / Ramsar supported an average of 881 individuals (0.3% of the Iceland & Faroes/Western Europe population), though the reference population remains 1,648 individuals.	Within the site, birds feed on intertidal mudflats including Seal Sands, North Tees Mudflat, Bran Sands and Hartlepool Bay, saltmarsh areas at Greatham Creek and intertidal rocky shores at Hartlepool Headland, Redcar and Coatham.	Seal Sands: ~1.5km North Tees Mudflat: <100m Bran Sands: ~0.9km Hartlepool Bay: ~4km Hartlepool Headland: ~9km Redcar Sands: ~6.5km Coatham Sands: ~3km
Waterbird assemblage of more than 20,000				
Waterbird assemblage	At designation, the average assemblage was 21,312 individuals (1991/92 to 1995/96).	During the period 2011/12 to 2015/16, the SPA / Ramsar supported an average of 26,014 individuals.	The assemblage includes a range of breeding, passage and wintering water bird species, including those species listed above plus nationally important numbers of gadwall, shoveler, sanderling, wigeon and significant numbers of lapwing, herring gull and black-headed gull.	

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.

12.4.2 Review of WeBS core count and low tide count data

WeBS core counts in the Tees estuary

Table 12.5 presents a summary of the most recent core counts from the Tees estuary WeBS count site (2014/15 to 2018/19). As reported below, the highest abundance of waterbirds in the estuary occurs during the winter months, with a mean seasonal peak (i.e. the five year mean of the sum of the maximum counts in a given season) of 21,801 individuals in winter. Each year, the highest monthly counts across the estuary were in either December or January, ranging between around 14,000 and 20,800 individuals.

Table 12.5 WeBS count totals of all species at Tees estuary WeBS core count site, 2014/15 to 2018/19

Year	Peak monthly total*	Autumn peak	Winter peak	Spring peak
2014/15	14,659 (Dec)	15,790	19,198	8,994
2015/16	17,339 (Jan)	18,635	22,851	8,579
2016/17	20,765 (Dec)	18,935	23,553	8,246
2017/18	14,044 (Jan)	16,657	19,329	8,681
2018/19	18,066 (Jan)	16,689	24,074	9,710
Mean	**16,963**	**17,341**	**21,801**	**8,842**

*Peak monthly total is the peak count of all individuals (of all species) in a single month

Table 12.6 presents the five-year annual peak counts of all SPA / Ramsar site qualifying features / assemblage component species and notifying features of the SSSI in the Tees estuary core site.

Table 12.6 Five-year annual peak counts from WeBS core counts at Tees estuary core count site

Species	2014/15	2015/16	2016/17	2017/18	2018/19	Mean peak
Shelduck	426	473	418	452	519	**458**
Shoveler	208	169	123	163	113	**155**
Gadwall	480	740	826	722	707	**695**
Wigeon	2,230	3,562	4,059	4,002	4,060	**3,583**
Avocet	47	116	117	131	92	**101**
Lapwing	3,066	3,938	4,363	2,405	4,571	**3,669**
Ringed plover	105	172	243	505	251	**255**
Knot	760	491	694	250	230	**485**
Ruff	21	45	33	17	12	**26**
Sanderling	204	283	200	190	420	**298**
Purple sandpiper	61	36	45	26	55	**45**
Redshank	765	940	929	657	915	**841**
Black-headed gull	2,888	1,291	2,082	1,892	2,218	**2,074**
Herring gull	3,307	2,595	1,715	1,334	1,751	**2,140**

Species	2014/15	2015/16	2016/17	2017/18	2018/19	Mean peak
Sandwich tern	176	204	235	662	290	**313**
Little tern	6	3	1	89	10	**34**
Common tern	317	280	584	743	343	**497**

WeBS core counts at sectors within or adjacent to the footprint of the proposed scheme, 2012/13 to 2018/19

The Teesmouth and Cleveland SPA / Ramsar site scientific brief (Natural England, 2018a) derived population counts of qualifying features from sectors within the Tees estuary WeBS core count site (as well as Durham Coast sector 1a).

The Tees estuary core count sectors used in the scientific brief include two within 1km of the footprint of the proposed scheme, namely:

- Sector 52426 (Tees Estuary opposite Smith Dock and Hargreaves Quarry), which overlaps with the proposed channel dredge, berth pocket and wharf demolition footprint and includes the North Tees Mudflat; and,
- Sector 52427 (Bran Sands South), which is located downstream of the Tees Dock turning circle and includes Bran Sands lagoon and Dabholm Gut (although it excludes Vopak foreshore).

Tables 12.7 and **12.8** present a summary of the most recent core counts from sector 52426 (2012/13 to 2016/17) and sector 52427 (2014/15 to 2018/19), respectively, which were procured from the BTO in 2020. In sector 52426, the highest mean seasonal peak was in autumn (301 individuals, representing 1.7% of the autumn peak across the entire Tees estuary count site), whereas in sector 52427 the highest mean seasonal peak was in winter (2,377 individuals, representing 10.9% of the winter peak across the entire Tees estuary count site). In all cases, seasonal peaks were higher at sector 52427 than at 52426, meaning that sector 52427 supported more waterbirds regardless of the season.

Table 12.7 Total core counts of all species at WeBS sector 52426 (Tees Estuary opposite Smith Dock and Hargreaves Quarry)

Year	Peak monthly total*	Autumn peak	Winter peak	Spring peak
2012/13	240 (Dec)	101	274	93
2013/14	204 (Feb)	143	238	65
2014/15	265 (Mar)	171	400	230
2015/16	609 (Sep)	632	132	70
2016/17	418 (Aug)	456	N/C	N/C
Mean	**347**	**301**	**261**	**115**

Table 12.8 Total core counts of all species at WeBS sector 52427 (Bran Sands South)

Year	Peak monthly total	Autumn peak	Winter peak	Spring peak
2014/15	2,120 (Mar)	883	2,932	1,685
2015/16	1,205 (Dec)	1,712	1,667	486
2016/17	946 (Nov)	905	1,491	278
2017/18	1,911 (Jan)	652	2,387	615
2018/19	1,989 (Jan)	1,222	3,408	324

Year	Peak monthly total	Autumn peak	Winter peak	Spring peak
Mean	**1,634**	**1,075**	**2,377**	**378**

Table 12.9 lists the five-year annual peak counts for individual species in sector 52426 (2012/13 to 2016/17) and sector 52427 (2014/15 to 2018/19), respectively. The values reported represent the highest count of a given species recorded in a single month for the year in question. In sector 52426, herring gull (mean peak of 175 individuals) and black-headed gull (130 individuals) were the most abundant species recorded over the period 2012/13 to 2106/17, and the only species with a mean peak count of more than 26 individuals.

In general, species counts were considerably higher in sector 52427, with the most abundant species being common gull *Larus canus* (mean peak 570 individuals) and herring gull (mean peak 536 individuals) over the period 2014/15 to 22018/19. Other species with a mean peak of over 100 individuals at sector 52427 (Bran Sands South) included lapwing (mean peak 370 individuals), black-headed gull (354 individuals), teal (303 individuals), redshank (174 individuals) and great black-backed gull *Larus marinus* (115 individuals).

Table 12.9 Five-year annual peak counts (i.e. highest count in a single month) from WeBS core counts at sectors 52426 and 52427

	Sector 52426 Tees Estuary opp. Smith Dock and Hargreaves Quarry						Sector 52427 Bran Sands South					
Species	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**	**Mean**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**Mean**
Canada goose	0	2	0	0	0	**<1**	0	3	5	12	0	**4**
Greylag goose	0	0	0	1	0	**<!**	0	0	0	0	0	**0**
Mute swan	0	4	0	0	0	**1**	1	0	0	0	0	**<1**
Shelduck	8	25	15	22	0	**14**	124	118	61	51	94	**90**
Gadwall	0	0	2	4	0	**1**	14	4	2	7	13	**8**
Wigeon	0	0	0	0	0	**0**	0	2	7	0	0	**2**
Mallard	2	0	1	4	0	**1**	21	14	12	13	8	**14**
Teal	0	4	0	0	0	**1**	248	126	171	145	827	**303**
Pochard	0	0	0	0	0	**0**	0	0	0	1	0	**<1**
Tufted duck	0	1	0	0	0	**<1**	0	0	1	0	0	**<1**
Scaup	0	0	0	0	0	**0**	0	0	1	0	0	**<1**
Eider	0	0	0	2	0	**<1**	1	2	0	1	4	**2**
Long-tailed duck	0	0	0	0	0	**0**	0	0	1	0	0	**<1**
Goldeneye	0	1	1	0	0	**<1**	26	33	29	22	29	**28**
Goosander	0	0	0	0	0	**0**	0	0	0	0	1	**<1**
Red-breasted merganser	4	1	3	0	0	**2**	42	52	52	34	43	**45**
Red-throated diver	0	0	0	0	0	**0**	2	0	0	1	0	**1**
Little grebe	0	0	0	0	0	**0**	13	14	26	23	18	**19**
Great crested grebe	0	0	0	0	0	**0**	1	1	1	11	0	**3**

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	Sector 52426 Tees Estuary opp. Smith Dock and Hargreaves Quarry						Sector 52427 Bran Sands South					
Species	**12/13**	**13/14**	**14/15**	**15/16**	**16/17**	**Mean**	**14/15**	**15/16**	**16/17**	**17/18**	**18/19**	**Mean**
Grey heron	1	1	1	2	0	**1**	10	9	9	6	3	**7**
Little egret	0	0	0	0	0	**0**	14	19	6	11	7	**11**
Shag	2	0	0	0	0	**<1**	0	0	0	1	0	**<1**
Cormorant	39	13	16	25	36	**26**	112	56	63	58	34	**65**
Moorhen	0	0	0	0	0	**0**	6	2	2	2	2	**3**
Oystercatcher	4	2	2	4	2	**3**	3	18	2	3	2	**6**
Lapwing	0	1	2	0	0	**1**	620	190	32	370	640	**370**
Grey plover	0	0	0	0	0	**0**	0	1	0	0	0	**<1**
Ringed plover	5	0	1	0	0	**1**	1	0	0	0	0	**<1**
Whimbrel	0	0	4	0	0	**1**	0	0	0	0	0	**0**
Curlew	15	35	25	36	19	**26**	3	1	5	3	2	**3**
Bar-tailed godwit	0	2	0	0	0	**<1**	0	0	0	0	0	**0**
Turnstone	4	0	1	0	0	**1**	13	11	6	8	2	**8**
Dunlin	0	0	0	0	0	**0**	0	47	2	7	6	**12**
Woodcock	0	0	0	0	0	**0**	0	0	0	0	1	**<1**
Snipe	0	0	0	0	0	**0**	1	0	1	0	0	**<1**
Common sandpiper	0	0	2	2	0	**1**	3	1	2	3	1	**2**
Redshank	12	22	11	9	46	**20**	180	190	180	160	160	**174**
Greenshank	0	0	0	0	0	**0**	0	1	3	0	0	**1**
Kittiwake	0	0	0	0	0	**0**	9	31	16	30	9	**19**
Black-headed gull	160	94	94	140	163	**130**	360	180	270	390	570	**354**
Common gull	2	18	16	1	0	**7**	440	440	470	700	800	**570**
Great black-backed gull	13	3	3	15	18	**10**	6	28	60	270	210	**115**
Herring gull	46	33	238	394	164	**175**	1,450	740	190	160	140	**536**
Lesser black-backed gull	1	0	1	5	4	**2**	2	5	2	8	7	**5**
Sandwich tern	0	0	0	0	0	**0**	0	4	12	6	0	**4**
Common tern	5	4	6	5	4	**5**	14	30	4	9	11	**14**
Arctic tern	0	0	0	0	0	**0**	1	0	0	0	0	**<1**
Kingfisher	0	0	0	0	0	**0**	0	1	0	1	0	**<1**

Royal HaskoningDHV

Of the SPA / Ramsar site qualifying features, those recorded in one or both sectors (i.e. listed in **Table 12.9**) were Sandwich tern, common tern and redshank. Additionally, major component species of the SPA / Ramsar site assemblage recorded included gadwall, wigeon, lapwing, herring gull and black-headed gull. Additional SSSI species present during the counts included shelduck and ringed plover.

Seasonality of the SPA / Ramsar site and SSSI features varied from species to species. Winter months (i.e. December to February) generally saw peak counts of redshank, gadwall, shelduck and lapwing. Summer and early autumn (notably July through September) saw peak counts of common tern, Sandwich tern and ringed plover. Herring gulls and black-headed gulls were generally present throughout the year, with peak counts occurring across all seasons.

Table 12.10 indicates the proportion of the SPA / Ramsar site populations (as per the SPA / Ramsar site citation and Natural England, 2018a) represented by the mean annual peak counts in Sectors 52426 and 52427, plus the proportion of the overall Tees estuary WeBS core site counts over the same period.

Table 12.10 Mean peak count of SPA / Ramsar site and SSSI assemblage species at WeBS sectors 52426 (2012/13 to 2016/17) and 52427 (2014/15 to 2018/19). Species in bold are those that qualify as features of the SPA / Ramsar site in their own right.

		Mean peak count by WeBS count sector and proportion of the Tees Estuary WeBS count site mean peak and SPA / Ramsar citation population					
		Tees Estuary opp. Smith Dock and Hargreaves Quarry (52426)			Bran Sands South (52427)		
Species	SPA mean	Mean peak count 12/13-16/17	% of Tees Estuary mean peak	% of SPA population	Mean peak count 14/15-18/19	% of Tees Estuary mean peak	% of SPA population
Shelduck	N/A	14	3.3	N/A	90	19.6	N/A
Gadwall	428	1	0.2	0.2	8	1.2	1.9
Wigeon	2,660	0	0.0	0.0	2	<0.1	<0.1
Lapwing	3,892	1	<0.1	<0.1	370	10.1	9.5
Ringed plover	N/A	1	0.5	N/A	<1	<0.1	N/A
Redshank	**1,648**	**20**	**2.3**	**1.2**	**174**	**20.7**	**10.6**
Black-headed gull	2,273	130	5.7	5.7	354	17.0	15.5
Herring gull	3,243	175	7.7	5.4	536	25.0	16.5
Sandwich tern	**1,900**	**0**	**0.0**	**0.0**	**4**	**1.3**	**0.2**
Common tern	**798**	**5**	**1.4**	**0.6**	**14**	**2.8**	**1.8**

Sector 52426 supported a significant[9] proportion of the SPA / Ramsar site assemblage component population of black-headed gull (~6% of the population) and herring gull (~5%), as well as a significant proportion of the overall Tees estuary counts over the same period.

Sector 52427 supported an important proportion of the SPA / Ramsar site population of redshank (~11%), as well as the assemblage component species lapwing (~10%), black-headed gull (~16%) and herring gull (~17%). Additionally, sector 52427 supported a significant proportion (~20%) of the overall Tees estuary count of shelduck, a SSSI notification feature.

[9] A 5% threshold was used to determine significant populations within the Teesmouth and Cleveland Coast pSPA/Ramsar Departmental Brief, which is consistent with assessments of the importance of prospective extensions to other sites in England (Natural England, 2018a)

Notably, neither sector supported significant populations of the qualifying features Sandwich tern, common tern, little tern and knot, nor other SPA / Ramsar site component species (i.e. gadwall, shoveler and wigeon) and SSSI features.

WeBS low tide counts in the Tees estuary

WeBS low tide count data provides information on the relative importance of intertidal feeding areas of UK estuaries for wintering waterbirds. Low tide count data in the Tees estuary provides more of an understanding of the use of intertidal areas and other habitats within the Tees estuary, including by SPA / Ramsar and SSSI qualifying features. Sector DT021, which encompasses Bran Sands South and intertidal areas just north of the turning circle, and Sector DT020, which encompasses the North Tees Mudflat, are the most relevant sectors to the proposed scheme.

Tables 12.11 and **12.12** present the species recorded during the most recent low tide counts in the Tees estuary from sector DT021 and DT020, undertaken during the winters of 2018/19 and 2012/13, respectively.

Table 12.11 Peak and mean densities recorded in WeBS low tide counts at sector DT021 (18/19)

Species	Preferred habitat	Area (ha) of preferred habitat	Peak count	Peak density	Mean count (ind./ha)	Mean density (ind./ha)
Mute swan	Subtidal	33	2	0.06	1	0.02
Shelduck	All habitats	40	138	3.45	129	3.23
Gadwall	All habitats	40	43	1.08	21	0.52
Mallard	All habitats	40	13	0.33	9	0.23
Teal	All habitats	40	848	21.20	677	16.92
Red-breasted merganser	Subtidal	33	2	0.06	1	0.02
Grey heron	Intertidal & non-tidal	7	5	0.71	4	0.50
Cormorant	All habitats	40	11	0.28	3	0.08
Moorhen	All habitats	40	2	0.05	1	0.02
Oystercatcher	Intertidal	7	13	1.86	8	1.14
Lapwing	Intertidal & non-tidal	7	548	78.29	227	32.36
Curlew	Intertidal & non-tidal	7	8	1.14	7	1.04
Turnstone	Intertidal	7	3	0.43	1	0.18
Redshank	Intertidal & non-tidal	7	134	19.14	86	12.21
Black-headed gull	All habitats	40	80	2.00	60	1.50
Common gull	All habitats	40	1	0.03	1	0.01
Great black-backed gull	All habitats	40	1	0.03	1	0.01
Herring gull	All habitats	40	61	1.53	31	0.78

Table 12.12 Peak and mean densities recorded in WeBS low tide counts at sector DT020 (12/13)

Species	Preferred habitat	Area (ha) of preferred habitat	Peak count	Peak density (ind./ha)	Mean count	Mean density (ind./ha)
Shelduck	All habitats	45	12	0.27	4	0.09
Teal	All habitats	45	47	1.04	12	0.26
Cormorant	All habitats	45	7	0.16	2	0.05
Oystercatcher	Intertidal	21	4	0.19	2	0.11
Lapwing	Intertidal & non-tidal	21	75	3.57	19	0.89
Ringed plover	Intertidal	21	2	0.10	1	0.02
Curlew	Intertidal & non-tidal	21	33	1.57	22	1.06
Turnstone	Intertidal	21	1	0.05	1	0.02
Redshank	Intertidal & non-tidal	21	121	5.76	44	2.11
Black-headed gull	All habitats	45	60	1.33	15	0.33
Great black-backed gull	All habitats	45	19	0.42	5	0.11
Herring gull	All habitats	45	123	2.73	31	0.68

The above tables suggest that population density is generally considerably lower at North Tees Mudflat than at Bran Sands South and areas downstream. The densest populations at North Tees Mudflat are those of curlew (mean of 1.06 individuals per hectare of suitable habitat) and redshank (2.11 ind./ha), indicating low usage of the site over the survey period. However, as mentioned, the WeBS low tide data from sector DT020 is dated winter 2012/13 and is not considered to be recent.

12.4.3 Site-specific estuarine bird survey

Given that the WeBS low tide data for North Tees Mudflat is old, a site-specific non-breeding water bird survey has been conducted by INCA. The survey commenced in July 2020 and will continue until March 2021. This survey has been undertaken, in agreement with Natural England, to provide an indication of the abundance of birds within the footprint of the proposed scheme and at the adjacent areas indicated in **Figure 12.3**, and the manner in which the site is used.

Available data at the time of writing are reported below. The survey gives an indication of the usage of the site by SPA / Ramsar site features and assemblage component species and can be set into the context of the SPA / Ramsar site populations. Low tide counts in particular are useful for understanding the importance of the intertidal zones (notably North Tees Mudflat) for foraging.

Results of the outstanding survey visits (i.e. those from October 2020 to March 2021), which will incorporate the key wintering period in the Tees estuary will be made available in the form of a post-submission supplementary report.

High tide counts

The results of the high tide counts (up to the time of writing) at each of the four sectors are presented in **Table 12.13**. As of the survey visit on 22nd September 2020, birds seen in Sector 1 (i.e. the intertidal zone and artificial structures at South Bank) were defined as either using the existing wharf structure or the South Bank riverbank / intertidal.

Table 12.13 Site survey high tide peak counts, July to September 2020

Survey visit	28/07				11/08				25/08				02/09				22/09			
Sector	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Cormorant	0	16	0	0	0	4	0	6	1	6	1	4	1	1	0	0	0	1	0	0
Curlew	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	2	0	1	0
Grey heron	0	0	0	7	0	0	5	0	1	0	10	0	1	0	2	0	2	0	7	5
Oystercatcher	2	0	0	0	0	0	0	2	0	0	4	0	2	0	2	0	0	0	0	0
Redshank	1	0	0	0	0	0	7	0	1	0	0	0	5	0	0	0	1	0	6	0
Turnstone	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0
Total	**3**	**16**	**0**	**7**	**0**	**4**	**17**	**8**	**3**	**6**	**15**	**4**	**10**	**1**	**4**	**0**	**5**	**1**	**17**	**5**

During the high tide counts to date, six species have been recorded across the four sectors. The majority of birds recorded were roosting at high tide, with a small amount of foraging activity by redshank and oystercatcher at Sectors 3 and 4. As of the 22nd September 2020 survey, birds in Sector 1 (notably curlew, grey heron and redshank) were seen to use both the riverbank and the existing quay structure. Birds recorded at high tide displayed a clear preference for the North Tees Mudflat (Sectors 3 and 4) over the main river channel (Sector 2) and the artificial structures and riverbank at Sector 1, as indicated in **Table 12.13**.

Of the six species recorded during the high tide surveys to date, only redshank is a feature and/or major assemblage component of the SPA / Ramsar site and SSSI. The peak count of redshank (7) represents 0.4% of the SPA passage population and 0.8% of the current Tees Estuary population, as per the most recent WeBS counts (2014/15 to 2018/19).

Low tide counts

The results of the low tide surveys (up to the time of writing) at each of the four sectors are presented in **Table 12.14**.

Table 12.14 Site survey low tide peak counts, July to September 2020

Survey visit	14/07				05/08				18/08				01/09				15/09			
Sector	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Bar-tailed godwit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Cormorant	3	2	2	0	5	0	1	6	0	0	5	3	2	1	6	2	0	2	3	6
Curlew	3	0	14	15	2	0	24	16	2	0	23	8	1	0	14	14	2	0	13	10
Grey heron	0	0	1	3	0	0	0	0	0	0	0	0	2	0	1	1	0	0	1	2
Lapwing	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	28	0	0	0	49
Little egret	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Oystercatcher	2	0	5	3	0	0	4	3	1	0	3	3	2	0	3	0	2	0	1	3
Redshank	0	0	2	0	0	0	5	7	0	0	30	52	1	0	26	56	2	0	29	51
Turnstone	0	0	0	0	0	0	0	0	0	0	0	12	0	0	4	3	0	0	9	1
Whimbrel	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**8**	**2**	**24**	**22**	**8**	**0**	**34**	**32**	**3**	**0**	**62**	**101**	**8**	**1**	**55**	**115**	**6**	**2**	**56**	**123**

During the low tide counts to date, ten species have been recorded across the four sectors. At low tide, foraging was the most regular activity recorded, highlighting the importance of the intertidal habitat at Sectors 3 and 4 (North Tees Mudflat) as a feeding resource. The relatively high total counts at North Tees Mudflat were largely driven by the presence of curlew, redshank and lapwing. Counts have increased with each subsequent visit, indicating that populations in the survey site will likely increase moving into winter months. Birds recorded at low tide displayed an even clearer preference for the North Tees Mudflat over the main river channel and the artificial structures and intertidal at Sector 1 than they did at high tide, as indicated in **Table 12.13**

Of the eight species recorded, one (redshank) is a feature of the SPA / Ramsar site and SSSI and one (lapwing) is a major component species of the qualifying assemblage. The peak count of redshank (82) recorded at North Tees Mudflat represents a significant proportion (5.0%) of the SPA passage population, and 9.7% of the current Tees estuary population as per the most recent WeBS counts (2014/15 to 2018/19). The peak count of lapwing (49) represents 1.3% of both the SPA population and the current Tees estuary population (2014/15 to 2018/19).

Summary of site-specific estuarine bird survey

The site-specific survey indicates that the intertidal areas adjacent to the proposed scheme footprint (i.e. North Tees Mudflat) provide important foraging opportunities for non-breeding water birds at low tide during the surveyed months of July to September. Species supported include a notable population of redshank, a qualifying feature of the SPA / Ramsar site and SSSI, and lapwing, a component species of the SPA / Ramsar site and SSSI assemblage. At high tide, when the intertidal areas are submerged, water bird numbers are considerably lower. Usage of South Bank and the existing quay structure during the surveyed period appears to be very low at both high tide and low tide, indicating that this habitat is of comparatively low value. However, it should be noted that at the time of writing the survey does not provide a quantitative indication of the usage of the area by water birds during winter months, when the Tees estuary supports its highest numbers.

As previously noted, in the absence of recent low tide counts of wintering birds at the North Tees Mudflat across the full winter period, the assumption made for the purposes of impact assessment is that North Tees Mudflat is used by a significant proportion of the Tees estuary water bird population (see also **Table 12.3**).

12.4.4 South Bank tern survey

The tern species survey undertaken from the South Bank Wharf between late June and early August 2020 (INCA, 2020) indicated that very few terns were recorded using or commuting along the river channel adjacent to the wharf (see **Figure 12.3**), and numbers were lower than in similar surveys undertaken in 2015 (Perrow *et al.*, 2016) and 2016 (INCA, 2016). No little terns were recorded during any of the four counts, and only three Sandwich terns were recorded (representing 0.2% of the SPA population). From previous counts of the site (Perrow *et al.*, 2016; INCA, 2016), it is understood that common tern is the most regular user of the site, and **Table 12.15** presents the common tern counts in 2020 compared with those in 2015 and 2016.

The maximum count in 2020 of 12 individuals represents 1.5% of the SPA population, and the behaviour recorded included commuting through the site and foraging. In 2020, common terns were most prevalent in June, with very few recorded in later counts. The counts indicate that, generally speaking, the only tern species to regularly use the river channel near to the proposed scheme is common tern, though even numbers of these are relatively low when compared with other areas of the Tees (INCA, 2020).

Table 12.15 Point counts of common tern at South Bank Wharf in 2020 (INCA, 2020), 2016 (INCA, 2016) and 2015 (Perrow* et al.*, 2016)

	Count		
	2015	2016	2020
Late June	11	10	12
Early July	5	9	0
Late July	22	4	1
Early August	N/A	N/A	2

12.4.5 Review of existing ornithological abundance and distribution data in the lower Tees estuary

This section provides information from other ornithological studies undertaken across the lower Tees estuary, supplementing the data from the WeBS and site-specific surveys of sites within or adjacent to the proposed scheme footprint (including the North Tees Mudflat).

Wintering bird surveys 2014-15 at Teesside

The Teesside wintering bird survey was undertaken across a number of survey sites within the Teesmouth and Cleveland Coast SSSI between November 2014 and March 2015, as part of a Natural England national review of the SSSI network (Ecology Consulting, 2015). Survey sites within 1km of the footprint of the proposed scheme included:

- North Tees Mudflat and Brownfield, an area of 65ha which incorporated the North Tees Mudflat and adjacent terrestrial area; and,
- Vopak Foreshore and Brownfield, an area of 22ha which incorporated the intertidal foreshore approximately 100m north of the Tees Dock turning circle (part of the SPA, Ramsar site and SSSI) plus adjacent terrestrial area.

Both low tide and high tide counts were undertaken in the two sectors (two low and two high per month in November / December 2014, three low and three high per month in January to March 2015). **Tables 12.16** and **12.17** present the peak monthly counts at North Tees Mudflat (and Brownfield) and Vopak Foreshore (and Brownfield), respectively, for all waterbird species with a peak count of more than one (for conciseness, species with a peak count of one or less have not been included).

Table 12.16 High tide and low tide peak counts at North Tees Mudflat and Brownfield (adapted from Ecology Consulting, 2015)

	High tide peak counts					Low tide peak counts				
Species	Nov.	Dec	Jan	Feb	Mar	Nov	Dec	Jan	Feb	Mar
Shelduck	0	4	12	37	12	11	6	8	22	27
Gadwall	0	0	0	0	4	0	0	0	0	0
Teal	0	6	0	0	0	0	0	0	0	0
Mallard	0	2	2	2	0	0	0	2	0	2
Red-breasted merganser	0	0	0	0	0	1	0	2	0	0
Cormorant	4	12	3	3	0	8	7	2	3	1
Oystercatcher	0	0	0	7	2	1	0	1	5	4

	High tide peak counts					Low tide peak counts				
Species	**Nov.**	**Dec**	**Jan**	**Feb**	**Mar**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**
Lapwing	0	0	0	0	0	2	0	36	0	0
Curlew	10	10	8	16	6	20	13	30	27	16
Redshank	0	0	0	0	0	115	54	11	4	2
Common gull	2	0	75	2	0	0	2	1	2	0
Lesser black-backed gull	0	0	0	0	1	0	0	0	0	4
Herring gull	1	3	66	120	5	202	451	236	755	457
Great black-backed gull	2	1	1	2	4	31	35	49	19	8
Black-headed gull	20	45	195	134	2	137	66	255	345	164

Table 12.17 High tide and low tide peak counts at Vopak Foreshore and Brownfield (adapted from Ecology Consulting, 2015)

	High tide peak counts					Low tide peak counts				
Species	Nov.	Dec	Jan	Feb	Mar	Nov	Dec	Jan	Feb	Mar
Shelduck	0	0	0	4	240	0	0	0	2	1
Mallard	0	0	2	0	0	0	0	0	0	0
Eider	0	1	0	0	0	0	0	0	5	3
Red-breasted merganser	0	0	8	6	1	2	0	1	5	4
Cormorant	1	1	37	0	4	2	14	16	46	1
Oystercatcher	8	6	5	5	4	3	3	4	8	4
Lapwing	225	0	243	124	0	230	82	189	17	0
Bar-tailed godwit	0	0	0	1	0	2	0	1	0	0
Curlew	19	20	7	9	6	3	12	13	4	6
Redshank	2	3	5	1	2	3	1	1	1	1
Turnstone	1	0	4	0	0	0	0	0	0	1
Common gull	24	29	46	12	4	1	0	3	255	6
Lesser black-backed gull	0	0	0	0	1	0	0	0	1	6
Herring gull	20	15	68	48	53	33	97	216	353	101
Great black-backed gull	0	0	2	8	1	12	52	38	36	1
Black-headed gull	45	11	26	2	3	11	0	17	20	1

The two sectors were divided into smaller subsections for the purpose of recording the distribution of birds. Both the North Tees Mudflat and the Vopak Foreshore supported much greater number of birds than their respective adjoining brownfield land. As is also suggested by the site-specific low tide surveys in 2020 (see **Section 12.4.3)**, the 2014/15 counts indicate that the North Tees Mudflat is notable as a foraging site for redshank at low tide (up to 115 individuals, representing 7% of the reference SPA / Ramsar site population) and small numbers of curlew *Numenius arquata* (peak count of 30). The intertidal area at North Tees Mudflat was also used for feeding and roosting by significant numbers of herring gulls (up to 755 individuals, 23% of the SPA mean population), black-headed gulls (up to 345 individuals, 15% of the mean SPA population) and great black-backed gulls (up to 49 individuals). Birds appeared to be relatively evenly distributed across most of the intertidal area.

The Vopak Foreshore count sector was generally less populated than the North Tees Mudflat, though it supported a significant roost of lapwing (peak count of 243 individuals, 6% of the mean SPA population), a component species of the SPA / Ramsar site assemblage. Lapwing roosts were mainly on the mudflat but also occasionally on the adjacent brownfield grassland. Small numbers of curlew were recorded feeding through the tide and a small cormorant roost was regularly present on the rocky shore. There were relatively high numbers of herring gull (an assemblage component species) and great black-backed gull roosting and feeding on the mudflat and rocky shore (Ecology Consulting, 2015).

Vopak Foreshore waterbird survey 2013/14

A vantage point monitoring survey was undertaken on a bi-monthly basis (June 2013 to March 2014) along the Vopak foreshore, as part of planning work for the Anglo American Harbour facilities (INCA, 2014). This section presents the results of the 2013/2014 Vopak Foreshore monitoring. The section of the foreshore monitored does not form part of an existing WeBS count sector.

Ten species were recorded during the monitoring period, of which two (common tern and redshank) are qualifying features of the SPA / Ramsar site, one (lapwing) is an important component of the SPA / Ramsar site waterbird assemblage, and one (shelduck) is additionally notified in the citation for the SSSI. **Table 12.18** indicates the species recorded and peak counts during the monitoring period.

Table 12.18 Peak counts during the Vopak Foreshore monitoring surveys 2013/14 (INCA, 2014)

Species	Months recorded	Peak count	Proportion of the pSPA/Ramsar population (Natural England, 2018)
Shelduck	Jun, Nov, Feb, Mar	2 (Feb, Mar)	
Grey heron	Jul	7	
Cormorant	Jun, Aug – Dec, Mar	73 (Jan)	
Oystercatcher	All	8 (Aug)	
Lapwing	**Jul – Jan**	**165 (Dec)**	**4.2%**
Curlew	Jun – Dec, Mar	5 (Oct, Dec)	
Bar-tailed godwit	Oct, Nov, Jan	5 (Oct)	
Dunlin	Sep	4	
Redshank	**Sep, Nov, Mar**	**2 (Sep, Nov)**	**0.1%**
Common tern	**Aug**	**2**	**0.3%**

The most abundant species recorded was lapwing, although the peak count recorded (165 in December 2017) represented less than 5% of the component lapwing population within the SPA / Ramsar site waterbird assemblage. Of the SPA / Ramsar site qualifying species, only redshank and common tern were present. Both had a peak count of two, which represents a negligible proportion of the SPA / Ramsar site populations.

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

In the absence of the proposed scheme, future trends in the numbers and distribution of bird species in the Tees estuary are likely to be shaped by localised drivers such as future industrial / commercial works along the river, plus wider issues such as climate change. The ongoing activities along the banks of the Tees estuary would continue, and therefore the levels of direct and indirect disturbance to birds within and adjacent to the Tees would not be expected to decrease.

12.4.7 Ornithology receptors scoped in for assessment

Based on the information gathered from the site-specific surveys and the desk-based review of other data sources in the Tees estuary, receptors included in the following impact assessments are as follows:

- Wintering (non-breeding) waterbirds, including features of the Teesmouth and Cleveland Coast SPA / Ramsar site and SSSI, which are notably present on intertidal areas of the North Tees Mudflat and the Vopak Foreshore.
- Breeding terns, which are features of the SPA and could potentially forage within the Tees estuary, including within the footprint of the proposed scheme.

12.5 Potential impacts during the construction phase

12.5.1 Loss of supporting habitat due to dredging / excavation and demolition works

During the construction phase, it will be necessary to excavate up to 2.5ha of the intertidal area which runs along the South Bank, between the existing wharf and the riverbank. This will be converted to new subtidal habitat within the proposed berth pocket. Additionally, the existing wharf structure and smaller jetties downstream will be demolished and replaced by a new quay set into the riverbank. All works below the high tide mark are within the Teesmouth and Cleveland Coast SPA, therefore such changes may represent a loss of potential foraging habitat (intertidal) and roosting habitat (artificial structures) for waterbirds, including SPA / Ramsar site and SSSI features.

The dredging footprint in the main channel does not overlap with the intertidal habitat available at North Tees Mudflat or any other intertidal areas along the river, therefore there is no direct impact on supporting habitat beyond those referred to above.

Data available to date from site-specific surveys undertaken in 2020 (albeit outside of the key wintering season), which indicate that high tide peak counts within Sector 1 (i.e. South Bank) range from zero to 10 individuals (see **Section 12.4.3**), suggest that the area which is to be subject to demolition and excavation (including the artificial structures) is of low value to roosting or foraging birds at high tide. This suggestion is supported by WeBS core counts of coastal and estuarine birds at Sector 52426 (which incorporates the structures due to be demolished), which indicate that the sector does not appear to support high numbers of birds (at high tide) even during the peak winter months (see **Section 12.4.2**). Numbers within the sector are significantly lower than other areas of the Tees estuary (for example, the mean winter peak at Sector 52426 is 261 individuals, compared with 2,377 at the neighbouring sector 52427). Furthermore, there are several other artificial structures along the Tees, typical of an industrialised waterway, that could offer alternate roosting / loafing locations.

The results obtained so far from the 2020 site-specific low tide surveys (see **Section 12.4.3**) show a consistent preference by waterbirds for North Tees Mudflat over South Bank and the intertidal area within the footprint of the proposed scheme. During the summer / early autumn months, peak low tide counts at South Bank range from three to eight individuals, compared with a range of 46 to 179 individuals at North Tees Mudflat. Whilst noting that the results to date do not encompass the key wintering months, they so far suggest that, even at low tide, the value of the habitat available in the area affected by excavation and demolition is low, and sensitivity of birds to loss of this habitat would be far lower than it would, for example, to a permanent loss at North Tees Mudflat or other intertidal areas further downstream.

The above also indicates that, within the immediate area, there are alternative (even preferable) high-value supporting habitats available to the comparatively low-value habitat to be lost through demolition and excavation. In the wider area, existing literature (e.g. Natural England, 2018a), Tees Estuary WeBS core site counts (**Section 12.4.2**) and other surveys of the Tees (**Section 12.4.5**) indicate that there are other alternative sites within a reasonable proximity that are clearly suitable for supporting high numbers of waterbirds, including *inter alia* Vopak Foreshore (~1.4km away), Bran Sands South (~2.1km away) and Seal Sands (~2.6km away). When set into the context of these (and other) areas in the Tees, displacement of birds due to the loss of 2.5ha of comparatively low-value intertidal habitat and the existing artificial structures is considered to be of low magnitude. Put into the context of the wider SPA, the total area of potential supporting habitat within the footprint of the proposed dredging and excavation represents just 0.3% of the SPA. As such, the loss of supporting habitat within the footprint of the proposed scheme is considered to be of **minor adverse** significance.

Mitigation and residual impact

While the artificial structures and other areas within the footprint of the works at South Bank may be considered to be of low value as supporting habitats, disturbance of any birds nesting at the site would be considered a contravention of the Wildlife and Countryside Act 1981 (as amended). To avoid this, surveys should be undertaken to check for the presence of potential nesting habitat and nests prior to demolition and other construction-phase works, if undertaken during the breeding season (March to August). In the event that nests are identified, an exclusion zone would be established around the nest and works not permitted within the exclusion zone until the nest is confirmed as no longer in use. This should be overseen by an experienced ornithologist. This mitigation will be included in the CEMP. The residual impact would be **minor adverse**.

12.5.2 Impacts on feeding and food resources due to reductions in water quality

As discussed further in **Section 13.5.1**, dredging and excavation activities resulting in an increase in SSC may have an adverse impact on prey items (i.e. fish) within the water column that could lead to barrier effects and behavioural responses that may see temporary displacement of those species, over an estimated period of approximately five months. This in turn has the potential to affect SPA / Ramsar site and SSSI features that feed on such resources, such as terns. Furthermore, high turbidity as a result of increased SSC limits visibility through the water, which may adversely affect the ability of aerial predators to detect prey items (Cook and Burton, 2010). As detailed in **Section 9.5.2**, the effects of increased SSC would have a negligible impact on benthic prey species in the intertidal zone so consequent effects on waterbirds feeding on such prey are unlikely.

The area that may be affected by increases in SSC during dredging has been described in **Section 6.5.2**. In summary, the largest sediment plumes are likely to arise during Stage 2 of the dredging (i.e. BHD and TSHD working in parallel to dredge in the berth pocket and the main channel). During this stage, the zone of influence extends approximately 750m downstream and 2,500m upstream of the dredged area (see **Figure 6.39**), though it should be noted that only part of those areas would be affected at any point in time (it is not a sediment plume, rather a combined zone of influence). The sediment dispersion modelling of Stage 2 dredging, presented in **Section 6.5.2** indicates that significant SSC excesses from the capital dredging are confined to the dredging transects and are predicted to decrease significantly with increased distance from the dredging vessel, both laterally and along the line of the vessel, with plumes diminishing typically to levels of <30 mg/l but often <10mg/l at a distance of no more than a few hundred metres. Baseline levels are expected to be restored within a few minutes to a few hours of release. For the purpose of this assessment, the sediment plume may be regarded as representing a temporary loss of foraging habitat.

As outlined in **Table 12.4**, little terns within the SPA / Ramsar site nest almost exclusively at Crimdon Dene (approximately 6km north of the mouth of the Tees estuary), with foraging grounds confined to the coastal waters north of Hartlepool Headland (Natural England, 2018a). Along with the absence of little tern sightings in the WeBS counts and site survey data reported in **Sections 12.4.2** and **12.4.4**, this indicates that little terns do not forage to any significant extent within the predicted range of the sediment plume. Likewise, the WeBS core counts and site-specific tern surveys indicate very little use of the affected area by passage Sandwich terns, with a mean annual peak (2013/14 to 2018/19) of four recorded across the two core count sectors and a total of three recorded during the 2020 South Bank tern survey visits (noting that, as a passage feature of the SPA, it is unlikely that significant numbers of Sandwich terns would be present during the breeding season). As such, there will be no significant impacts to the foraging capability of either of these tern species as a result of increased suspended sediments during the construction phase.

Common terns are known to breed at Saltholme RSPB Reserve (see **Table 12.4**) and regularly use the Tees estuary for foraging (Natural England, 2018a). As such this species is the most likely to be affected by impacts on foraging resources, and as a worst-case scenario the assumption for this assessment is that the dredging campaign may overlap with part of the common tern breeding period.

A peak count of 12 birds (representing 1.5% of the SPA / Ramsar site population) was recorded during the 2020 tern survey (the coverage of which is assumed to provide sufficient evidence for the use of the area affected by dredging, as detailed in **Section 12.3.2**). The peak count in 2020 was a decrease on previous surveys, and the 5-year mean peak from WeBS counts at sectors 52426 and 52427 was 19, representing 2.4% of the SPA / Ramsar site population. As such, while foraging resources for terns are considered to be of high value, particularly during the common tern breeding period, the number of terns that use prey resources within the affected area are relatively low (INCA, 2020). Common terns have been reported to have a high sensitivity to the potentially longer-term indirect impacts on prey resources (MMO, 2018) but, as detailed further in the assessment on fish resources (see **Section 13.5.1**), there are not anticipated to be any long-term impacts on fish as a result of increased SSC.

Tern foraging ability may be inhibited by poor visibility above the surface. Terns typically hover several metres above the water surface, before plunging after prey. Vision through clear waters is generally important for foraging and therefore terns may be sensitive to the turbidity caused by dredging operations and re-suspension of sediment (Cook and Burton, 2010). However, common terns typically only dive to 1m or less, which is shallower than some other terns (Cabot and Nisbet, 2013), which means that impacts on common terns from increased turbidity are likely to be less significant than they would for deeper-diving species (e.g. Sandwich tern). Furthermore, the occurrence of frequent (almost daily) maintenance dredging activity within the river channel and berths suggests that exposure to such effects in the affected area is already relatively high and some level of habituation to such impacts is likely. As such, the sensitivity of common terns within the Tees estuary to increases in SSC is considered to be medium.

As described above, the zone of influence of the Stage 2 dredge presented in **Figure 6.39** significantly overstates the area that would be affected at any single time, which would be considerably smaller. It should be noted that approximately 9,400ha of subtidal in the January 2020 extension to the seaward boundary of the SPA was informed by the predicted foraging range of breeding common terns at Saltholme (Natural England, 2018a), and the area likely to be affected by the sediment plume at any one time represents around 0.5% of the total subtidal foraging area within the SPA. Therefore there is sufficient alternate foraging habitat available even if the plume does result in temporary occlusion from the affected area. Furthermore, SSC levels are only predicted to exceed baseline levels during the dredging campaign (a period of approximately five months) and would return to normal upon completion. Even during the campaign, baseline levels would return within a few minutes to a few hours of cessation at a given point. It should also be noted that Stage 2 dredging will only comprise approximately one month of the approximately five month dredging campaign, and the other stages of the dredge campaign would result in a smaller plume than that described for Stage 2. The magnitude of the impact is therefore considered to be low.

Given the high value and medium sensitivity of common tern as a breeding SPA / Ramsar site and SSSI feature, and the low-level magnitude predicted, it is predicted that impacts on common tern as a result of increased SSC would be **minor adverse**.

Mitigation and residual impact

While the anticipated impact is minor, the following mitigation measure, proposed to reduce the potential for impacts on migratory fish from increased SSC (see **Section 13.5.1**), may also help to reduce consequent impacts on foraging terns:

- Limiting the TSHD and backhoe to working within one side of the river at a time. Operations will therefore be undertaken in long strips along the axis of the estuary rather than dredging across the width of the river. This is to reduce both the extent and impact of the dredged plume, as any plume generated by operations is predicted to collectively occupy around half the width of the river channel. This approach has been proposed for other capital dredge operations in the Tees, such as in the NGCT scheme (Royal HaskoningDHV, 2020).

With the implementation of the above mitigation measure, the modelled plume would only occupy half of the width of the river at any one time, which would have a two-fold effect. Firstly, since one side of the river will remain relatively unaffected at any given time the risk of displacement of fish would be reduced. Secondly, it would lessen the risk of high turbidity and would thus likely improve tern foraging ability. With the implementation of this measure, the residual impact is predicted to be of **minor adverse** significance.

12.5.3 Effects of sediment deposition on intertidal food resources

The deposition of fine sediment within intertidal areas due to capital dredging has the potential to affect benthic communities that represent a feeding resource for waterbirds. For example, high levels of overall deposition or a high rate of deposition could adversely affect components of the benthic community, to the detriment of feeding waterfowl.

The nature of the predicted deposition of fine material, in terms of total deposition and areas affected by the dredging, is presented in **Section 6.5.2**. Fine sediment will be deposited within minutes or hours if carried in suspension from the point of release. Most falls within the dredged areas, whilst deposition elsewhere is much lower. There is no measurable modelled deposition (see **Figures 6.50 and 6.55**) at waterbird-supporting habitats (i.e. mudflats), such as North Tees Mudflat, Seal Sands, Brand Sands and North Gare Sands. The implications of deposition for benthic communities at North Tees Mudflat are presented in **Section 9.5.3**, where it is concluded that the structure and functioning of the benthic communities of intertidal areas would not be affected by the extent or level of deposition predicted.

Given the above, it is concluded that there will be no adverse effect on intertidal food resources as a result of the effects of capital dredging and therefore a **negligible** impact is predicted on the waterbirds relying on such resources.

Mitigation and residual impact

No mitigation measures are required and the residual impact is of **negligible** significance.

12.5.4 Construction-phase disturbance

The construction phase of the proposed scheme has the potential to cause acoustic and visual disturbance effects to bird populations within, or in close proximity to, the footprint of the proposed scheme. Bird reactions are likely to depend on the level and nature of the disturbance. Displacement from the site would effectively represent temporary habitat loss while construction works are ongoing. Noise and visual disturbance are considered separately below although in practice the two will be ongoing at the same time.

Noise disturbance

A distinction may be made between 'continuous' noise levels (L_{Aeq}) and maximum (impulsive) noise levels (L_{Amax}). During the construction phase, it is assumed that the greatest noise disturbance to birds using the study area is likely to arise from impulsive sources, such as impact piling works. As reported in **Section 3.9**, piling will be undertaken (non-continuously) over a period of approximately 15 months (seven months for Phase 1 and eight months for Phase 2), with downtime during transportation of piling rigs from one location to the next. Assuming the use of four rigs and ten minutes of impact piling activity per rig per day, there would be up to 40 minutes of piling activity per day during that period.

Wright *et al.* (2010) investigated the effects to waterbirds of impulsive noise and identified ranges in noise which cause behavioural responses (based on a measured L_{Aeq}). These are:

- No observable behavioural response: 54.9 to 71.5 dB(A);
- Non-flight behavioural response: 62.4 to 79.1 dB(A);
- Flight with return: 62.4 to 73.9 dB(A); and,
- Flight with all birds abandoning the site: 67.9 to 81.1 dB(A).

Similarly, Cutts *et al.* (2009; 2013) compiled classifications for construction noise disturbance to wintering waterbirds as follows:

- Noise below 50 dB(A): low;
- Regular noise 50-70 dB(A): moderate to low;
- Irregular noise 50-70 dB(A): moderate; and,
- Noise above 70 dB(A): high.

In this classification, low response was defined as 'no effect', moderate response was defined as 'head-turning, scanning, reduced feeding or movement to nearby areas' and high response was defined as 'preparing to fly, flight or abandonment on the area'.

Noise modelling undertaken for the proposed scheme was derived from baseline noise levels recorded at four ecological monitoring locations (for more information see **Section 17** and **Figure 17.1**), and predicted construction noise levels at seven noise-sensitive ecological receptors. This data is presented in **Table 12.19** below.

The predicted noise levels shown in **Table 12.19** indicate that general construction noise levels (i.e. those from dredging and demolition works, represented as the day / night L_{Aeq}) at most receptor locations will be less than 55 dB(A). Such noise levels are considered to be 'low' disturbance and are not anticipated to result in any observable behavioural response from birds (Cutts *et al.*, 2009; Wright *et al.*, 2010). At the downstream end of the North Tees Mudflat (i.e. directly across the river from the proposed scheme), general construction noise levels are predicted to be around 59.5 dB(A). Although higher than at other receptors, this is still considered to be within the moderate to low disturbance range and is unlikely to result in a behavioural response (Cutts *et al.*, 2009; Wright *et al.*, 2010).

Table 12.19 Predicted airborne noise levels at ecological receptors during construction

Calculation standard	Receptor	Day dB(A)	Night dB(A)	Lmax dB(A)
ISO 9613	ST1 – Vopak Foreshore	38.6	38.6	56.6
	ST4 – Dabholme Gut (mouth)	36.8	36.8	56.4
	ST5 – Dabholme Gut (centre)	35.5	35.5	53.1
	North Tees Mudflat – 1 (downstream)	59.5	59.5	80.0
	North Tees Mudflat – 2 (centre)	51.1	51.1	72.9
	North Tees Mudflat – 3 (upstream)	46.8	46.8	68.8
	Seal Sands	32.1	32.1	50.4

While most construction-related noise is unlikely to cause significant disturbance to birds at North Tees Mudflat, the impulsive noise levels associated with the piling works indicated in **Table 12.19** range between 68.8 dB(A) at the upstream receptor and 80.0 dB(A) at the downstream receptor (nearest to the site of the piling works).

In addition to the supporting habitat offered at North Tees Mudflat, the change to the boundary of the Teesmouth and Cleveland Coast SPA / Ramsar site indicates that the waters in the Tees channel downstream of the Tees Barrage represent sensitive feeding habitat for terns. However, South Bank tern surveys undertaken in 2020, 2015 and 2014 (see **Section 12.4.4**) indicate that this section of the river is infrequently used by terns, with more important foraging areas elsewhere within the SPA / Ramsar site (INCA, 2020). As such, impacts on tern species are considered to be of less significance than impacts on waterbirds at North Tees Mudflat.

Based on the noise levels predicted in **Table 12.17**¸ noise disturbance at North Tees Mudflat from the proposed piling activities is considered to be high, such that the waterbirds present may exhibit behavioural responses such as flight with return or abandonment of the site. As described previously, it has been agreed with Natural England that, in the absence of recent site-specific survey low tide data for the North Tees Mudflat, the assumption for this assessment is that it supports a significant number of foraging and/or roosting waterbirds. The significance of the potential impact of noise disturbance due to the proposed construction works will depend on the timing of the construction works relative to the period when waterbirds numbers are at their highest in the Tees estuary (i.e. the wintering season, generally October to March). For the purposes of the assessment, and on a precautionary basis, it has been assumed that the piling works take place over some or all of the winter period.

As such, under a worst-case scenario of 40 minutes of impact piling noise per day, at low tide, the magnitude of the impact is considered to be high.

In terms of receptor sensitivity, the EIA for NGCT (Royal HaskoningDHV, 2020) referred to monitoring undertaken by INCA in 2004. Waterbird behaviour on Seal Sands was monitored during a period of percussive piling at Conoco-Phillips (approximately 270m away)). On all four of the monitoring visits (undertaken at the start and during the piling), there was no evident disturbance to the birds, with continued feeding at Seal Sands. At the nearest point, the piling in the proposed scheme is similarly distant (260-280m) from the North Tees Mudflat, and it is plausible that waterbirds using intertidal areas in the Tees would have a reasonably low sensitivity to piling disturbances at this kind of distance, therefore similar responses (or lack of) may be expected.

However, according to the Waterbird Disturbance Mitigation Toolkit (Cutts *et al.,* 2013), species such as redshank are 'particularly sensitive to noise stimuli, especially in conjunction with visual stimuli'. Although conducted outside of the wintering season, the site-specific low tide survey in July to September 2020 (see **Section 12.4.3**) suggests that, among the species it is likely to support, the North Tees Mudflat may be important for populations of SPA / Ramsar site and SSSI features such as redshank (for example, during the survey period the abundance of redshank represented up to 5% of the SPA / Ramsar site reference population). For this species, the Toolkit suggests that a noise of up to 70dB is acceptable at the bird but with caution above 55dB, which represents the most conservative threshold of all the species considered in the Toolkit. Given the conservation value of the species and its sensitivity to noise disturbance, it is suitable for consideration as a representative species for the purpose of this assessment; therefore, the assessment is conservatively based on a high receptor sensitivity.

As such, it can be concluded that the potential for construction related noise disturbance to waterbirds will be **moderate adverse**.

Mitigation and residual impact

As mitigation for the potential impact of noise disturbance during the construction phase, it is proposed that noise reduction shrouding will be employed for the piling rigs, the use of which will (based on research) provide an estimated 14dB attenuation in impulsive noise. With the shrouding in place, and assuming a 14dB attenuation, the predicted noise levels reported above will be reduced to the levels presented in **Table 12.20** below.

Table 12.20 Predicted airborne noise levels at ecological receptors with shrouding on piling rigs

Calculation standard	Receptor	Day dB(A)	Night dB(A)	Lmax dB(A)
ISO 9613	ST1 – Vopak	37.8	37.8	42.6
	ST4 – Dabholme Gut (mouth)	35.9	35.9	42.4
	ST5 – Dabholme Gut (centre)	34.8	34.8	39.1
	North Tees Mudflat – 1 (downstream)	58.5	58.5	66.0
	North Tees Mudflat – 2 (centre)	49.3	49.3	58.9
	North Tees Mudflat – 3 (upstream)	44.8	44.8	54.8
	Seal Sands	31.2	31.2	36.4

Assuming the above reduction in noise level as a result of the shrouding, the noise levels at North Tees Mudflat and other important areas of intertidal within the Tees would be significantly lessened. Over much of the intertidal area (represented by the 'centre' and 'upstream' receptor points), impulsive noise falls to a level regarded as moderate to low (Cutts *et al.*, 2009 and 2013) and unlikely to result in observable behavioural responses (Wright *et al*, 2010). At the downstream receptor, an L_{Amax} of 66.0 dB(A) is within the range considered acceptable (i.e. less than 70 dB(A)) to sensitive species such as redshank, according to the Waterbird Disturbance Mitigation Toolkit (Cutts *et al.*, 2013). With this in mind, and considering the historic evidence that waterbird species in the Tees estuary may have some degree of tolerance to piling noises at the distances associated with this project, the implementation of the above mitigation measures are expected to reduce the potential for construction-related noise disturbance at North Tees Mudflat to **minor adverse**. A residual impact of negligible significance is predicted at the other sensitive intertidal areas within the Tees.

Visual disturbance

In addition to noise disturbances, there may be accompanying visual disturbances as result of the presence of construction personnel, plant / machinery, dredgers / other vessels and construction lighting. In particular, during dredging of the main channel, dredging vessels will operate in close proximity to the North Tees Mudflat and Vopak Foreshore. Dredging is due to continue for a period of approximately five months. This is considered most likely to affect waterbirds foraging and / or roosting on the nearby intertidal areas. Foraging and commuting terns passing through the site are not likely to be significantly affected since they could easily forage elsewhere within close proximity.

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al.,* 2013) categorises visual disturbances into the following:

- High disturbance – associated with plant and personnel encroaching onto the mudflat.
- High to moderate disturbance – plant and personnel at the seaward toe and face of the bank. intermittent plant and personnel on the crest.
- Moderate disturbance – long-term plant and personnel on the crest.
- Low disturbance – long-term plant only on the crest, activity behind the flood bank.

High level disturbances would likely result in birds moving away from the source to less disturbed areas, and those that remain may not forage efficiently (which could impact on the survival of individual birds). However, activities occurring over a long period of time can lead to habituation and a reduction in the level of disturbance. As a worst-case scenario, demolition works involving plant and personnel working at the riverbank and on the South Bank intertidal are considered, but there will be no cause for personnel or plant on North Tees Mudflat or other high-value intertidal habitats further downstream.

Cutts *et al.* (2009) devised a schematic that summarises basic visual disturbance thresholds for general activities, key species and function. It indicates that for some species, behavioural responses during feeding may commence at around 300m distance, whilst others have a lower disturbance threshold (i.e. are less sensitive to visual disturbance).

Most areas of supporting habitat for waterbirds in the SPA / Ramsar site, including *inter alia* Vopak Foreshore, Bran Sands, Seal Sands and North Gare Sands, lie beyond the 300m threshold and would not be affected by visual disturbance at South Bank. However, at the nearest point, North Tees Mudflat is located approximately 250m from the South Bank and the site of the quay construction.

At North Tees Mudflat, evidence from WeBS core counts between 2012/13 and 2016/17 suggests that there is relatively little in the way of roosting activity at high tide, which is supported by the evidence from the site-specific surveys undertaken to date. However, the intertidal area is assumed to support a significant number of waterbirds, including SPA / Ramsar site features, which forage on the mudflat at low tide. According to Cutts *et al.* (2009), at a 250m distance feeding activity may be disrupted by some species taking flight and showing other behavioural changes, such as a potential reduction in feeding.

The above guidance is based on the disturbance thresholds for unhabituated birds, whereas at North Tees Mudflat it is likely that most birds would be habituated to activity along the riverbank given that the Tees along this stretch is characterised by industrial activity. Furthermore, only works at the extreme upstream end of the proposed scheme footprint are within 300m of the mudflat (not including dredging activities, which are considered separately below), therefore during the majority of works they will be beyond the range of impact. As such, it is unlikely that there will be any significant effects on birds at the North Tees Mudflat due to construction-phase works on the opposite side of the river.

Artificial lighting associated with construction activities is a potential source of disturbance at night, although much of the riverbank in the Tees is used for industrial purposes so several areas are already lit at night, and it is expected that birds using the area would be habituated to sources of artificial lighting. In addition, waterbirds may feed nocturnally and some may actually take advantage of artificial light sources to extend feeding opportunities in darkness (e.g. Dwyer *et al.*, 2013). However, given the distance of North Tees Mudflat from the construction site it is unlikely that there would be any significant impact on roosting or foraging behaviour.

During dredging of the main channel and the turning circle, dredging vessels will operate in close proximity to the North Tees Mudflat and Vopak Foreshore. Most notably, sections of the channel dredge footprint run adjacent to the North Tees Mudflat (this is illustrated in **Figure 11.2**), therefore the presence of dredging vessels may result in disturbance to waterbirds foraging or roosting on the mudflat, including visual disturbance and the disturbance caused by shipwash, which can propagate across intertidal areas and cause birds to take flight. This disturbance, especially if it is repeated, could reduce the time that birds can feed within the tidal cycle and could therefore potentially reduce the overall feeding efficiency. This can be critical during the winter months and during periods of particularly severe weather when maximising available feeding time is of paramount importance.

The sensitivity of such species is offset by the fact that there is regular vessel traffic in the Tees (there are between 800 and 900 vessel movements in the Tees per month from commercial vessels alone, according to PDT (for more information on shipping movements, refer to **Section 14**)). This also includes regular maintenance dredging vessels which operate on an almost daily basis within the channel, including within 30m of the Vopak Foreshore and immediately adjacent to North Tees Mudflat. Therefore it is likely that birds foraging on the mudflat would have some level of habituation to such activities. Furthermore, it is likely that there will be further habituation over the dredging period and any effects would lessen through the course of the campaign.

Disturbances to birds at Vopak Foreshore would be limited to the very short-term dredging within the Tees Dock turning circle (anticipated to take approximately one week). Those at North Tees Mudflat would be limited to Stages 1 to 3 (a period of approximately 4.5 months), but only during times when the dredging transect runs close to the mudflat (for example, when dredging the southern half of the river it is unlikely to have any significant effect on foraging at the mudflat). It should also be noted that only birds foraging at the downstream end of the North Tees Mudflat would be affected, even when considering a 300m threshold, and the mudflat itself extends over a kilometre upstream of the dredge footprint. As such, any displacement of birds would likely amount to local redistribution on the same area of intertidal, which further limits the effects on foraging efficiency. With this in mind, the magnitude of the impact is considered to be medium.

Given the above, it is anticipated that visual disturbances from dredging operations would have a **minor adverse** impact on waterbirds using areas of intertidal within the Tees estuary.

Mitigation and residual impact

The mitigation measures outlined in **Section 12.5.2** would ensure that dredging vessels only operate along the axis of the river, rather than across it, thus minimising the frequency of occasions whereby the dredger operates adjacent to the North Tees Mudflat. There is no practical way of avoiding dredging activities since the deepening of the channel is integral to the proposed scheme.

Additionally, and as a matter of best practice, all construction lighting will be installed in a manner that reduces (wherever possible) light spill over the river.

While lessening the impacts somewhat, the above measures will not eliminate the sources of disturbance that may affect waterbirds foraging and roosting on North Tees Mudflat and Vopak Foreshore. As such, the residual impact is **minor adverse**.

12.5.5 Impacts on food resources due to underwater noise

As described in **Section 12.5.2**, the proposed scheme has the potential to indirectly impact on foraging common tern (and potentially wintering waterbirds) by affecting the availability of prey fish species. **Section 13.5.3** and **13.5.4** provides an assessment of the potential impact of underwater noise disturbance to fish as a result of dredging activities and residual noise from land-based piling works. The assessment concludes that there may be a minor adverse effect as a result of the dredging leading to fish moving away from the source of disturbance. In the worst case, the construction works are expected to result in the localised redistribution of resident fish species and temporary disturbance to migration patterns of fish throughout the Tees estuary. As such, affected resources are likely to remain within the foraging range of common terns and other piscivorous birds in the estuary and it is, therefore, anticipated that the temporary and localised disturbance to feeding resources will result in an impact of **negligible** significance.

Mitigation and residual impact
Mitigation measures for this impact are not considered necessary and the residual impact is **negligible**.

12.6 Potential impacts during the operational phase

12.6.1 Noise disturbance

Noise disturbances associated with the operational phase would include noise from day-to-day quayside operations, plus periodic vessel movements. In general, this is likely to form a fairly continuous background noise with occasional irregular sounds. The predicted noise levels were modelled at the same ecological receptor locations referred to in **Section 12.5.4** and are presented in **Table 12.21**.

Table 12.21 Predicted airborne noise levels at ecological receptors during operation

Calculation standard	Receptor	Day Db(A)	Night dB(A)	Lmax dB(A)
ISO 9613	ST1 – Vopak	29.5	29.5	40.6
	ST4 – Dabholme Gut (mouth)	26.9	26.9	38.1
	ST5 – Dabholme Gut (centre)	26.1	26.1	37.2
	North Tees Mudflat – 1 (downstream)	49.3	49.3	61.9
	North Tees Mudflat – 2 (centre)	40.7	40.7	54.0
	North Tees Mudflat – 3 (upstream)	36.8	36.8	50.0
	Seal Sands	23.2	23.2	35.5

The ‘continuous’ L_{Aeq} noise levels at the receptors during the operation phase, on a day-to-day basis, are predicted to range from 23.2 dB(A) to 49.3 dB(A), depending on distance from the source. Such levels are classified as low disturbance events and would have no observable effect on the behaviour of birds at any of the receptors (including North Tees Mudflat) (Cutts *et al.*, 2009 and 2013; Wright *et al.*, 2010).

The L_{Amax} levels predicted at the receptors range between 50.0 dB and 61.9 dB(A) at North Tees Mudflat, and less than 40.6 dB(A) at other receptors. At North Tees Mudflat, the levels fall within the range classified as ‘low to moderate’ by Cutts *et al.* (2009 and 2013), which are likely to have no significant behavioural effect according to Wright *et al.* (2010), but as a worst case may lead to non-flight responses such as head turning, scanning, reduced feeding or movement to nearby areas.

The noises associated with the operational phase (i.e. vessel activity and quayside operations) are similar in type and level to those typical of the wider environment in the Tees estuary and form part of the background sounds that already exist at the receptors (for more information on the baseline noise levels at the ecological receptors see **Section 17.4**). As such, it is likely that birds foraging in intertidal areas along the riverbank are somewhat tolerant to day-to-day riverside human activities. With this in mind, it is considered that the impact of most noise disturbances arising from the operation of the new quay would be **negligible**, and any exceedances of the thresholds stated in Cutts *et al.* (2009) or Wright *et al.* (2010) would be sufficiently occasional that there would be no significant long-term impact.

Mitigation and residual impact
Mitigation measures for this impact are not considered necessary and the residual impact is **negligible**.

12.6.2 Disturbance due to increased vessel activity

Shipwash can be a source of disturbance to feeding waterbirds in that it can propagate across intertidal areas and cause birds to take flight. This disturbance, especially if it is repeated, minimises the time that birds can feed within the tidal cycle and can reduce the overall feeding efficiency. This can be critical during the winter months and during periods of particularly severe weather when maximising available feeding time is of paramount importance. With respect to the proposed scheme, the areas used by waterbirds that may potentially be affected are North Tees Mudflat, Vopak Foreshore and other intertidal areas further downstream such as North Gare Sands, Bran Sands and Seal Sands.

Most of these areas are relatively exposed areas of intertidal, although some protection is afforded by the breakwaters. Seal Sands is likely to be less vulnerable to shipwash given its relatively sheltered location and the presence of the training wall fronting Seaton Channel. North Tees Mudflat is opposite the proposed quay and Vopak Foreshore is close to the Tees Dock turning circle, and both could be affected by shipwash from manoeuvring vessels. However, the fact that speeds will be low at these locations results in a low potential for ship-generated wash to impact significantly on the foreshore at the mudflat.

The Tees estuary currently experiences high levels of shipping activity, with between 800 and 950 vessel movements per month. It is predicted that there would be an additional 390 operational vessel calls per year from windfarm-associated vessels upon completion of the proposed scheme.

Given the very low magnitude of increase in vessel traffic compared with existing vessel movements, the potential additional impact of vessel disturbance associated with the proposed scheme is assessed to be of **negligible** significance.

Mitigation and residual impact
Mitigation measures for this impact are not considered necessary and the residual impact is **negligible**.

12.6.3 Effects of artificial lighting

The operational phase will include the use of lighting columns along the quayside. Under existing conditions there is little light spill from the proposed scheme footprint given its largely derelict nature, however, there is light spill into the water column from operations throughout the majority the estuary. An assessment of the disturbance impacts of artificial lighting on fish, set out in **Section 13.6.2**, concludes that effects would be negligible, therefore any effects on waterbirds and foraging terns would manifest as a direct behavioural response to lighting, rather than as a displacement of food resources.

Given the industrial use of the Tees, it is likely that there will be some level of habituation to riverside lighting. Waterbirds may feed nocturnally and some may actually take advantage of artificial light sources to extend feeding opportunities in darkness (e.g. Dwyer *et al.*, 2013). The area directly affected (i.e. adjacent to the proposed quay) has, as described above, little value to estuarine ornithology. Regardless, birds that may otherwise be affected will have been displaced from the site during demolition of existing features and excavation of the intertidal area at South Bank. Areas of higher value, such as North Tees Mudflat, are considered to be sufficiently distant to avoid impacts on roosting or foraging behaviour. As such, impacts on foraging / roosting waterbirds and terns is predicted to be **negligible**.

Mitigation and residual impact

While impacts are anticipated to be negligible, the implication of best practice mitigation measures set out in **Section 12.5.4** (i.e. sympathetic placement and orienting of lighting to minimise light spill across the water) will further reduce the impact on foraging / roosting waterbirds. The residual impact is **negligible**.

12.6.4 Effects on intertidal habitats due to hydrodynamic changes

The long-term changes to the hydrodynamic regime and tidal prism as a result of the deepened channel and new alignment of the South Bank are discussed in **Section 6.6.2 and 6.6.3**.

Figures 6.69 to **6.72** indicate that baseline tendencies (i.e. current speeds being greater on spring tides than on neaps, an ebb dominance during neaps and a flood dominance during springs) are largely unaffected by the proposed scheme. There are, however, zones of reduction in baseline flow along the northern bank, albeit slight, during peak flood neaps and peak flood springs. This coincides with the downstream section of the North Tees Mudflat. There are not anticipated to be any notable changes at other intertidal locations further downstream, such as Vopak Foreshore and Bran Sands.

The reductions in flow speed may lead to a slight increase in deposition at North Tees Mudflat; however, given the low magnitude of change to current flow, this is expected to be in the order of millimetres and is unlikely to lead to any significant changes to the foraging capability of birds using the site. Although surveys at North Tees Mudflat indicate that it may be important for foraging redshank and an assemblage of wintering waterbirds, SPA / Ramsar site qualifying features, minor increases in deposition are predicted to have a negligible impact on intertidal benthos (see **Section 9.6.2**) and would not adversely affect the availability of invertebrate prey to birds feeding on the mudflats . The predicted minor accretion of sediment at North Tees Mudflat may help to sustain the mudflat in the face of long-term sea level rise.

As outlined in **Section 6,** design calculations for the proposed scheme show that the increase in mean tidal prism as a result of the proposed scheme is 150,901m^3, which represents an estuary-wide increase of 0.8% and is not deemed to be a cause of significant estuary-wide change in hydrodynamics.

Given the above, it is anticipated that long-term impacts on water birds using the North Tees Mudflat as a result of hydrodynamic changes would be **negligible**.

Mitigation and residual impact

No mitigation measures are considered necessary, therefore the residual impact is **negligible**.

13 FISH AND FISHERIES

13.1 Introduction

As well as the terrestrial environment, the proposed scheme will occupy subtidal and intertidal areas of the Tees estuary that may provide suitable habitat for finfish and shellfish species of commercial and ecological importance. This section assesses the potential impacts on these receptors, as well as the fishing industry that is reliant on such resources.

A desk-based assessment has been undertaken based on the most recent data sources available in the Tees estuary; the data available from other recent projects in the Tees is considered to negate any requirement for a site-specific fish survey in order to complete the assessment.

The potential impacts on fish and other marine species and habitats from the offshore disposal of dredged sediments are assessed in **Sections 26**. Potential cumulative impacts are addressed in **Section 27**.

Given that fish provide an importance prey source for marine mammals and seabirds, this chapter should also be read in conjunction with **Section 10** and **Section 12**, respectively.

Potential impacts on fish resources and fisheries activities that are assessed in this section of the EIA Report are broadly separated into the following:

- impacts on marine water quality;
- noise-related injury or disturbance to fish stocks;
- direct impacts on supporting habitat for fish stocks; and,
- obstructions to fishing activity within the Tees.

13.2 Policy and consultation

13.2.1 North East Inshore and Offshore Marine Plan

Full details of the draft North East Inshore and Offshore Marine Plan are provided in **Section 4.9**. **Table 13.1** signposts relevant objectives and policies within the draft Marine Plan when considering the potential effects of the proposed scheme on fish resources and fishing activities.

As set out in the draft Marine Plan, spatial planning within inshore and offshore plan areas *"seeks to support access to fishing activities and ensures considerations are made of the impacts upon fisheries from other marine activities. Proposals will identify potential significant adverse impacts on access to fishing activities. Significant adverse impacts on access includes the loss of access resulting from a proposal that blocks transit routes to and from an area, and also the loss of access to the area where the proposal is located."*

Table 13.1 Marine plan policies relevant to fish and fisheries

Marine Policy Statement / Marine Plan Objectives	- ***There is equitable access for those who want to use and enjoy the coast, seas and their wide range of resources and assets;*** - ***The marine environment and its resources are used to maximise sustainable activity, prosperity and opportunities for all, now and in the future.***	
Marine plan policies relevant to this section		**Where addressed in this section**
NE-FISH-2	*Proposals that may have significant adverse impacts on access for fishing activities, must demonstrate that they will, in order of preference:* *a) Avoid;*	Impacts on access to fishing activities are addressed in **Section 13.5.6**.

	b) *Minimise;* c) *Mitigate significant adverse impacts;* d) *If it is not possible to mitigate the significant adverse impacts, proposals should state the case for proceeding.*	
Marine Policy Statement / Marine Plan Objectives	- ***Biodiversity is protected, conserved and, where appropriate, recovered, and loss has been halted;*** - ***Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse communities and the functioning of healthy, resilient and adaptable ecosystems.***	
Marine policies relevant to this section		**Where addressed in this section**
NE-FISH-3	*If proposals cannot enhance essential fish habitat, they must demonstrate that they will, in order of preference:* d) *Avoid;* e) *Minimise;* f) *Mitigate significant adverse impact on essential fish habitat, including spawning, nursery and feeding grounds, and migration routes.*	Defined spawning / nursery grounds are listed in **Section 13.4.1.6**. Impacts on fish supporting habitat are addressed in **Section 13.5** and **13.6**.
NE-BIO-1	*Proposals that may have significant adverse impacts on the distribution of…priority species must demonstrate that they will, in order of preference:* e) *Avoid;* f) *Minimise;* g) *Mitigate;* h) *Compensate for significant adverse impacts.*	Priority species are listed in **Section 13.4.1.4**. Impacts on fish, including priority species, are addressed in **Sections 13.5** and **13.6**.
NE-BIO-2	*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:* e) *Avoid;* f) *Minimise;* g) *Mitigate significant adverse impacts;* h) *Compensate for significant adverse impacts.*	Migratory species are described in **Section 13.4.1.2**. Impacts on migratory species are addressed in **Sections 13.5** and **13.6**

13.2.2 Consultation

Site-specific comments relevant to fish and fisheries that were received during the EIA scoping process are detailed in **Table 13.2**. This table also signposts to the relevant section of this EIA Report where the comment has been addressed.

Table 13.2 Relevant site-specific comments received from stakeholders during the scoping process

Consultee	Comment	Response / section of the EIA Report where the comment is addressed
Environment Agency	The creation of a wharf involves a substantial amount of piling. The noise from piling, particularly impact piling may impact severely on fish migration. Salmon, sea trout, eel, lamprey and possibly smelt all frequent this area of the Tees on their upstream migrations. Some restrictions on piling activity should be expected in order to reduce the impact on protected migratory fish species such as Atlantic Salmon. We have noted that report states that as the piling would occur on land that the noise would be reduced, the EA are still concerned there would be a risk to fish. This would not be the case if the applicant were to provide noise/vibration assessment survey which demonstrated that this would not be the case.	Following receipt of this comment, Subacoustech were commissioned to undertake a review of potential underwater noise impacts as a result of piling activities associated with the construction of the new quay (on land (**Appendix 8**)). The output from the review has been incorporated into the assessment of impacts from piling noises in **Section 13.5.4**.

Consultee	Comment	Response / section of the EIA Report where the comment is addressed
	Extensive dredging activity is planned for this area of the River Tees, and the effects of deepening this large section of the Tees estuary on intertidal mixing will be uncertain. In order to protect vulnerable fish species such as European Eel, Atlantic Salmon and Lamprey, it is likely that dredging activity will need to take into account the protection of these species during critical migration periods. This would entail limiting dredging activity to certain times of the year and/or providing suitable monitoring and mitigation such as stop start thresholds for parameters such as suspended sediment and dissolved oxygen levels.	Changes to marine water quality as a result of the dredging have been considered in **Section 7**, and the assessment of consequent impacts on migratory fish is presented in **Section 13.5.1**.
	The structure itself [i.e. the existing timber and concrete wharf] 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.	A survey underneath the structure is proposed and results will be provided following completion. However, due to the time frames involved, the results are not available at the time of assessment. Correspondence with the Environment Agency in September 2020 (**Appendix 3)** indicated that, in lieu of survey results, the assessment should be based on an assumption that the structure will have habitat value for sheltering fish. This has been carried forward into the assessment in **Section 13.5.5**.

13.3 Methodology

13.3.1 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. In this instance, this has been informed by the hydrodynamic and sedimentary plume modelling undertaken, as well as the understanding of underwater noise levels arising from construction works such as piling and dredging. This section excludes consideration of potential impacts to the fisheries interests of the Tees Bay C offshore disposal site; such impacts are considered in **Section 26**.

13.3.2 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:

- Existing data on fisheries resources in the Tees estuary and surrounding marine environment collated for other developments in the area, specifically the benthic trawl surveys undertaken for the NGCT scheme (2019) (Royal HaskoningDHV, 2020), the Hartlepool Approach Channel deepening (2018) (Royal HaskoningDHV, 2018), the consented Anglo American Harbour Facilities scheme (2014) (Royal HaskoningDHV, 2015) and the Dogger Bank Teesside A and Sofia project (2012/13) (Forewind, 2014) (see **Section 13.4.1.1**);
- Readily available resources on UK fisheries interests, specifically the Environment Agency's Tees Barrage fish counter, information on spawning and nursery grounds from Ellis *et al.*, 2010, and the International Union for Conservation of Nature(IUCN) Red List of Threatened Species;

- UK sea fisheries statistics from the period 2014/15 to 2018/19, detailing the value and tonnage of landings from the coastal region in which the Tees estuary lies (see **Section 13.4.1.3**);
- A review undertaken by Subacoustech (2020) on the risk of underwater noise impacts from land-based piling works (see **Section 13.5.4** and **Appendix 8**), plus threshold underwater noise criteria provided by Popper *et al.* (2014); and
- The Marine Life Network (MarLIN) sensitivity assessment for UK marine life.

13.3.3 Methodology for assessment of potential impacts

The methodology used to assess potential environmental impacts on fish and fisheries interests follows that described in **Section 5** of this report.

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**), the marine water quality assessment (**Section 7**) and the assessment on marine benthic ecology receptors (**Section 9**) has been made when assessing potential impacts to marine ecological receptors.

13.4 Existing environment

13.4.1 Fish and shellfish

13.4.1.1 Review of existing studies within the Tees estuary and adjacent marine areas

The lower Tees estuary provides both intertidal and subtidal habitat for a number of benthic-feeding marine fishes, some of which are estuary-dependent (such as flounder *Platichthys flesus*) and some temporary residents (such as plaice *Pleuronectes platessa*) which use the estuary as a nursery ground. Herring *Clupea harengus*, sprat *Sprattus sprattus*, cod *Gadus morhua*, spurdog *Squalus acanthias*, anglerfish *Lophius piscatorius*, whiting *Merlangius merlangus*, lemon sole *Microstomus kitt* and nephrops *Nephrops norvegicus* have all been documented within the estuary and adjacent marine area (Royal HaskoningDHV, 2015 and 2020).

Summary of 2019 benthic trawls within the lowers Tees estuary

As part of a benthic ecological survey undertaken in the lower Tees Estuary in March 2019 for the NGCT project (Royal HaskoningDHV, 2020), 16 benthic trawls were undertaken within and downstream of the Tees Dock turning circle. While benthic trawls are limited in the data they can provide (for example, pelagic or semi-pelagic species are likely to be under-represented in benthic trawls, and they only provide a 'snapshot' of the species present), they do provide some information on the demersal species likely to be present within the lower Tees.

A total of 18 finfish taxa were recorded from the 2019 benthic trawls, the most abundant of which was plaice (433 individuals across the 16 trawls). Other abundant taxa included commercial species, such as dab *Limanda limanda* (168 individuals), whiting (45 individuals) and flounder (40 individuals), plus non-commercial species such as *Pomatoschistus* gobies (96 individuals). Despite being a benthic trawl, herring and sprat (both pelagic species) were also recorded. A full list of the finfish species recorded in the 2019 benthic trawls is presented in **Table 13.3Table**. Commercially targeted shellfish species recorded included one common lobster *Homarus gammarus*, 24 pink shrimps *Pandalus montagui* and various crab species.

Royal HaskoningDHV

Of the species recorded during the trawls, plaice, whiting, cod and herring are listed as species of principal importance for conservation in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (see **Section 13.4.1.4**).

Table 13.3 Finfish species recorded during 16 benthic trawls undertaken in Tees Estuary, March 2019 (Royal HaskoningDHV, 2020)

Species	Abundance (no. of individuals)
Plaice *Pleuronectes platessa*	433
Dab *Limanda limanda*	168
Pomatoschistus spp. gobies	96
Whiting *Merlangius merlangus*	45
Flounder *Platichthys flesus*	40
Pogge *Agonus cataphractus*	27
Cod *Gadus morhua*	16
Fivebeard rockling *Ciliata mustela*	6
Bull rout *Myoxocephalus scorpius*	3

Species	Abundance (no. of individuals)
Poor-cod *Trisopterus minutus*	3
Lesser weever *Echiichthys vipera*	2
Herring *Clupea harengus*	1
American plaice *Hippoglossoides platessoides*	1
Saithe *Pollachius virens*	1
Sprat *Sprattus sprattus*	1
Common dragonet *Callionymus lyra*	1
Butterfish *Pholis gunnellus*	1

Summary of 2014 epibenthic beam trawl survey in the lower Tees estuary

Epibenthic beam trawl surveys were undertaken in the Tees in July 2014 within and downstream of the Tees Dock turning circle, to inform the EIA undertaken for the consented Anglo American Harbour facilities (Royal HaskoningDHV, 2015). A total of 13 finfish and two commercial shellfish species were recovered from ten trawls. The most abundant finfish species recorded was cod (83 individuals), with relatively low abundance of all other species. A full list of the finfish species caught in the 2014 trawls is presented in **Table 13.4**. Commercial shellfish recovered included *c.*7,500 brown shrimp *Crangon* spp. and *c.*150 pink shrimp.

Of the species recorded during the trawls, plaice, whiting, cod and herring are listed as species of principal importance for conservation in England under Section 41 of the NERC Act 2006 and sand goby *Pomatoschistus minutus* is listed for protection in Appendix III to the Bern Convention (see **Section 13.4.1.4**).

Table 13.4 Finfish species recorded during 10 epibenthic trawls undertaken in the Tees estuary, July 2014 (Royal HaskoningDHV, 2015)

Species	Abundance (no. of individuals)
Cod *Gadus morhua*	83
Pogge *Agonus cataphractus*	20
Plaice *Pleuronectes platessa*	18
Pollock *Pollachius pollachius*	12
Dab *Limanda limanda*	10
Sand goby *Pomatoschistus minutus*	4
Whiting *Merlangius merlangus*	3

Species	Abundance (no. of individuals)
Flounder *Platichthys flesus*	3
Fivebeard rockling *Ciliata mustela*	2
Poor-cod *Trisopterus minutus*	2
Common dragonet *Callionymus lyra*	1
Butterfish *Pholis gunnellus*	1
Bull rout *Myoxocephalus scorpius*	1

Summary of 2018 benthic trawls for the Hartlepool Approach Channel project

A benthic ecological survey undertaken in October 2018 in the Hartlepool Approach Channel (Royal HaskoningDHV, 2018), approximately 5km north of the Tees estuary mouth, included three beam trawls, which offer some further information on the demersal species that may be present in the marine area in and around the Tees estuary.

Five species of fish were identified from the trawls, including commercial flatfish such as juvenile plaice (the most abundant fish species recorded), dab and sole *Solea solea*, plus common goby *Pomatoschistus microps* and pogge *Agonus cataphractus*. Plaice catches made up 71% of the total flatfish haul during the trawls. Commercial shellfish recorded included brown shrimp and harbour crab *Liocarcinus depurator*.

Of the species recorded during the beam trawls, plaice and sole are both listed as species of principal importance for conservation in England under Section 41 of the NERC Act 2006, and common goby is listed for protection in Appendix III to the Bern Convention (see **Section 13.4.1.4**).

The species recorded during the 2018 trawls were reported to be typical of North Sea inshore assemblages inhabiting soft sediment environments.

Summary of 2012 and 2013 fish surveys in the Dogger Bank Teesside A & Sofia export cable corridor

A number of fish surveys were undertaken in 2012/13 within the export cable corridor for the Dogger Bank Teesside A / Sofia offshore wind farms, which makes landfall near to Redcar (*c.* 8km from the mouth of the Tees) (Forewind, 2014). Surveys undertaken within (or partly within) the export cable corridor included an adult and juvenile fish characterisation trawl surveys, shellfish (potting) survey and trammel net survey (Forewind, 2014).

Otter trawl surveys, undertaken in April 2012, July/August 2012 and September/October 2012, confirmed that significant numbers of grey gurnard *Eutrigla gurnardus* and whiting were present within and around the export cable corridor. Dab and sand goby were the dominant species caught in beam trawl surveys over the same period. Whiting, haddock *Melanogrammus aeglefinus*, dab, plaice and grey gurnard were the dominant species recorded from additional otter trawls in April 2013, undertaken at the inshore end of the export cable corridor (i.e. in Tees Bay, near to the landfall at Redcar).

Trammel nets were deployed close to the shore in Tees Bay in September 2013 and April 2013, and estuarine species caught included edible crab *Cancer pagurus*, dab, cod, small-spotted catshark *Scyliorhinus canicula*, thornback ray *Raja clavata*, spotted ray *Raja montagui* and lesser sandeel *Ammodytes tobianus*. Edible crab was the most abundant shellfish species caught during inshore shellfish surveys undertaken over two four-day periods in September 2012 and April 2013, with moderate numbers of lobster and velvet swimming crab *Necora puber.*

13.4.1.2 Migratory fish in the Tees

As outlined in the MMO Scoping Opinion EIA/2019/00017, key migratory fish species that have been recorded in the Tees estuary include salmon *Salmo salar*, brown trout *Salmar trutta*, European eel *Anguilla anguilla*, sea lamprey *Petramyzon marinus* and river lamprey *Lampetra fluviatilis*. Salmonid numbers recorded in the Tees have increased in recent years, and the Tees is recognised as an important migration route for salmon. All of these species are listed under Section 41 of the NERC Act 2006, with salmon, sea lamprey and river lamprey afforded additional protection as Annex II species in the EU Habitats Directive (see **Section 13.4.1.4**).

River and sea lamprey are anadramous 'jawless' fish species, which grow to maturity in estuarine areas and migrate upstream to spawn. Both species have been recorded within the Tees estuary, and sea lampreys have been observed at the Tees Barrage at Stockton, approximately 9km upstream of the proposed scheme footprint. The 2018 Tees fish survey, undertaken by the Environment Agency as a seine sweep near the Tees Barrage, included catches of European eels, a catadramous species that migrate to marine areas from freshwater environments to spawn.

The Environment Agency installed an electronic fish counter at the Tees Barrage in 2011, which monitors the upstream migration of salmonids (salmon and brown trout) through the fish pass. The stacked chart shown in **Figure 13.1** presents count data from the counter since the beginning of 2012 (the first full year of operation) until June 2020 and illustrates the seasonal nature of migration movements in the Tees. The season for adult salmonids migrating upstream to spawn generally commences in April, peaks in the summer months, notably July and August, and finishes around November. The peak number of upstream migrations counted in a given month was 735 in August 2012. Downstream smolt migration is not recorded by the electronic counters, but the seasonality of this is temperature-dependent and in other rivers in the northeast, such as the Tyne, smolt migration tends to peak in May (Environment Agency, 2019).

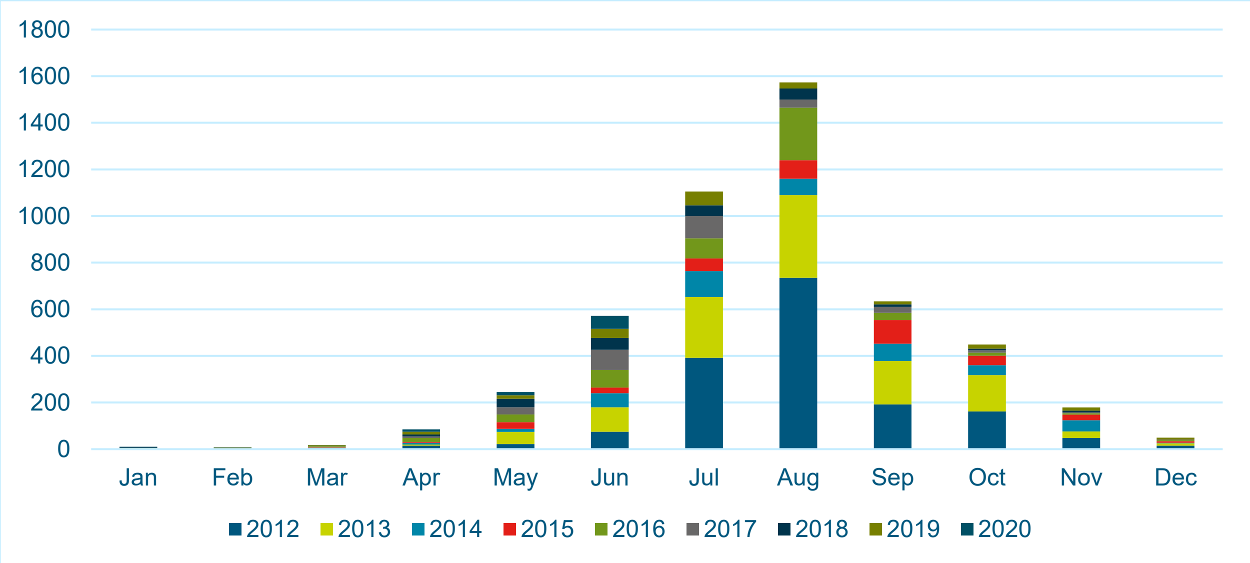

Figure 13.1 Stacked bar chart showing monthly counts of salmonids (sea salmon and brown trout) on upstream migration through the Tees Barrage fish pass (data from Environment Agency electronic fish counter)

13.4.1.3 Commercial species

As well as the site-specific studies outlined above, commercial landings data from the International Council for the Exploration of the Sea (ICES) provides an indication of the commercially targeted fish and shellfish species that may be present in the lower Tees estuary and Tees Bay. ICES statistical rectangle 38E8 encompasses the east coast from Marske-by-the-Sea (*c.*10 km south along the coastline from the mouth of the Tees) to Tynemouth and includes the Tees Estuary and Tees Bay. **Table 13.5** lists the species for which there have been significant (greater than 1 tonne) landings from ICES rectangle 38E8.

Table 13.5 Commercial fish species with significant landings from ICES rectangle 38E8 (ICES, 2020)

Species	ICES total annual landings FROM 38E8 (metric tonnes)					
	2014	2015	2016	2017	2018	Total 2014-18
Blonde ray *Raja brachyura*	0	1	1	0	0	2
Brill *Scophthalmus rhombus*	4	8	8	4	2	26
Cod *Gadus morhua*	88	123	35	21	16	283

Species	ICES total annual landings FROM 38E8 (metric tonnes)					
	2014	2015	2016	2017	2018	Total 2014-18
Crab – edible crab *Cancer pagurus*	161	135	128	114	155	693
Crab – velvet swimming crab *Necora puber*	8	7	3	3	4	25
Cuckoo ray *Leucoraja naevus*	2	0	0	0	0	2
Dab *Limanda limanda*	1	0	0	0	2	3
Gurnard – grey gurnard *Eutrigla gurnardus*	2	8	8	2	0	20
Gurnard – red gurnard *Chelidonichthys cuculus*	7	32	20	10	1	70
Haddock *Melanogrammus aeglefinus*	14	22	20	12	8	76
Hake *Merluccius merluccius*	3	2	1	0	0	6
Halibut *Hippoglossus hippoglossus*	1	2	3	3	3	12
Herring *Clupea harengus*	1	1	1	1	1	5
Lemon sole *Microstomus kitt*	26	35	16	9	4	90
Ling *Molva molva*	2	2	2	1	0	7
Lobster *Homarus gammarus*	80	74	81	89	94	418
Mackerel *Scomber scombrus*	20	33	16	14	10	93
Monkfish / anglerfish *Lophius piscatorius*	23	41	15	10	5	94
Mullet – red mullet *Mullus surmuletus*	0	2	1	0	0	3
Nephrops *Nephrops norvegicus*	427	262	442	330	378	1,839
Plaice *Pleuronectes platessa*	33	55	23	14	6	131
Scallops	36	3	5	4	3	51
Sea trout *Salmo trutta*	1	0	0	0	0	1
Sole *Solea solea*	11	15	7	4	2	39
Spotted ray *Raja montagui*	1	1	1	0	0	3
Squid *Loligo* spp.	12	9	14	11	1	47
Thornback ray *Raja clavata*	1	4	5	2	1	13
Turbot *Scophthalmus maximus*	14	19	11	8	5	57
Whelk *Buccinum undatum*	0	0	0	5	0	5
Whiting *Merlangius merlangus*	295	339	267	154	108	1,163
Witch *Glyptocephalus cynoglossus*	1	1	1	0	0	3

13.4.1.4 Conservation interests

There are 22 fish species on the OSPAR List of Threatened and / or Declining Species, of which 19 are present in OSPAR Region II (Greater North Sea). The OSPAR list is designed to identify species that require protection and guides the OSPAR Commission in setting priorities for future conservation and protection of marine biodiversity. Additionally, the statutory list of species of principal importance for the purpose of conserving biodiversity in England (issued in accordance with Section 41 of the NERC Act 2006) contains a number of bony, cartilaginous and jawless fish species. This list is derived from the UK Biodiversity Action Plan (BAP) list of Priority Species.

Some migratory diadromous fish species are afforded additional protection since they are listed in Annex II to the EU Habitats Directive. These are species requiring consideration during the designation of Natura 2000 sites across Europe, and sites designated as being important for such species must be managed in accordance with the ecological needs of the species. The nearest SAC for which Atlantic salmon is a qualifying feature is the River Tweed SAC, which joins with the Tweed Estuary SAC at Berwick-upon-Tweed, Northumberland. The nearest SACs in which river and sea lamprey are qualifying features are the Tweed Estuary SAC and the Humber Estuary SAC, which meets the coast near Grimsby, Northeast Lincolnshire. The Tweed Estuary and the Humber Estuary are both over 100km from the Tees Estuary and Tees Bay C. Given the scale of the proposed scheme and the separation distance, there is no pathway for effect on either of these SACs and they are not considered further in this assessment (nor are they considered in the HRA (**Section 29**).

Table 13.6 lists those species recorded in the studies described above that are recognised as species of conservation interest.

Table 13.6 Conservation status of species recorded in the Tees Estuary and marine areas around Tees Bay

Species	Conservation status				
	OSPAR	NERC S41	IUCN Red list*	Bern Convention	Habitats Directive Annex II
European eel *Anguilla anguilla*	✓	✓	CR		
Salmon *Salmo salar*	✓	✓	LC	✓	✓
Sea trout *Salmo trutta*		✓	LC		
Sea lamprey *Petromyzon marinus*	✓	✓	LC	✓	✓
River lamprey *Lampetra fluviatilis*	✓	✓	LC	✓	✓
Blonde ray *Raja brachyura*	✓		NT		
Spotted ray *Raja montagui*	✓		LC		
Thornback ray *Raja clavata*	✓		NT		
Lesser sandeel *Ammodytes tobianus*		✓	-		
Common goby *Pomatoschistus microps*			LC	✓	
Sand goby *Pomatoschistus minutus*			LC	✓	
Herring *Clupea harengus*		✓	LC		
Cod *Gadus morhua*	✓	✓	VU		
Whiting *Merlangius merlangus*		✓	LC		
Plaice *Pleuronectes platessa*		✓	LC		
Mackerel *Scomber scombrus*		✓	LC		
Sole *Solea solea*		✓	-		
Hake *Merluccius merluccius*		✓	LC		
Halibut *Hippoglossus hippoglossus*		✓	EN		
Monkfish / Anglerfish *Lophius piscatorius*		✓	LC		
Ling *Molva molva*		✓	LC		

*CR = critically endangered, EN = endangered, VU = vulnerable, NT = near threatened, LC = least concern

13.4.1.5 Ecological resources

A Departmental Brief from Natural England on the extension of Teesmouth and Cleveland Coast SPA (Natural England, 2018) states that prey items of foraging seabirds such as terns include sandeels, clupeids (i.e. herring *Clupea harengus* and sprat *Sprattus sprattus*) and zooplankton.

Herring are widely distributed throughout the northwest and northeast Atlantic, with adults generally restricted within the 100m depth contour. As well as evidence from ICES landings data that herring are present within the wider area around the Tees (ICES rectangle 38E8), evidence from site-specific surveys outlined in **Section 13.4.1.1** indicate that herring (and sprat) are present within the Tees and adjacent marine and coastal areas. There are defined nursery grounds for juvenile herring in rectangle 38E8 (see **Section 13.4.1.6**), and juveniles remain within the nursery grounds for up to two years before recruiting into adult fish stocks. Herring spawning grounds were defined by Coull *et al.* (1998), with the nearest located approximately 5km from the mouth of the Tees. Spawning grounds are determined by the substrate available, since herring require coarse gravel and stony substrate to which they attach their eggs.

Sandeels were not recorded from the Tees estuary during the site-specific surveys summarised in **Section 13.4.1.1**. The nearest defined sandeel spawning / nursery grounds are ICES rectangle 39E8 and the eastern half of ICES rectangle 38E9, approximately 40km from the mouth of the Tees. However, a sandeel was recorded in trammel net surveys of inshore areas within the Dogger Bank A & Sofia OWF export cable corridor, near to Redcar, and ESs for consented projects within the Tees estuary (e.g. Royal HaskoningDHV, 2015) indicate that sandeels are abundant in the marine area adjacent to the estuary.

13.4.1.6 Spawning and nursery grounds

An evidence-based study of the potential spawning and nursery grounds of 40 fish species considered to be of conservation importance was undertaken by Cefas (Ellis *et al.*, 2010), which formed an update to an earlier study by Coull *et al.* (1998). Spawning and nursery ground distribution information from Ellis *et al.* (2010) was derived from juvenile fish data recorded during UK groundfish beam trawl surveys.

Where confidence in the juvenile fish data from Ellis *et al.* (2010) allowed, the spatial extent of spawning and nursery areas was defined at a resolution of half an ICES statistical rectangle. The Tees Estuary is situated within the eastern half of ICES rectangle 38E8. Defined spawning / nursery areas that may include the Tees Estuary and may overlap with the proposed scheme and / or disposal site are summarised in **Table 13.7**.

Table 13.7 Defined spawning and / or nursery areas that overlap with the proposed scheme and / or Tees Bay C disposal site

Species	General description	Defined spawning area?	Defined nursery area?
Whiting	Whiting is a marine species that utilises estuarine habitats and other coastal waters as nursery grounds.	No	High intensity[1,2]
Spurdog	Spurdog is a fully marine species that is recorded occasionally in estuaries, though not typically occurring water <10m deep. Locations and temporal stability of specific parturition grounds are not well established.	No	Low intensity[1]
Plaice	Plaice is a marine species that utilises estuarine habitats and coastal zones as nursery grounds.	Low intensity[1,2]	Low intensity[1,2]
Herring	Herring is a marine species that utilises estuarine habitats as nursery grounds. Defined herring spawning grounds are sites of suitable spawning substrate and known active or historic spawning.	No	High intensity[1,2]

Species	General description	Defined spawning area?	Defined nursery area?
Cod	Cod is a marine species that utilises estuarine habitats and other coastal waters as nursery grounds.	No	High intensity[1,2]
Anglerfish / monkfish	Anglerfish is a fully marine species that is recorded only very occasionally in estuaries. Juveniles may occur in coastal waters, although adults tend to occur further offshore.	No	Low intensity[1]
Lemon Sole		Yes (unspecified intensity)[2]	Yes (unspecified intensity)[2]
Nephrops		Yes (unspecified intensity)[2]	Yes (unspecified intensity)[2]

[1]Defined in Ellis *et al.* (2010); [2]Defined in Coull *et al.* (1998).

As shown in **Table 13.7**, the Tees estuary and adjacent coastal/marine areas may be used as nursery grounds by a number of species and may be used as a spawning habitat by plaice, lemon sole and *nephrops*. It should be noted, though, that the species listed in the table all have extensive nursery and spawning grounds which encompass much of the central North Sea.

There are extensive herring spawning grounds (defined by Coull *et al*., 1998) at Flamborough, which extend north along the Yorkshire coastal waters, though at the nearest point the defined spawning grounds lie at least 5km from the mouth of the Tees estuary.

The list of species in **Table 13.7** is not an exhaustive list; these are simply the species for which defined spawning or nursery areas have been mapped. It is possible that other species may use the Tees estuary and adjacent coastal areas as spawning and / or nursery grounds, but there is insufficient data for defining the extent of such grounds. As an example, during 2018 benthic trawl surveys of Hartlepool Channel (Royal HaskoningDHV, 2018), all dab recovered were smaller than length at first maturity and an assemblage of pogge and common goby was composed of a mixture of both juvenile and mature individuals.

13.4.2 Commercial and recreational fisheries

Marine fisheries (including estuarine fisheries) in the Tees estuary and Tees Bay, out to a distance of 6nm from the shore, fall within the remit of the North East Inshore Fisheries and Conservation Authority (NEIFCA), although the Environment Agency has responsibility for the management of fisheries for migratory species, namely salmon, sea trout and eels.

13.4.2.1 Fisheries byelaws

Under NEIFCA byelaws, the following spatial restrictions apply to fisheries within the Tees estuary and adjacent marine area:

- Byelaw III – Trawling: Prohibition: Exceptions – prohibits trawling activity within the Tees estuary upstream of an invisible line drawn between the seaward extremities of the North Gare and South Gare breakwaters;
- Byelaw IV – Seine Net, Draw Net or 'Snurrevad': Prohibition Of – prohibits use of seine netting or similar gear within the Tees estuary and adjacent marine areas;
- Byelaw XXVIII – Crustacea Conservation Byelaw – only vessels 10m or under in length can deploy potting gear within the Tees Estuary (unless a legacy vessel existing prior to the byelaw implementation); and,
- Byelaw XXIII – Method and Area of Fishing (Scallop Dredges) Byelaw 2015 – prohibits any scallop dredge activity within the Tees Estuary and any marine area within 3nm of the coast.

13.4.2.2 Commercial fishing activity

Vessels fishing within marine areas adjacent to the mouth of the Tees largely operate out of fishing ports at Redcar, Hartlepool, South Gare (Paddy's Hole) and further afield. Annual landings data for vessels operating in the ICES statistical rectangle 38E8 are available from ICES (MMO, 2020), up to the year 2019. This data is based on reported landings, which is mandatory for larger fishing vessels (above 10m) but is not for vessels under 10m in length, therefore landings from the under-10m fleet may be understated.

As illustrated in **Figure 13.2**, landings by both the under-10m fleet and the over-10m fleet are dominated by landings of shellfish and, to a lesser extent, demersal finfish species. Over the period 2014 to 2018, it is evident that in rectangle 38E8 the fleet of smaller vessels (i.e. 10m or under) are the main operators. Over the period 2015 to 2019, the key shellfish species landed by small vessel operators were lobster (which made up 48% of the shellfish landings, by value) and nephrops (which made up 41% of the shellfish landings, by value).

Consultation with the NEIFCA as part of other EIAs recently undertaken in the Tees estuary indicated that the majority of commercial fishing activity takes place outside the estuary, though there are limited seasonal fisheries for lobster and velvet swimming crab within the estuary during the summer months, undertaken by vessels under 10m in length. As outlined in **Section 13.4.2.1**, trawling, scallop dredging and netting gear are prohibited within the Tees estuary. There is some bait digging activity in intertidal mud and sandflat areas, targeting lugworm, ragworm and peeler crabs.

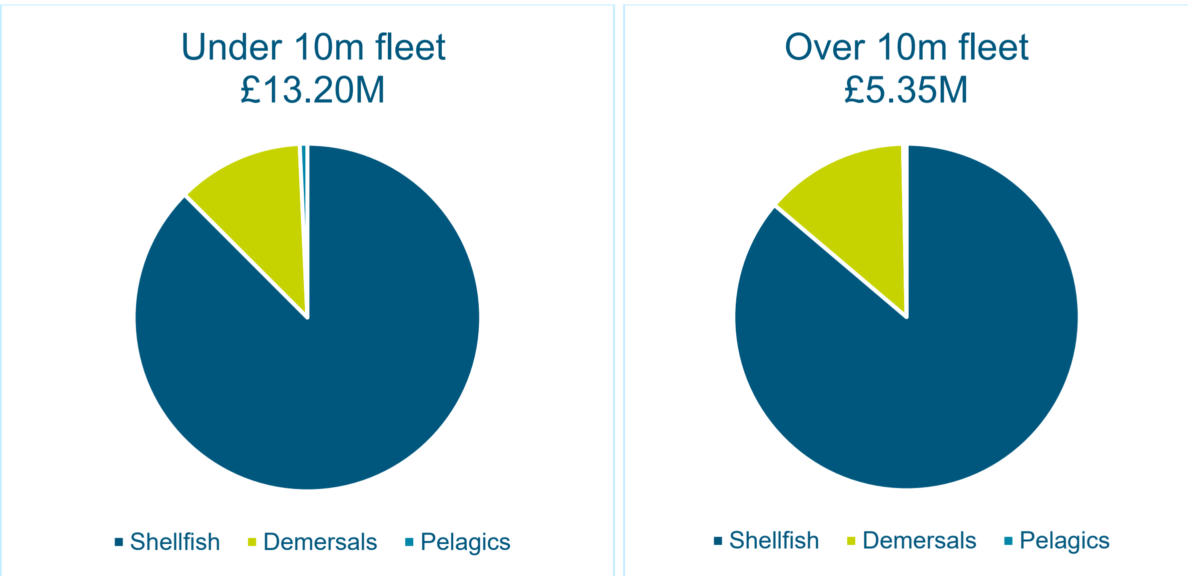

Figure 13.2 Landings from ICES rectangle 38E8 during the period 2015 to 2019 (data source: MMO, 2020)

13.5 Potential impacts during the construction phase

13.5.1 Changes in marine water quality due to dredging activity

During capital dredging, approximately 1.8Mm^3 of sediment (including approximately 1.27Mm^3 of soft material) will be removed by TSHD and backhoe dredger, which will result in a temporary increase in SSC within the water column. Under a worst-case scenario whereby the proposed scheme is implemented in full in one phase, the capital dredge campaign is anticipated to continue for approximately four months. Full details of the increase in SSC, including the visual output of sediment plume modelling for the capital dredging, is provided in **Section 6**. The peak suspended sediment concentration within the Tees during the dredging campaign is predicted to be around 85 mg/l, although this is very limited in extent and would only occur for a very limited amount of time (approximately one hour).

As detailed in the water quality assessment in **Section 7**, sediment quality testing from 2019 indicates that it is very unlikely that disturbance of sediment during the dredging would result in exceedances of EQSs, therefore the risk of physiological effects on fish from contaminant release is considered to be very low. Furthermore, **Section 7** indicates that long-term effects on DO concentrations within the Tees are unlikely, and any effect would be temporary and reversible. As such, this assessment focuses on potential effects from an increase in SSC.

An increase in SSC in the water column may lead to physiological effects in finfish, including, *inter alia*, impaired swimming ability, immunosuppression (i.e. increased susceptibility to disease) and reduced rates of growth and larval development (Robertson *et al.*, 2006). Particles in the water column may increase the risk of asphyxiation due to inhibition of gaseous exchanges at the gill lamellae or blockage of the opercular cavity. Increased SSC can also result in decreased foraging efficiency and a reduction in the ability to detect and evade predators.

In shellfish resources, increased SSC can affect an organism's filter-feeding mechanisms and its ability to respire and excrete. Behavioural and biological responses to an increase in SSC will increase energetic costs and may cause metabolic stress and, potentially, mortality. The likelihood of mortality increases with longer levels of exposure (John *et al.*, 2000), and other effects may include reduced growth rates, reduced feeding efficiency and weakened shells.

Generally speaking, estuarine fish and shellfish have a degree of resilience to relatively large changes in SSC due to the natural fluctuations associated with tidal activity, discharge from the river during high rainfall and increased wave action during storms. Sensitivity of lobsters and velvet swimming crabs (the species of highest commercial interest within the Tees estuary, see **Section 13.4.2**) to increased SSC is low, according to the MarLIN sensitivity scoring index. Mobile species (including most adult finfish) are generally able to detect early onset of increased SSC and relocate away from the affected area. Some juveniles and larvae finfish, however, may be more susceptible due to the fact that their sensory systems may be less developed, and they are less likely to relocate from affected areas. Similarly, juvenile and larval shellfish are more sensitive than adults as they have more limited mobility and hence are less capable of avoiding affected areas (Appleby and Scarratt, 1989). However, given that maintenance dredging is regularly undertaken with the Tees by PDT (almost daily maintenance dredging all year round), it can be reasonably assumed that resident individuals within the affected area would likely be relatively tolerant / acclimatised to the disturbances associated with dredging activity.

It is important to note that migratory species move upstream and downstream within the Tees (see **Section 13.4.1.2**), including both adult fish and juveniles / smolts. During the peak migratory season, when a sediment plume creating a 'barrier' effect could cause a significant disruption to the annual migration pattern, such species are considered to be more sensitive than resident species. For the purpose of this assessment it is assumed that the programme for the capital dredging in the proposed scheme may coincide with peak migration periods, and the sensitivity of receptors is considered to be high.

As outlined in **Section 6**, background SSC within the Tees channel measured during the 2020 met ocean survey was generally very low (0.0 to 8.5 mg/l), though it should be noted that the survey was undertaken during a period of very hot and dry weather. Modelling of the sediment plume during capital dredging indicates that an increase in SSC up to 350mg/l is predicted, although this only affects the direct vicinity of the dredging activity and falls below 50mg/l a short distance from the area being dredged. Concentrations of suspended sediments are predicted to decrease significantly with increased distance from the dredging vessel, both laterally and along the line of the vessel. The periphery of the plume (10 to 20 mg/l) extends no more than a few hundred metres from the dredging source.

The cross section of the river channel affected by the plume is particularly relevant when considering migrating fish; if areas remain relatively unaffected then migration would be able to continue. With respect to the proposed dredging, significant elevations in SSC are predicted to occur in the immediate vicinity of the dredger and along the streamline and, for the most part, are expected to be restricted to a relatively narrow plume along the axis of the river.

However, when considering the worst-case scenario (i.e. maximum enhanced SSCs) from the four modelled dredging phases set out in **Section 6**, the maximum area affected by increased SSC includes the entire width of the Tees (see **Figure 6.49**), meaning that there is the potential for a cross-sectional area of the river to be influenced. This is a highly conservative scenario; the maximum enhanced SSC plots indicate the maximum area affected but it is important to note that not all areas would be affected at any one time and it is very unlikely that entire cross sections of the river would be significantly affected for any protracted period. However, while unlikely, it has to be taken into account that sediment plumes encompassing the entire cross section of the river for any significant length of time, may result in significant impacts on migratory fish movement in the estuary, particularly in juvenile (smolt) stages. With the dredging lasting for approximately five months, the worst-case situation would be that this period covers a significant proportion of the peak migratory window, hence the magnitude of the impact is considered to be high.

With this in mind, there is predicted to be a **moderate adverse** impact on fish populations within the estuary, particularly when considering migratory species that may be prevented from undertaking their migratory journeys throughout the dredging campaign.

Mitigation and residual impact
The following mitigation measure is proposed to reduce the potential for impacts on migratory fish from changes to marine water quality:

- Limiting both the TSHD and BHD to working within one side of the river at a time. Operations will therefore be undertaken in long strips along the axis of the estuary rather than dredging across the width of the river. This is to reduce both the extent and impact of the dredged plume, as any plume generated by operations is predicted to remain on the same side of the river as the dredging operation, as with other capital dredge operations in the Tees (e.g. Royal HaskoningDHV, 2020).

With the implementation of the above mitigation measure, water quality will only be impacted on one side of the river at a time and, should dredging be undertaken during the months when migratory fish are present in the river, one side of the river will remain relatively unaffected. This area will form a passage through which migratory fish will be able to move past the dredging activity (and for resident species to relocate to largely undisturbed areas), thus reducing the magnitude of the impact.

Mitigation of the plume effects by reducing the size of the TSHD, and thus reducing the rate of overflow, is not viable since the size of dredger has to be sufficient to carry a large enough drag head and to have sufficient propulsion power to undertake the required dredging operation.

With the implementation of the above measure, the residual impact is considered to be **minor adverse** to both resident and migratory fish.

13.5.2 Entrainment of fish and fish eggs by dredging gear

Use of dredging apparatus, particularly TSHD dredge heads, could potentially lead to the entrainment of fish/shellfish, fish eggs and benthic food resources on which some fish/shellfish species rely. Potential effects from direct uptake during dredging include physical injury, mortality and displacement. The potential for entrainment is greater for demersal species, such as flatfish, than pelagic or semi-pelagic species. From the studies described in **Section 13.4.1**, it is evident that demersal species are likely to be present within the lower Tees estuary, including the footprint of the proposed dredge, with plaice and dab notably abundant in the 2018 and 2019 benthic trawl surveys (Royal HaskoningDHV, 2018 and 2020).

Physical disturbance to the riverbed and noise/visual disturbance within close proximity to the dredging activity would likely result in an avoidance reaction by mobile individuals (i.e. adult and juvenile fish, crustaceans), with the presence of the dredge head likely resulting in them temporarily relocating away from the immediate area, thereby avoiding direct uptake. Given their ability to relocate away from the source of entrainment, adult/juvenile finfish and mobile shellfish likely to be present in the Tees are considered to have low sensitivity to such impacts.

Eggs of benthic fish species that remain in close contact with the seabed, whether by adhering directly to the substrate or by other means, are likely to be sensitive to entrainment from dredging activities on that substrate. As detailed in **Section 13.4.1.6**, defined spawning grounds that may incorporate the lower Tees estuary include those for plaice and lemon sole (Coull *et al.*, 1998; Ellis *et al.*, 2010), though eggs of both of these species develop in the water column and are less sensitive to being entrained by dredge gear operating at the seabed. Regardless, regular maintenance dredging undertaken within the proposed dredge footprint almost daily across the whole year suggests that the riverbed is likely to be characterised by regular disturbance events, making it unsuitable for spawning activity by any fish/shellfish species and reducing the risk of direct uptake of eggs during the capital dredge.

In the event that some level of entrainment of fish/shellfish eggs does occur, it would be of low magnitude since it would be limited to those present within the dredge footprint (an area of ~350,000m^2). Given that the defined spawning areas are delineated at a resolution of half an ICES rectangle (Ellis *et al.*, 2010), the overall defined extent of spawning areas is generally very large. As such, localised effects on fish eggs would be of low magnitude when considered in the context of the defined populations in the Tees estuary and beyond. The impact is therefore predicted to be of **negligible** significance.

A loss of benthic food resources for fish/shellfish by entrainment is encompassed within the overall effects of dredging on benthic habitat and food resources, assessed in **Section 13.5.5**.

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

13.5.3 Underwater noise during dredging

Sources of underwater noise when using a TSHD (the worst-case scenario in terms of noise emissions from the dredging options) include movement of the drag head on the seabed, material suctioned through the underwater pipe and vessel sources such as the inboard pump, thrusters, propeller and engine noise (CEDA, 2011; WODA, 2013). Noise measurements indicate that the most intense sound emissions from TSHD dredgers are typically low frequencies, up to and including 1kHz (Robinson *et al.,* 2011). Underwater noise from a TSHD is comparable to those for a cargo ship travelling at modest speed (between 8 and 16 knots) (Theobald *et al.,* 2011). Although backhoe dredging will also be employed during the capital dredging, underwater noise associated with this method is generally considered to be lower than for TSHD (as demonstrated later in this section, the zone of influence from BHD is considerably less than it is for TSHD).

Fish have a wide range of auditory capabilities, mostly in the range of 30Hz to 1kHz, and detect sound through mechanosensory organs including the otolithic organs and (for detecting nearby sounds) a lateral line system. As such, underwater sound arising from the dredging is expected to fall within the hearing ranges of fish species present in the Tees (Popper *et al*., 2003). This could be a particular issue for migratory species, such as salmonids and eels, which must pass along the length of the Tees to access upstream or downstream spawning grounds.

The extent to which underwater sound might cause an adverse impact on fish is dependent on the sound energy level, sound frequency, duration and / or repetition of the sound wave (Hastings and Popper, 2005). The impacts can be summarised into three broad categories:

- Physical trauma / mortality;
- Auditory damage (temporary or permanent threshold shift); and,
- Disturbance (i.e. behaviour modification, masking of background noise).

The presence of a gas-filled swim bladder (or other gas chamber) increases the risk of sound pressure-related injury (i.e. barotrauma), since the involuntary movement of the swim bladder caused by sudden pressure changes (notably from impulsive noises) can cause damage to it and surrounding organs. As such, fish with swim bladders are more sensitive to exposure to sound pressure (i.e. more likely to be physically harmed) than those without a swim bladder (Popper *et al.*, 2014). Given that barotrauma can lead directly or indirectly to mortality, impulsive anthropogenic sounds at a level capable of causing such injuries pose the most severe risk to fish.

Disturbance effects may occur anywhere within the zone of audibility and may include evasive actions or other altered behaviour, and masking of ambient background sounds. Masking effects can be significant if an anthropogenic sound prevents fish from responding to biologically relevant sounds. Importantly for migratory species, evasive responses to increased noise levels could result in 'barrier' effects that prevent migration up- and downstream.

Some fish, such as clupeids and cod, can detect sounds over a broader frequency range and at greater distances than other species due to their ability to detect sound pressure due to them having swim bladders close to the otolithic organs (i.e. the swim bladders are 'involved in hearing') (Popper *et al.* 2003). Those species are likely to modify their behaviour in response to sound exposure over a greater distance than those lacking swim bladders, or those with swim bladders not involved in hearing. They would also be more affected by the masking of ambient sounds.

Popper *et al.* (2014) provides information on the relative risk of the effects of continuous sounds sources, such as those produced by operational dredging vessels, to fish, as presented in **Table 13.8**. Given a lack of information, quantitative thresholds are only available for auditory damage in fish with a swim bladder involved in hearing (i.e. the most sensitive species). Salmon and trout, the most sensitive to noise of the migratory species, fall into the category of species with 'swim bladders not involved in hearing'.

Table 13.8 Relative risk of auditory impacts from continuous sound emissions at near-, intermediate- and far-field locations (Popper et al.*, 2014)*

	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
No swim bladder	N: Low I: Low F: Low	N: Low I: Low F: Low	N: Moderate I: Low F: Low	N: High I: High F: Moderate	N: Moderate I: Moderate F: Low
Swim bladder not involved in hearing	N: Low I: Low F: Low	N: Low I: Low F: Low	N: Moderate I: Low F: Low	N: High I: High F: Moderate	N: Moderate I: Moderate F: Low
Swim bladder involved in hearing	N: Low I: Low F: Low	170 dB rms for 48 hrs	158 dB rms for 12 hrs	N: High I: High F: High	N: High I: Moderate F: Low
Eggs and larvae	N: Low I: Low F: Low	N: Low I: Low F: Low	N: Low I: Low F: Low	N: High I: Moderate F: Low	N: Moderate I: Moderate F: Low

N = near-field (tens of metres); I = intermediate-field (hundreds of metres); F = far-field (thousands of metres)

Based on the range of species present in the Tees estuary, as described in **Section 13.4.1**, the sensitivity of receptors varies, though for the purpose of this assessment a conservative estimate of high sensitivity (taking into account receptors particularly sensitive to sound pressure level changes, such as clupeids) has been applied. There is little evidence on the sensitivity of marine invertebrates (including shellfish) to anthropogenic noise but the suggestion is that sensitivity is low (Hawkins and Popper, 2012). Where applicable, particular focus in the assessment is placed on migratory species and how their migration activities may be impacted.

Temporary or permanent physical effects on fish

For the purposes of this assessment, the risk that noise from dredging activities could result in mortality or potential mortal injury is not considered to be an issue, given that there is no direct evidence of such noise resulting in mortal injury (Popper *et al.*, 2014). More relevant is the risk of recoverable injury and / or TTS. As indicated in **Table 13.8**, sound emissions greater than 158 dB rms for 12 hours mark the threshold at which TTS may be elicited, and 170 dB rms for 48 hours marks the point at which recoverable physical injury may be experienced by the most sensitive species.

A detailed underwater noise survey and modelling exercise was undertaken in 2014 to inform the EIA for the Anglo American Harbour Facilities (Royal HaskoningDHV, 2014). The findings of the modelling exercise provide useful context for the proposed scheme since a number of the input parameters used in the 2014 study are applicable, specifically:

- Source noise levels from a TSHD were used in the underwater noise assessment to represent a worst-case scenario (this form of dredging forms the worst-case scenario for the proposed scheme);
- The footprint of the Anglo American Harbour Facilities is approximately 600m downstream from the Tees Dock turning circle and the dredge footprint for the proposed scheme.
- The bathymetry and substrate in the proposed dredging location is broadly similar to that in the area modelled.

The 2014 modelling results, presented in **Table 13.9**, provide a summary of the estimated ranges out to which certain unweighted RMS SPLs were expected to occur from both backhoe and TSHD dredging.

Table 13.9 Summary of the modelled ranges for unweighted RMS SPLs in 10dB increments for dredging activities in the Tees (Royal HaskoningDHV, 2014)

Unweighted RMS SPLs	Backhoe dredging			TSHD		
	Max. range	Min. range	Mean	Max. range	Min. range	Mean
160 dB re 1 µPa	<5m	<5m	<5m	20m	20m	20m
150 dB re 1 µPa	10m	10m	10m	95m	75m	88m
140 dB re 1 µPa	30m	25m	28m	475m	335m	423m
130 dB re 1 µPa	105m	65m	92m	2,140m	485m*	1,310m
120 dB re 1 µPa	480m	275m	400m	2,460m	485m*	1,700m
110 dB re 1 µPa	1,860m	485m*	1,090m	2,920m	485m*	1,860m

**minimum range was limited by the width of the river*

Modelled ranges for backhoe dredging are notably less than they are for TSHD. For the most sensitive species (i.e. those with swim bladders involved in hearing), the unweighted SPLs outlined above only exceed the quantitative threshold for TTS (see **Table 13.8**) at a very short range (less than 88m from source when considering use of TSHD, and 5 to 10m from source when undertaking backhoe dredging). This is also based on the assumption that exposure is continuous for a period 12 hours, whereas in reality there will be breaks in dredging activity during the dredge/disposal cycles, plus it is highly unlikely that fish would remain within the injurious range (especially high value receptors such as migrating salmonids and eels).

Given the above, the risk and magnitude of recoverable injury or temporary auditory impairment is considered to be very low, and the significance of the impact is **negligible**.

Noise-related barrier effects on migrating species

When assessing the potential disturbance impact of noise on fish populations (whether by eliciting a behavioural response or by masking background sounds), it is important to consider the nature of the baseline sounds in the local environment and assess impacts in this context.

Underwater noise measurements were recorded in the River Tees, including the area of the proposed capital dredging, during an underwater noise survey conducted by Subacoustech in 2014 (Royal HaskoningDHV, 2014). The 2014 measurements indicated that background noise levels are typically in the region of 103 to 115 dB re 1µPa SPL_{RMS} along the centre of the river, which is considered to be relatively high for a wide, slow-moving river and is influenced by constant sources of shipping, engine and generator noise audible along the entire length of the channel. With passing heavy vessels, measurements were typically seen to increase to between 130 and 150 dB SPL_{RMS}.

Given the background noise levels in the river, it can be assumed that underwater noise above ~115dB re 1uPa SPL_{RMS} will be audible to fish, and **Table 13.9** indicates that noise levels of at least 130-140 dB SPL_{RMS} will be present across the entire width of the river during use of TSHD. As such, the underwater noise levels expected during TSHD use are likely to fall within the range experienced with passing vessels, although it will be sustained for as long as dredging is ongoing (a period of approximately four months). Noise levels from backhoe dredging are considerably lower, and only significantly exceed background levels within a short distance (<100m) of the source.

While effects on resident fish species may include some temporary behavioural alterations and masking, resident species are likely to have a level of acclimatisation to fluctuating noise levels caused by passing vessels and almost daily maintenance dredging, and they would also be able to temporarily move to nearby, less affected areas within the river while dredging is ongoing. Potential impacts for migratory species are considered to be more severe, since there is a risk of barrier effects that could prevent migration up- or downstream, particularly if dredging is undertaken during key migratory periods (see **Section 13.4.1.2**). Given that significantly elevated noise levels produced during backhoe dredging are not expected to extend across the entire width of the river (and would therefore be less likely to form a complete barrier effect for migrating fish), this assessment is based on the use of TSHD.

The TSHD campaign is predicted to last for approximately four weeks. While dredge/disposal cycles will run continuously during this period, each cycle time is estimated to last 175 to 190 minutes, of which only 60 to 75 minutes will be spent loading, with 115 minutes spent discharging and commuting to and from the disposal site.

As described in Popper *et al*. (2014), fish with swim bladders not involved in hearing (which includes migratory species such as salmon and trout) are considered to be moderately sensitive to the risk of behavioural impacts at both near-field and intermediate-field locations with regard to continuous noise sources (see **Table 13.8**). With this as a proxy, for the purpose of this assessment the sensitivity of the main receptors (i.e. migratory species) is considered to be medium.

Outside the migratory period, there would be a negligible impact on fish movement up- and downstream since noise emissions would not affect a significant number of migrating fish. If the TSHD campaign is undertaken during the key months of July and August (when salmonid migration is at a peak), the magnitude of the impact would be medium since, whilst being undertaken at a critical time of the year, it should be recognised that the noise levels produced would fall within the range experienced at the site as a matter of course when vessels pass on a day-to-day basis. Furthermore, noise levels associated with the capital dredging would likely be very similar to the almost-daily maintenance dredging activities undertaken in the channel; it should be noted that the baseline migration trends are in the face of this regular maintenance activity.

Given that the TSHD campaign would only last approximately four weeks, the duration of the impact is not expected to encompass the entire migratory season and normal migratory patterns would be expected to recommence once the dredging campaign has ceased. Furthermore, the noise levels at the site will abate for the majority of each dredge/disposal cycle while the TSHD vessel transports material to and from the disposal site, meaning that there are windows in which normal migratory patterns can occur even during the dredging campaign. As such, the significance of a potential barrier effects on migratory species caused by noise from TSHD is considered to be **minor adverse**.

Mitigation and residual impact

Use of dredging vessels are imperative for the proposed scheme. While use of smaller dredger heads may slightly reduce noise levels, they would continue for a longer period so are not considered to be a suitable measure. Applying the measure set out in **Section 13.5.1** (dredging along the axis of the river, rather than across the river) will help to ensure that noise levels at the opposite side of the river from the dredger remain as low as possible over a dredge/disposal cycle, but as stated above the elevated noise levels will be detectable across the entire width of the river. As such, the residual effect will remain **minor adverse**.

13.5.4 Underwater noise from land-based piling activities

While piling works are to be undertaken on land at least 20m from the river edge, consultation with the Environment Agency (see **Section 13.2.1**) has raised the issue of noise emissions from the landside piling propagating into the water column and potentially affecting migratory fish during upstream migration. Experience of piling in the Tees estuary suggests that impact pile driving is envisaged to take approximately 10 minutes per pile, with one pile driven per day at a rig and four rigs in use. As such, there could be up to 40 minutes of impact pile driving activity per day.

Popper *et al.* (2014) provides information on the relative risk of the effects of impulsive (percussive) piling driving sounds sources, presented in **Table 13.10**. As outlined in **Section 13.5.3**, salmon and trout, the most sensitive to noise of the migratory species, fall into the category of species with ‘swim bladders not involved in hearing’.

Table 13.10 Summary of the qualitative effects on fish from impulsive pile driving sources (Popper* et al., *2014)

	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
No swim bladder	>219 dB SEL_{cum} or >213 dB peak	>216 dB SEL_{cum} or >213 dB peak	>>186 dB SEL_{cum}	N: Moderate I: Low F: Low	N: High I: Moderate F: Low
Swim bladder not involved in hearing	>210 dB SEL_{cum} or >207 dB peak	>203 dB SEL_{cum} or >207 dB peak	>186 dB SEL_{cum}	N: Moderate I: Moderate F: Low	N: High I: Moderate F: Low
Swim bladder involved in hearing	>207 dB SEL_{cum} or >207 dB peak	>203 dB SEL_{cum} or >207 dB peak	186 dB SEL_{cum}	N: High I: High F: Moderate	N: High I: High F: Moderate
Eggs and larvae	N: Low I: Low F: Low	N: Low I: Low F: Low	N: Low I: Low F: Low	N: High I: Moderate F: Low	N: Moderate I: Moderate F: Low

N = near-field (tens of metres); I = intermediate-field (hundreds of metres); F = far-field (thousands of metres)

Additionally, Woodbury and Stadler (2008) and, more recently, Caltrans (2015) referenced a noise threshold of 150 dB 1 µPa SPL (RMS assumed) for eliciting a behavioural response in fish. Although Popper and Hawkins (2019) state concerns with this figure, including that the basis for it is unknown, or exactly what behaviour it relates to, in the absence of any alternative numerical criteria for behavioural effects, the noise levels produced by piling have been compared to this below.

Sound propagates most efficiently via a single, uninterrupted medium. Where it must pass through multiple media (i.e. mixed sand/silt and water), then the transmission of noise is reduced. In the proposed piling activities, vibration will be transferred from the pile and hammer and distributed into the substrate, and out into the river. Situations involving ground-borne noise transmission are complex due to the variety and layers of media. The calculation of how, and how much, noise is transmitted is much more difficult than a simple calculation of transmission directly through air or water, and it varies depending on the ground type present, and is most accurately identified by direct measurement. When it comes to predicting the noise level, the detail of analysis in calculation should be commensurate with the level of risk, and this relates to the level of noise present at source (i.e. the noise-generating activity) and the sensitivity of the receptor.

Subacoustech (2020) reviewed the risk of transmission of underwater noise into the river from the piling activities and the potential impacts on migratory fish (**Appendix 8**). Based on prior underwater noise surveys of land-based piling in other locations, Subacoustech considered a likely minimum loss of 5dB between the working area and the river. Applying this to typical piling underwater noise levels, the conservative noise level predictions in the Tees from piling, as used in the review, are set out in **Table 13.11** below.

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Table 13.11 Predictions of underwater noise levels during percussive piling in the River Tees (Subacoustech, 2020)

Range	SPL_{Peak}	SPL_{RMS}	SEL_{ss}
100m	186	169	163
200m	175	158	152
300m	170	153	147
400m	167	151	144

For the cumulative exposure calculations, an assumption has been used that the receptor remains in the middle of the river closest to the piling for 10 minutes, considered to be a reasonable estimate for the length of time that impact pile driving could take per pile. A stationary animal calculation has been used. This is a worst-case assumption as the receptors are migratory and expected to be highly mobile, therefore are unlikely to remain static in the water near to the noise source (they would likely move away in the event of a noise that would be considered disturbing or hazardous).

The maximum noise level predicted from percussive piling is 159 dB SEL_{ss} in the centre of the river channel, at 150m directly opposite the piling. Based on the above assumption, this is equivalent to 185 dB SEL_{cum}. This is under the quantitative threshold for TTS set out by Popper *et al.* (2014), and itself is expected to be a significant over-estimation of the actual noise exposure to an individual, therefore there is no risk of injury or TTS to even the most sensitive species of fish.

Noise-related barrier effects on migrating species during piling

The predicted level of 158 dB SPL_{RMS} at a distance of 200m is somewhat higher than the background noise levels in the Tees described in **Section 13.5.3**. Based on the predicted piling noise levels at the greatest distance (i.e. 151 dB SPL_{RMS} at 400 m), the noise level at the furthest 'line of sight' of the piling (around Middlesbrough Dock) using a reasonable estimation for noise attenuation in the water, the noise level would drop to 139 dB SPL_{RMS} (Subacoustech, 2020). This is still likely to be audible to fish, including migratory species.

The noise level predicted at the opposite side of the river (~300 m), 153 dB SPL_{RMS}, is slightly over the behavioural reaction threshold of 150 dB SPL_{RMS}. As this threshold is only for a "behavioural reaction" rather than the somewhat stronger response of aversive behaviour that would lead to an effective barrier in the river, and the relative insensitivity of the fish under consideration, it is thought that the noise from piling on land is unlikely to impede their passage during piling (noting that caution such be used in the generalisation of the behavioural reaction threshold (Popper *et al.*, 2019).

It is important to note that any motorised vessel present in the river will produce noise levels considerably in excess of background noise and of similar order (or greater) than the noise level produced during piling for much of the affected area. As stated in **Section 13.5.3**, the migratory species present in the Tees are expected to have some level of tolerance to periodic increases in noise levels. Furthermore, underwater noise emissions associated with the impact pile driving are expected over an approximate period of 40 minutes in a single day. Outside the key migration period there would be no effect on migration; however, even if piling takes place during the peak months of July and August the magnitude of the impact would be low since movement of fish along the river would be unimpeded for the majority of the time. The impact of underwater noise of piling activities is therefore considered to have a **negligible** impact on migration up- and downstream.

Mitigation and residual impact

No mitigation measures are required. The residual impact remains **negligible**.

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13.5.5 Direct loss/alteration of habitat and food resources

As outlined in **Section 13.2.2**, in lieu of survey data under the existing timber and concrete wharf at the time of writing, the assumption has been made that the structure is likely to provide sheltering habitat for juvenile fish. Removal of the wharf would result in a permanent loss of such habitat. Additionally, capital dredging and excavation of the subtidal and intertidal will result in temporary or permanent loss or alteration of habitat that could potentially be used for foraging and/or shelter by both adult and juvenile fish and shellfish. Full details of the anticipated changes in the intertidal and subtidal benthic environments are described in **Section 9**.

Alteration of subtidal habitat

Although there is potential for subtidal habitat within the Tees to offer feeding opportunities for fish that prey on benthic estuarine flora and fauna, the regular maintenance dredging undertaken by PDT within the river channel leads to a conclusion that the area of subtidal to be affected by the proposed dredging is unlikely to represent an important spawning or feeding site . Regardless, capital dredging activities on existing subtidal habitat would not represent a permanent loss of such habitat, as described in **Section 9.**

The ongoing maintenance dredging suggests that subtidal habitat in the proposed dredge footprint is likely to be characteristic of estuarine habitats influenced by regular disturbance events, and as such is expected to return to a similar condition following completion of capital works. In the short term the subtidal benthic community would be removed from an area of approximately 32.5ha, but, as described in **Section 9**, the majority of benthic species likely to be present (i.e. potential food resources for fish) are typical of the wider estuarine environment. As such, this temporary loss would not represent a significant reduction in available feeding habitat within the lower Tees estuary, and the magnitude of the impact on fish is considered to be low.

It should be noted that approximately 5ha of existing subtidal would see a permanent change due to the placement of a rock blanket in front of the new quay wall. As stated, however, the area affected is typical of the wider subtidal environment and would not represent a significant loss of such habitat. Furthermore, the introduction of hard, complex substrate may offer new opportunities for foraging, shelter and spawning that do not currently exist at the site, which may in turn improve biodiversity of fish and shellfish using the site. The placement of the rock blanket is not, therefore, expected to significantly change the magnitude stated above.

Given the maintenance dredging that occurs, it can be reasonably assumed that fish feeding within the affected subtidal area would likely be relatively tolerant / acclimatised to the disturbances associated with dredging activity. For this reason, the general sensitivity of fish to temporary changes in subtidal habitat in the affected area is considered to be low.

Given the above, alteration of the subtidal habitat as a result of dredging activity is considered to have a **negligible** impact on fish species within the Tees.

As well as the subtidal area affected directly by dredging activity, the increases in SSC anticipated during capital dredging activity will consequently result in an increase in sediment deposition, which has the potential to cause smothering and consequent loss of epibenthic food resources of benthic feeding fish/shellfish. The extent of sediment deposition above baseline levels is detailed in **Section 6**. The maximum sediment deposition, illustrated in **Figure 6.50**, shows that much of the sediment falls to bed within the dredged area, whilst other areas outside the dredge footprint affected are typically less than 5cm. In the small extent of subtidal area outside the dredge footprint that may be affected by a small amount of sediment deposition, it again can be assumed that feeding fish would be accustomed to similar conditions occurring during the regular PDT maintenance works.

Loss of sheltering/nursery habitat for juvenile fish

During excavation of the berth pocket, approximately 2.5ha of intertidal habitat along the south bank of the Tees will be converted to subtidal habitat. Additionally, removal of the existing wharf will remove what is assumed to be a source of shelter for juvenile fish (see **Section 13.2.1**). As described in **Section 13.4.1.6**, Ellis *et al.* (2010) defined nursery grounds for a number of species (including species of conservation importance) that may encompass suitable areas within the Tees estuary. Small and juvenile fish are considered to have high sensitivity to the loss of sheltering habitat, since it can leave them vulnerable to predation.

Walkover surveys at the site in 2020 (see **Section 9**) indicate that the intertidal area beneath and behind the existing wharf structure is relatively poor quality, with artificial debris and low species diversity (mainly dominated by fucoid algae). The intertidal area comprises mud and gravelly sediment with some rocks. While the loss of such habitat is considered to be insignificant (in terms of impact assessment) for the habitats and benthic communities present in the intertidal, it should be noted that even on poor quality intertidal habitat juvenile fish may, to an extent, use algal cover and artificial debris for shelter when immersed However, notable sheltering habitats such as intertidal pools were not recorded in the survey.

The supporting structures from the wharf appeared to support a low diversity of colonising species during the 2020 walkover survey and were dominated by mat-like green algae. These structures are at the subtidal/intertidal boundary and therefore at least some part of the structures are underwater most of the time. Such structures, when colonised by algae and other taxa that afford shelter, can act as aggregating sites for small / juvenile fish, particularly in nursery sites. The wharf itself may offer protection from aerial predators such as terns and other seabirds. In the absence of survey data at the time of writing, this assessment is based on the worst-case assumption that the structure is important for sheltering small and juvenile fish.

While the removal of sheltering structures and the conversion of intertidal areas to subtidal will result in permanent loss of such features, this is partly offset by the fact that the area of such habitat affected is relatively small (~2ha) and there are numerous other intertidal locations and sheltering structures within the Tees estuary that can be used by the wider population. With this in mind, the magnitude of the impact is considered to be medium, and the loss of sheltering habitat is predicted to have a **moderate adverse** impact on small and juvenile fish.

Mitigation and residual impact

Removal of the existing structures and excavation of the intertidal is an intrinsic part of the project design for the proposed scheme, and there is no feasible mitigation measure that can prevent such losses. However, as described in **Section 3**, opportunities for introducing environmental enhancement measures (IECS, 2018 and Naylor *et al*., 2017) include the incorporation of 'verti-pools' in the quay face at different heights within the tidal frame. Such water retentive measures would provide new shelter for small and juvenile fish from larger marine predators as well as aerial predators. Given that these would be specifically designed to offer shelter throughout the tidal range, this would help to offset the loss of the existing structures and reduce the magnitude of the impact. With the adoption of such enhancement measures, the residual impact on sheltering fish would be reduced to **minor adverse**.

13.5.6 Displacement or disturbance of fishing activities

The use of construction vessels within the river channel (e.g. TSHD and backhoe as well as other supporting vessels to be used during demolition and construction) and the construction work in the intertidal could impede access to passing vessels commuting to fishing grounds in the outer estuary or adjacent coastal areas and, in theory, could lead to localised displacement of fishing activities within (or adjacent to) the footprint of the works.

Although most commercial fishing activity takes place outside of the Tees estuary, there are limited seasonal lobster and velvet swimming crab fisheries in the lower estuary during summer month, as described in **Section 13.4.2**. However, areas within and adjacent to the marine footprint of the proposed scheme are those already subject to regular maintenance dredging and/or experience high volume of vessel traffic and would therefore already be unsuitable for potting activity. Bait digging takes place on intertidal mud and sandflats within the Tees estuary, but the area of intertidal that will be lost during the construction of the proposed scheme is small and has restricted public access; furthermore, most bait digging occurs lower in outer estuary and along the adjacent coastline.

Given the above, it is highly unlikely that there would be any significant displacement of fishing activity within the footprint of the works, and even if there was, the number of vessels/fishers affected would be negligible and could easily use other areas within the lower Tees.

In terms of restricting access to passing fishing vessels commuting to fishing grounds downstream or out to sea, the navigational impacts of the proposed scheme during construction works are assessed in detail in **Section 14**). The navigation assessment concludes that potential conflict between construction activities and navigation within the Tees estuary is predicted to be negligible, given that works will be co-ordinated through the Harbour Master.

As such, any impacts on local fishing activities taking place within the Tees estuary or adjacent coastline are predicted to be **negligible**.

Mitigation measures and residual impact

No mitigation measures are required, although as a matter of course PDT will manage any conflicts through coordination via the Harbour Master and use of VTS. Fishing vessel users will be provided with Notices to Mariners informing them of proposed works, allowing them to adjust accordingly. The residual impact would remain **negligible**.

13.6 Potential impacts during the operational phase

13.6.1 Noise disturbance from increased vessel traffic

It is understood that on average, there are between 800 and 950 commercial vessel movements per month (up to 11,400 per year) in the Tees estuary under baseline conditions. This figure does not include non-commercial activity; therefore, the true number of motorised vessel movements is likely to be higher. It is predicted that there would be an additional 390 operational vessel calls per year at the proposed quay.

Given that fish within the Tees are already exposed to a high degree of vessel-associated disturbance (including noise levels elevated above ambient levels), they are considered to be accustomed to such impacts (including hearing sensitive species, such as those with swim bladders). Furthermore, in the context of existing vessel traffic, the predicted operational vessel movements are considered to be of very low magnitude and there would be significant increase on noise levels already experienced. The minor increase in motorised vessel traffic is therefore considered to have a **negligible** impact on fish populations or behaviour.

Mitigation and residual impact

No mitigation measures are required. The residual impact will remain **negligible**.

13.6.2 Impacts from quayside lighting

At present there is no/minimal light source at the site of the proposed new quay and therefore light spill into the channel will be very limited (although lighting is present along all other operational quays along both banks of the river). However, during the operation phase, approximately 18 new lighting towers (each up to 30m in height) will be present on the quayside for safety reasons. Consequently, there is the potential for additional disturbance to fish as result of light spill compared to the present-day scenario.

The reaction of many fish to this type of disturbance is attraction to the light sources. Therefore, there is the potential for some attraction of fish to the operational area, although noise generated from vessels using the quay will counteract this effect to an extent. Overall, it is concluded that the noise and light during the construction phase will result in some highly localised redistribution of fish within the area around the new quay. However, this would not affect the fish populations of the estuary as a whole and, therefore, the impact is predicted to be of **negligible** significance.

Mitigation and residual impact

No mitigation measures are required; however, in accordance with best practice, lighting would be directed away from the estuary where possible in order to minimise light spill into the water column. The residual impact would be **negligible**.

13.6.3 Change in maintenance dredging regime affecting supporting habitats and benthic prey resources

The predicted changes to the rate of infill of the navigation channel as a consequence of the proposed scheme are minimal. It is concluded that the predicted changes are insignificant with respect to potential effects on the existing maintenance dredging strategy, and no changes to the present-day maintenance dredging strategy are necessary. As such, there would be **no additional impact** on supporting benthic habitats and prey resources beyond those already associated with the existing maintenance dredging regime.

Mitigation measures and residual impact

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

14 COMMERCIAL AND RECREATIONAL NAVIGATION

14.1 Introduction

This section of the EIA Report considers the following potential impacts to commercial navigation:

- Conflict between construction activities and commercial navigation.
- Increased collision risk and delays to shipping due to increased vessel traffic during operation.
- Effects on safety of shipping movements due to changes in the hydrodynamic regime during operation.

14.2 Policy and consultation

14.2.1 Policy

Marine Policy Statement
As outlined within the UK MPS (HM Government, 2011), port development may result in an increase in shipping activity. When considering any potential increase in shipping activity, the MPS states (in Paragraph 3.4.10) that marine plan authorities and decision makers should ensure that the social and economic benefits and environmental impacts are taken into account and that impacts are considered in line with sustainable development principles.

As outlined in the MPS (Paragraph 3.4.6), environmental impacts arising from shipping activity can be through accidental pollution from ships in the course of navigation or lawful operations, pollution caused by unlawful operations or physical damage caused by collisions. Other pressures on the environment from shipping activity relate to noise and airborne emissions. These potential impacts (with the exception of noise and emissions from vessels which have been considered in the noise and air quality chapters respectively) have been assessed within this section of the EIA Report, where they are relevant to the proposed scheme.

The MPS (authorised by Section 44 of the Marine and Coastal Access Act, 2009) states that marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity, freedom of navigation and navigational safety and ensure that their decisions are in compliance with international maritime law (Paragraph 3.4.7).

14.2.2 Consultation

Consultation with PDT was undertaken during June 2020 regarding the potential impacts of the proposed scheme on navigation within the estuary. It was confirmed that a Navigation Risk Assessment (NRA) would be required for PDT to understand the potential impacts of the proposed scheme. An NRA has therefore been undertaken to inform this chapter; the findings which are reported below. The NRA is also presented in full within **Appendix 9**. Consultation with PDT has also been undertaken to inform the design of the proposed scheme; specifically, PDT advised that the berth pocket should be located outside of the approach channel in order to minimise risks to navigation. STDC is undertaking further consultation with PDT to discuss the findings of the NRA.

14.3 Methodology

The assessment methodology used to determine the potential environmental impacts on commercial navigation associated with the proposed scheme is generally as set out in Section 5. The methodology used to produce the NRA is detailed in **Appendix 9**.

14.4 Existing environment

Many of the riverside industrial plants along the 17km stretch of the River Tees have docking and cargo facilities and, therefore, the River Tees experiences significant commercial vessel traffic. PDT has confirmed that on average, there are between 800 and 950 vessel movements per month within the Tees estuary.

The Tees estuary is approached from the north-east through a deep-water channel in Tees Bay. The approach channel has an advertised depth of 15.4m below CD from Tees fairway light buoy to the entrance, where it reduces to 14.1m below CD. Thereafter the maintained depth is progressively reduced to 4.5m below CD, seven nautical miles from the entrance. The current advertised depths of the channel are shown in **Figure 14.1** (it should be noted that the Harbour Master has stated that the current channel depths do not match the advertised depths due to sedimentation within the channel).

There are currently two turning areas within the estuary; one within the Seaton Channel area which can accommodate vessels 350m in length and is regularly used for large tankers which berth at the Tees North Sea Oil Terminal and large bulk carriers bringing coal and ore to Redcar Ore Terminal. The second is the Tees Dock turning area which is used to turn vessels which berth at Tees Dock and at the bulk liquid jetties opposite.

Large deep drafted ships bound for Tees North Sea Oil Terminal and the Redcar Ore terminal pick up tug assistance after passing South Gare. Fully laden ships can only enter on the high tide but can leave at any time once their cargo has been discharged. Similarly, any fully laden ships to exit the river must wait for the high tide. Vessels are turned when unloaded either in the Seaton Channel turning area or in the Tees Dock Turning Area depending on which quay or jetty they are destined for.

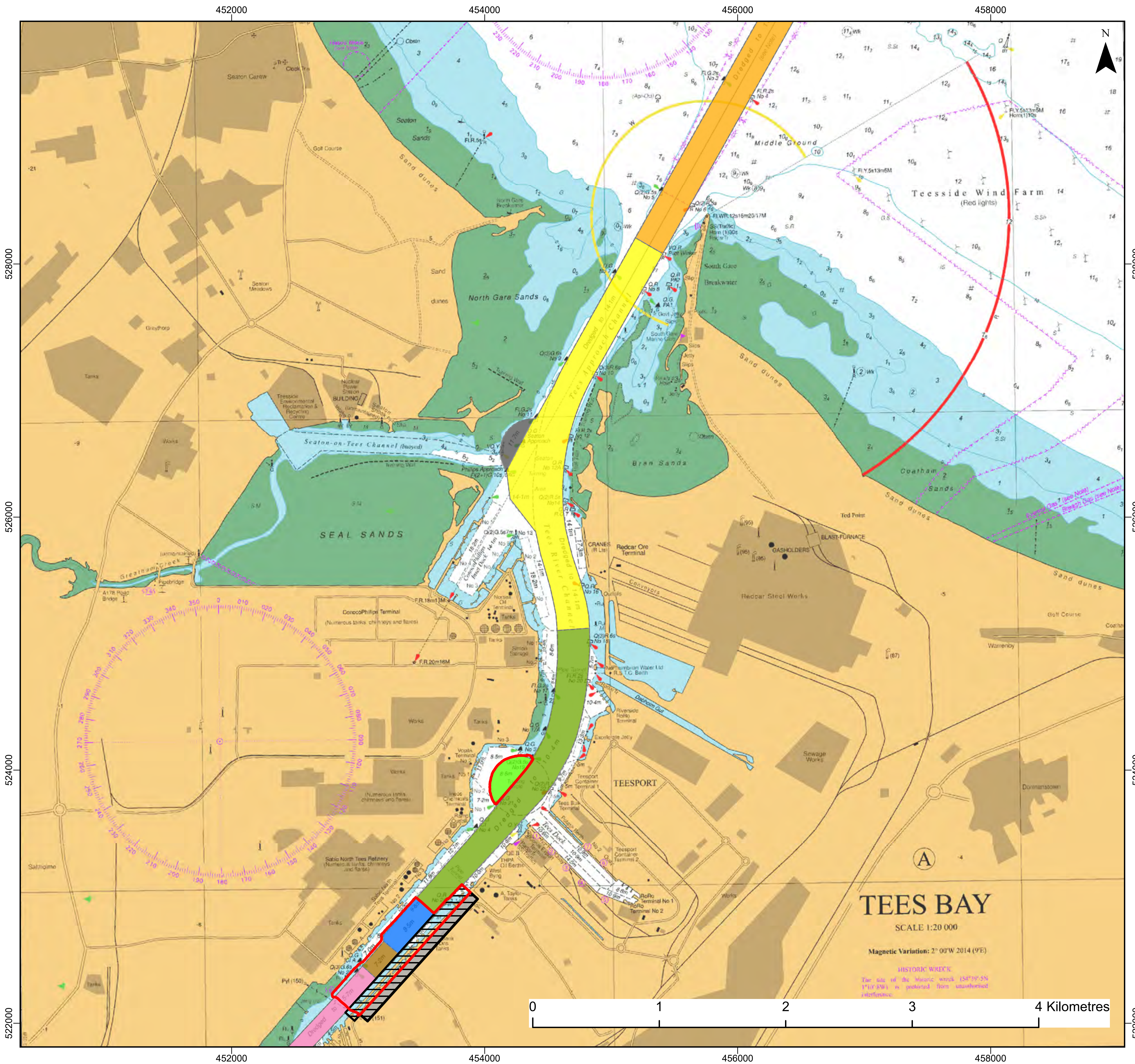
The channel is maintained by PDT which has a statutory responsibility to maintain the channel for safe navigation. Additionally, traffic in the Tees estuary is controlled by a sophisticated vessel traffic system (VTS).

The proposed scheme is currently occupied by a dilapidated wharf and three concrete jetties. The wharf (and the three downstream jetties) has not been used for a number of years and has fallen into a state of disrepair.

Consultation with PDT during December 2017 confirmed the volume of cargo handled by Teesport. This information is detailed in Table 14.1 (alongside information from 2004 as a comparison), and confirms that liquid bulk remains the dominant material handled at the port. The data shows that there has been a reduction in the overall tonnages of cargo handled by PDT since 2004 (however the volume of unitised cargo has increased). This reduction is largely as a result of the closure of the steel works and reduced exports from the Conoco Philips facility.

Table 14.1 Tonnages of cargo handled by Teesport during 2004 and 2016

Material handled	2004 tonnages	2016 tonnage
Liquid bulk	36.2 million tonnes	20 million tonnes
Dry bulk	12.5 million tonnes	2.3 million tonnes
Unitised cargo	3.6 million tonnes	4 million tonnes
Overall	53.8 million tonnes	26.7 million tonnes



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Advertised Dredge Depths (m)

- -5.7
- -7.2
- -8.5
- -8.8
- -10.4
- -11.7
- -14.1
- -15.4

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Advertised Dredge Depths

Figure: 14.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	SR	A3	1:30,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

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

In the absence of the proposed scheme, commercial navigation within the Tees estuary would continue in order to support the existing operators along its banks. From a container terminal perspective, it is predicted that Teesport would be at full capacity by approximately 2024, preventing the future growth of the port for container cargo. The port may therefore need to look to other markets to allow growth of the port, which could result in a change in the nature of vessels transiting through the river.

14.5 Potential impacts during the construction phase

14.5.1 Potential conflict between construction activities and commercial navigation within the Tees estuary

During the construction phase there is the potential for conflict between the construction activity and navigation within the Tees estuary. Given that the proposed construction works for the quay are proposed to be undertaken on land using predominantly land based plant, this potential for conflict arises largely due to the presence of the dredger and barges within and adjacent to the navigation channel (as well as any support vessels required during demolition and construction). Construction activity will be focused on the area in the vicinity of the proposed quay but the capital dredging will, at certain stages in the construction programme, affect the wider estuary between the proposed quay and the Tees Dock turning circle.

The potential conflict between construction plant and shipping traffic could take a number of forms, including delays to shipping, increased risk collision, obscuring navigational aids and the prevention/interference of activities of other operators that are present in the vicinity of the proposed quay. This potential conflict exists for the duration of the construction which is predicted to last for a period of approximately three years overall.

As detailed in the NRA, a number of embedded mitigation measures are already enforced by PDT which have been taken into account during the construction phase risk assessment undertaken by Marico Marine (see **Appendix 9**). These embedded mitigation measures comprise:

- Adherence to risk control measures listed within the current Port Navigation Risk Assessment.
- Use of the existing VTS.
- Post dredge surveys and promulgation.
- Issue of Notices to Mariners.

It is envisaged that PDT would manage any potential conflicts in the same way as routine dredging and other construction activities, through co-ordination between STDC, the appointed Contractor and the Harbour Master. Management of dredging operations within a busy port environment is a standard activity for the Harbour Master. It is considered that the use of a VTS would provide a satisfactory mechanism for the effective management of all shipping traffic within the Tees estuary and Tees Bay. STDC would liaise with the Harbour Master to ensure that Notices to Mariners are issued at the appropriate times to inform other users of the proposed construction works. In addition, construction vessels would use appropriate signals as required by International Regulations to allow safe navigation.

The Port Maritime Safety Code will be taken into account within the detailed design of the proposed scheme. Liaison with the Harbour Authority will be undertaken to develop a robust Safety Management System, which would be implemented and adhered to during the construction phase for the proposed scheme.

As reported in **Appendix 9**, the NRA concludes that construction phase hazards have been assessed to be 'As Low As Reasonably Practicable', and are therefore, acceptable in terms of risk with the proposed scheme determined to have minimal effect on the existing navigation profile (Marico Marine, 2020).

Based on the above, the magnitude of the impact is anticipated to be very low on a medium sensitivity receptor. The proposed scheme is, therefore, predicted to have an impact of **negligible** significance on commercial navigation during the construction phase.

Mitigation measures and residual impact

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

14.6 Potential impacts during the operational phase

14.6.1 Increased collision risk and delays to shipping due to increased vessel traffic during operation

During the operational phase, there would be an increase in shipping traffic within the estuary as a result of the proposed scheme. It has been estimated that up to 390 offshore wind vessel calls would take place at the facility on an annual basis. This includes approximately 300 vessel calls per year associated with offshore wind staging and 90 vessel calls per year associated with offshore wind manufacturing activities. Such an increase in vessel numbers has potential to impact on the existing vessel movements within the estuary, due to increased collision risk of delays to shipping movements.

As noted above, a number of embedded mitigation measures are already enforced by PDT which have been taken into account during the operational phase risk assessment undertaken by Marico Marine (see **Appendix 9**). These embedded mitigation measures which are applicable to the operational phase comprise:

- Adherence to risk control measures listed within the current Port Navigation Risk Assessment.
- Use of the existing VTS.
- Movements associated with barges carrying windfarm cargos would be treated as 'project moves' in accordance with PDT procedures.
- Review navigation aids in the vicinity of the proposed berths as directed by PDT,
- Establishment of a 15m safety zone on the riverside of stowed windfarm blades.

As reported in **Appendix 9**, the NRA concludes that operational phase hazards have been assessed to be 'As Low As Reasonably Practicable', and are therefore, acceptable in terms of risk with the proposed scheme determined to have minimal effect on the existing navigation profile (Marico Marine, 2020).

In addition to the above embedded mitigation measures, the following measures are proposed to be adopted as part of the proposed scheme:

- marking and lighting of overhanging blades; and,
- introduction of a safety zone in the vicinity of overhead cables whereby vessels may not enter if they or their load exceeds the given height restrictions.

Based on the above, the magnitude of the impact is anticipated to be very low on a medium sensitivity receptor. The proposed scheme is, therefore, predicted to have an impact of **negligible** significance on commercial navigation during the construction phase.

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Mitigation measures and residual impact

No additional mitigation measures are required beyond those detailed above (to be built into the proposed scheme) and the residual impact is predicted to be of **negligible** significance.

14.6.2 Potential effects on navigation safety due to changes in hydrodynamic regime

There is potential for effects on navigational safety during the operational phase as a result of changes to the existing hydrodynamic regime. As reported in Section 6.6, the effects of the proposed scheme on the hydrodynamic regime can be summarised as follows:

- The proposed new quay alignment and capital dredging to deepen the Tees Dock turning circle and approach channel and to create a berth pocket will not significantly affect the existing baseline hydrodynamic conditions.
- There will be flow newly occurring in the area of the new quay because it is being set-back from the existing riverbank, but even the peak flows in this area will be low.
- Elsewhere, there will be a general small magnitude reduction in baseline flows varying during different phases of the tidal cycle, but always remaining largely within the reach immediately opposite the new quay. This reduction in baseline flows is caused by both a slight widening of the channel (due to the new quay alignment) and the local deepening of the bed due to the capital dredging.
- The reductions in baseline current speeds in these areas may lead to a slight increase in deposition of sediment. 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.
- There is no measurable change caused by the capital dredging at the Tees Dock turning circle.
- There is no predicted effect on local wind-generated waves at the site since the changes in hydrodynamics are so small and localised.
- There are no estuary scale effects on baseline hydrodynamic conditions.

Based on the above, the magnitude of the impact is anticipated to be very low on a high sensitivity receptor (human health/safety). The proposed scheme is, therefore, predicted to have an impact of **negligible** significance on navigation safety during the operational phase.

Mitigation measures and residual impact

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

15 TRAFFIC AND TRANSPORT

The traffic and transport impacts of the proposed scheme are detailed within a supporting Transport Statement (TS) (**Appendix 10**). The TS includes:

- a review of the relevant policy and consultation and details of the proposed schemes compliance with such policy;
- a review of the existing highway environment, including accessibility, road safety and baseline traffic flows; and,
- details of the forecast increases in traffic that would be generated by the proposed scheme and the distribution onto the highway network.

The salient guidance for environmental assessment of traffic and transport impacts associated with new schemes is provided within the Guidelines for the Environmental Assessment of Road Traffic (GEART). GEART provides rules for delimiting the scope of any assessment and notes that increases in total traffic (or HGV component) of less than 10% are likely to lead to no discernible environmental impacts.

Table 15.1 provides a summary (from the TS) of the background traffic flows and forecast peak daily traffic that would be generated by the construction of the proposed scheme when assigned to the highway network.

Table 15.1 Existing and proposed daily traffic flows

Link description	Existing 2018 annual average daily traffic flows (AADF)		Forecast daily construction vehicle movements		Percentage Increase	
	All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
Tees Dock Road	4,830	1,486	242	42	5%	2.8%
Old Station Road	5,013	795	242	42	5%	5.3%
Dockside Road	5,446	776	242	42	4%	5.4%
A66 (East)	47,977	3,763	177	42	0%	1.1%
A66 (West)	22,383	2,999	141	42	1%	1.4%
A1053	22,378	1,736	141	42	1%	2.4%

It can be noted from **Table 15.1** that peak daily construction traffic movements would be significantly less than 10% and therefore in accordance with GEART, no discernible environmental impacts are identified. The impact of the proposed development's construction traffic is therefore assessed as of **negligible** significance.

The TS does not include a detailed review of the operational traffic demand as it is understood that the proposed scheme would be required to support the landside works at the South Industrial Zone. An ES submitted in support of the planning application for the South Industrial Zone scheme included a detailed assessment of the potential operational phase impacts on traffic and transport.

The ES for the landside works identifies that when fully operational, there could be up to 3,870 employees at the SIZ. It is forecast that up to 10 employees would be required to operate the new quay. It is therefore implicit that the 10 employees (for the proposed new quay) would have been contained within the bounds of the assessed outcomes of the SIZ ES and are therefore not a material consideration. The impact of the proposed schemes operational traffic is therefore assessed as **negligible** significance.

Mitigation measures and residual impact

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

16 ARCHAEOLOGY AND CULTURAL HERITAGE

16.1 Introduction

This section sets out the results of an archaeological desk-based assessment and settings assessment, and presents the assessment of likely impacts upon the known and potential archaeological resource as a result of the proposed scheme.

16.2 Policy and consultation

16.2.1 National Policy Statement for Ports

The assessment of potential impacts to archaeology and cultural heritage has been made with reference to the NPS for Ports (Department for Transport, 2012, Section 5.1.2 Historic Environment) as summarised in **Table 16.1.**

Table 16.1 Summary of NPS for Ports requirements with regard to archaeology and cultural heritage

NPS requirement	NPS reference	Section where requirement has been addressed
As part of the ES, the applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on the significance of the heritage asset.	Section 5.12.6	**Section 16.4**
As a minimum, the applicant should have consulted the relevant Historic Environment Record and assessed the heritage assets themselves using expertise where necessary according to the proposed development's impact.	Section 5.12.6	**Section 16.4.1**
Where a development site includes, or the available evidence suggests it has potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation.	Section 5.12.7	Section **16.4** (please note that a field evaluation has not been required)
Where proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact.	Section 5.12.7	**Section 16.4.4** (and visualisations in **Section 19)**
The possibility of damage to buried features from underwater disposal of dredged material should be taken into account.	Section 5.12.8	Disposal will be undertaken at an existing licensed offshore site.
The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents.	Section 5.12.9	**Sections 16.5** and **16.6**

16.2.2 National Planning Policy Framework

The NPPF (Ministry of Housing Communities and Local Government, 2019) considers the importance of the historic environment in planning and development and sets out the government's policies regarding development that affects the historic environment and informs the decision-making progress for Planning Authorities. It requires that proposals are fully assessed to help inform decision making. Provision for the historic environment is given principally in Section 16 'Conserving and enhancing the historic environment' (paragraphs 184-202) of the NPPF, which directs Local Planning Authorities to set out "*a positive strategy for the conservation and enjoyment of the historic environment, including heritage assets most at risk through neglect, decay or other threats*" (Paragraph 185). In doing so, Local Planning Authorities should recognise that heritage assets are "*an irreplaceable resource and should be conserved in a manner appropriate to their significance*" (Paragraph 184). Account has been taken of the policies set out in the NPPF in the assessment of archaeology and cultural heritage set out below.

16.2.3 Marine Policy Statement

Section 2.6.6. of the MPS outlines the approach to be taken with regards to the Historic Environment states that "*The historic environment includes all aspects of an area that are the result of an interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged*". Of particular relevance to this assessment is Section 2.6.6.7 of the MPS which states that "*In considering the significance of heritage assets and their setting, the marine plan authority should take into account the particular nature of the interest in the assets and the value they hold for this and future generations. This understanding should be applied to avoid or minimise conflict between conservation of that significance and any proposals for development*". In addition, Section 2.6.6.8 of the MPS states that "*Substantial loss or harm to designated assets should be exceptional, and should not be permitted unless it can be demonstrated that the harm or loss is necessary in order to deliver social, economic or environmental benefits that outweigh the harm or loss*".

Account has been taken of the policies set out in the MPS in the assessment of archaeology and cultural heritage set out below.

16.2.4 North East Marine Plan

Policy NE-HER-1 of the draft North East Marine Plan states that "*Proposals that demonstrate they will conserve and enhance elements contributing to the significance of heritage assets will be supported. Proposals unable to conserve and enhance elements contributing to the significance of heritage assets will only be supported if they demonstrate that they will, in order of preference:*

a) avoid

b) minimise

c) mitigate harm to those elements contributing to the significance of heritage assets

d) *if it is not possible to mitigate, then public benefits for proceeding with the proposal must outweigh the harm to the significance of heritage assets*".

The aim of this policy is to "*conserve and enhance marine and coastal heritage assets through considering the potential for harm to elements that contribute to their significance*".

The assessment presented in this section takes account of policies set out in the North East Marine Plan.

16.2.5 RCBC Local Plan

Section 8 of the RCBC Local Plan (RCBC, 2018) addresses the Historic Environment, stating (paragraph 8,.6) that "*Development proposals which affect the historic environment will need to sustain the borough's local distinctiveness and character by safeguarding, conserving and enhancing designated and undesignated heritage assets and their settings*".

Policy HE 1 addresses conservation areas based upon the principle that, because of their special importance any change within a conservation area will be carefully controlled and appropriate layout, design,

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materials and detailing will be necessary. There are, however, no conservation areas that would be affected by the proposed scheme.

Policy HE 2 addresses designated and non-designated heritage assets. As above, there are no designated heritage assets, nor non-designated heritage assets that are demonstrably of equivalent significance, which would be directly affected by the proposed scheme (see **Section 16.4.1**). However, the setting of specific designated heritage assets within a wider study area have been assessed (see **Section 16.4.4**), with regards to Policy HE 2, which states that any development affecting the setting of a designated heritage asset will only be permitted if the proposal:

- preserves or enhances its significance as a designated heritage asset;
- protects its immediate setting including the space(s) around the building and the historically significant hard and soft landscaping, including trees, hedges, walls, fences and surfacing; and
- retains historic plot boundaries and layouts.

Policy HE 3 (archaeological sites and monuments) states that a desk-based assessment, and an archaeological evaluation where necessary to determine an appropriate course of action, will be required to be submitted as part of a planning application for any development that may affect a known or possible archaeological site. The results of the desk-based assessment undertaken for the proposed scheme are presented in this section of the report. An archaeological evaluation has not been required for the purposes of the marine licence and planning application which this document supports. Policy HE 3 also states that, "Development that affects a site where archaeology exists or where there is evidence that archaeological remains may exist will only be permitted if:

- the harm or loss of significance is necessary to achieve public benefits that outweigh that harm or loss. Harm or loss may be avoided by preservation in situ or refusal; or
- where in situ preservation is not required, appropriate satisfactory provision is in place for archaeological investigation, recording and reporting to take place before, or where necessary during, development. Where archaeological investigation, recording and reporting has taken place it will be necessary to publish the findings within an agreed timetable.

Account is taken of these relevant polices in the assessment presented below.

16.2.6 Consultation

A summary of consultation responses relevant to the assessment of archaeology and cultural heritage and how these have been addressed is presented in **Table 16.2**.

Table 16.2 Summary of relevant consultation responses

Consultation	Summary of response	Section where response has been addressed
MMO Scoping Opinion (previously proposed development from 2019)	The Tees has been subject to dredging in the recent past meaning the potential for archaeologically significant deposits or features to be impacted is likely to be negligible and therefore not necessary to be assessed.	**Section 16.4.2.**
	The development could have an impact on a number of designated heritage assets and their settings around the site. The MMO expects that the following designated heritage assets should be assessed in the ES: • HA1139267 Transport Bridge • HA1160408 Baptist Church	**Section 16.4.4**

Consultation	Summary of response	Section where response has been addressed
	• HA1139622 Church of St Peter • HA1160378 War Memorial Circa 5 metres South West of Church of St Peter • HA1310598 1 Milbank Street • HA1329634 War Memorial • HA1329635 Church of St John the Evangelist	
	Views of the Grade II* Transporter Bridge should be assessed in the 'Landscape and Visual Impact Assessment' to determine the likely impact of the crane and other tall features in the proposal.	**Section 19**
	The ES should also consider the potential impacts on non-designated heritage assets since these can be of national importance. The Local Authority's Historic Environment Record (HER) should be consulted for baseline data in this regard.	**Section 16.4.1**
RCBC Archaeology Consultant Scoping Opinion (previously proposed development from 2019)	The cultural heritage chapter of the relevant EA should be required to consider (a) both the direct and indirect archaeological impacts to all designated heritage assets and their settings; and (b) the direct and indirect effects on non-designated heritage assets and their settings. A sufficiently large zone of archaeological interest should be considered for the assessment of both designated and non-designated assets. This zone is likely to be of a minimum 2km radius from the application site, and in relation to impacts on setting is likely to be considerably larger.	**Sections 16.5, 16.6** and **16.3.1**
Conversation and Listed Building Conservation (Landside Planning Application)	The proposal to mitigate the loss of relatively low significance industrial archaeology by recording features uncovered during ground work and photogrammetric recording of remaining above ground structures is considered to be sufficient. The submitted documents are considered to fulfil policy requirements.	**Section 16.5**
RCBC Archaeology Consultant Scoping Opinion (Landside Planning Application)	They agree with the recommendations set out within the Below Ground Heritage Chapter. The only exception to this would be remains of blast furnaces from the South Bank Iron works, were they to be present in any form on site; however, the chapter states that this Iron Works is no longer extant in any form (having been built over), albeit it is unclear whether this conclusion is due to site inspection/evaluation, or solely a matter of historical record.	N/A (applicable to landside application only)
	Because the site consists of deep made-up ground above former tidal mud flats and marsh Chapter M states categorically that no prehistoric remains will exist on the site. This is a conclusion that may be a little too sweeping, given the location of the site, at the tidal edge, in an area likely to have been exploited in the prehistoric period. Rather than the conclusion, it is the paucity of evidence – at least as far as this is set-out within chapter M – for the conclusion that concerns us. The former land surface is undoubtedly sealed at depth (especially at the southern part of the site), and the site has been heavily developed, but an area at the coast, and one probably subject to late Holocene inundation such as the Tees estuary, could be of archaeological potential if that surface is buried but not destroyed by development. Evidence of prehistoric activity or deposits, would typically be of peat, waterlogged wood, coppiced or worked wood, worked flint, worked animal bone and antler.	**Section 16.4.2**
	Site investigation information (especially borehole data and cores) should be archaeologically inspected, with a view to identifying any layers of prehistoric archaeological interest; and any positive results in that regard should inform where any deep excavations (including piling) carried out as part of construction should be monitored by a paleo-environmental archaeologist.	**Section 16.4.2**

Consultation	Summary of response	Section where response has been addressed
	Recommendations 1. There should be appropriate recording of the foundations of identified heritage assets of local / regional importance, and of 20th century structures. 2. There should be some attempt to assess deeply buried layers of prehistoric interest, and thereafter the archaeological monitoring of deep excavations in areas where any deposits of pre-historic interest may survive. 3. A condition requiring a written scheme of investigation for archaeological work.	**Section 16.5**
RCBC Archaeology Consultant Scoping Opinion (currently proposed scheme)	In general we agree with the statement within the memorandum that marine heritage is likely to be limited by dredging within the immediate area of the proposed dock facilities. Archaeological review of borehole logs is welcome, as part of the heritage assessment.	**Section 16.4.2**
	In addition, the archaeological desk-based assessment should indicate in relation to wreck sites whether these are situated within an area of proposed new dredging (either for construction or on-going channel maintenance).	**Sections 16.4.1** and **16.4.2**

16.3 Methodology

16.3.1 Study area

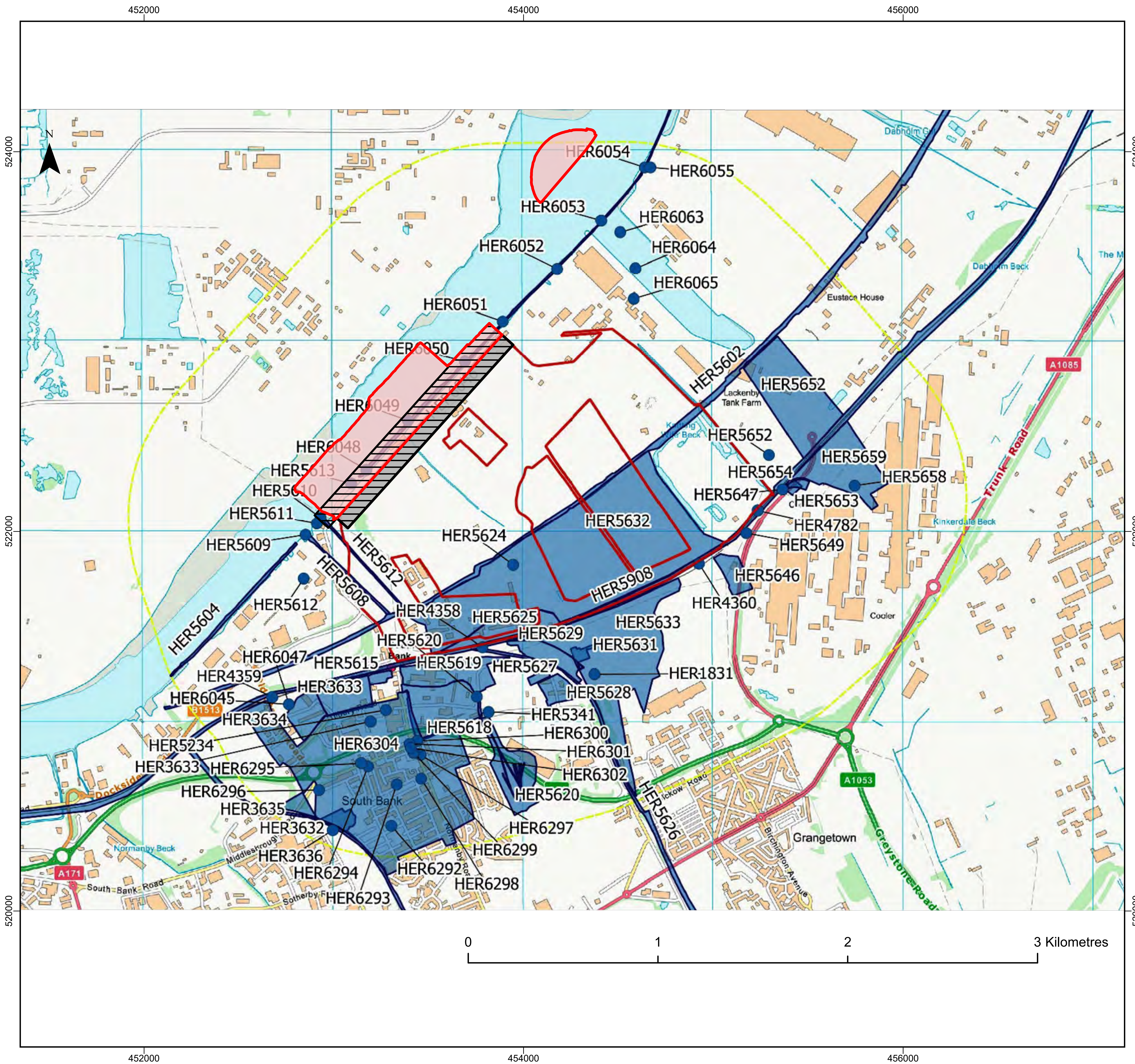
The study area for the purposes of the assessment presented below comprises the footprint of the elements of the proposed scheme (**Figure 1.1**). The study area for archaeological assessment does not include the offshore disposal site as this is an existing, licenced facility. This study area has been extended for the archaeological desk-based assessment as follows:

- For the purposes of data searches, the assessment of existing conditions for the planning application was based on a study area extending 1km from the boundary of the proposed scheme footprint on land, which incorporates the proposed marine and coastal study area (**Figure 16.1**);
- For the settings assessment (see **Section 16.4.4**) designated heritage assets within a 3km boundary of the proposed scheme footprint have been taken into account (**Figure 16.2**); and
- For the assessment of indirect effects associated with potential changes to the hydrodynamic and sedimentary regime (see **Section 6**) the study area comprises all areas of river, adjacent coastline and offshore seabed that potentially could be affected by the proposed scheme, including the dredging and offshore disposal activities (**Figure 6.2**).

16.3.2 Sources of data

The following sources of data have been accessed to inform the assessment:

- Records of designated heritage assets from the National Heritage List for England (NHLE) (https://historicengland.org.uk/listing/the-list/) and including listing data for GIS;
- Desk-based assessment prepared by Prospect Archaeology for the terrestrial elements of the proposed works (Appendix M1 of the Environmental Statement) including data from the Redcar and Cleveland Historic Environment Record (HER) (see **Figure 16.1**);
- National Historic Landscape Characterisation (HLC) open source data for ArcGIS;
- National Historic Seascape Characterisation (HSC) GIS dataset provided by Historic England;



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Redcar & Cleveland HER undesignated heritage assets from South Industrial Zone ES, Vol 3, App M, July 2020

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Undesignated Heritage Assets (Cleveland & Redcar HER)

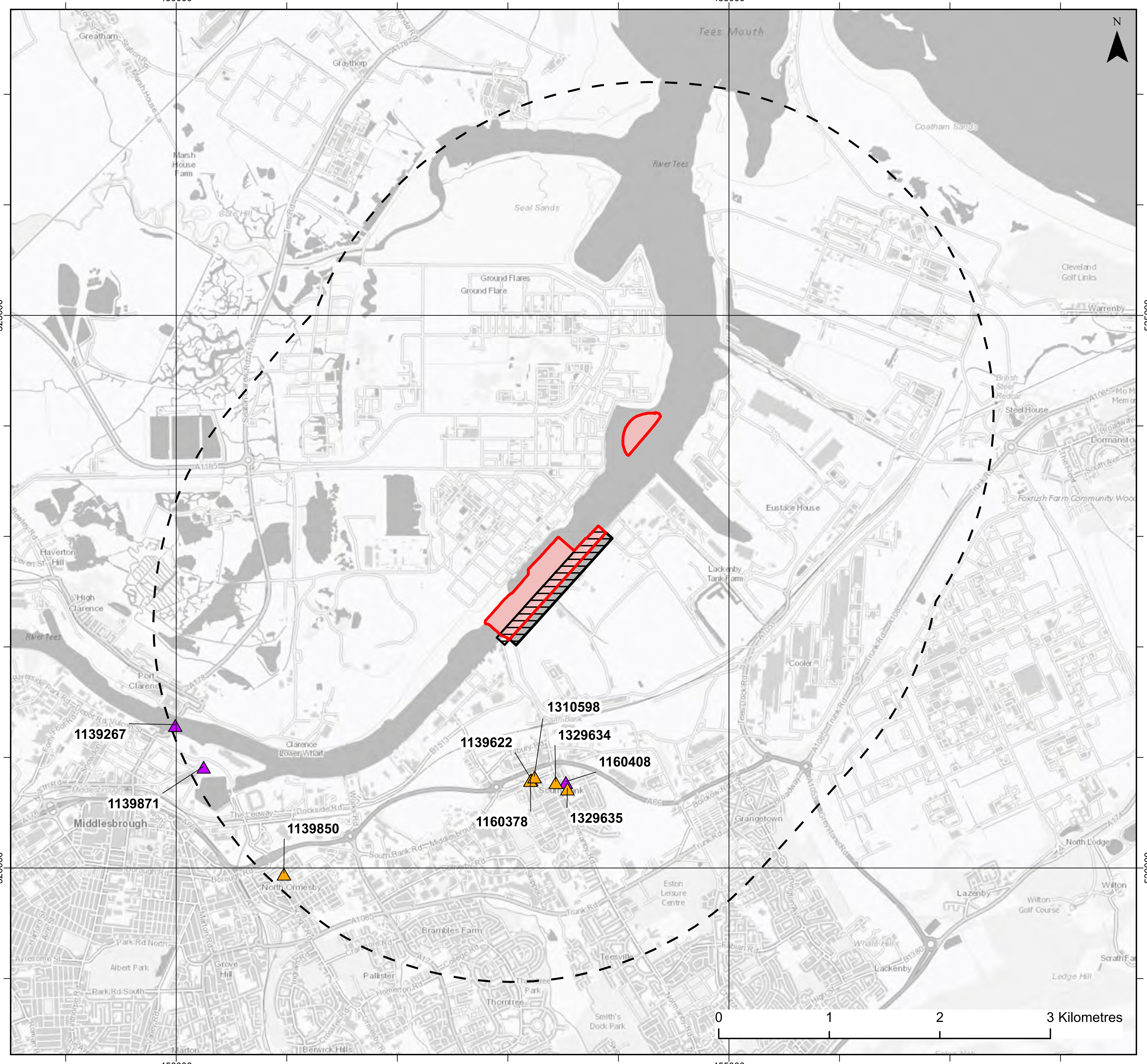
Figure: 16.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	VC	A3	1:20,000

Co-ordinate system: British National Grid

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Royal HaskoningDHV
Enhancing Society Together



Legend

- 3km Search Area
- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Listed Buildings

Grade

- II
- II*

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Designated Heritage Assets

Figure: 16.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	VC	A3	1:35,000

Co-ordinate system: British National Grid

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ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

- The 'Wrecks within UK EEZ' GIS dataset made available by UKHO under Open Government Licence via the Admiralty marine data portal;
- The CITiZAN (Coastal and Intertidal Zone Archaeological Network) coastal map of intertidal heritage (https://www.citizan.org.uk/);
- The North East Rapid Coastal Zone Assessment (NERCZA) (Archaeological Research Services Ltd, 2009) reporting and GIS downloaded from the Archaeology Data Service (ADS) (https://archaeologydataservice.ac.uk/);
- Existing archaeology and heritage baseline information from various development projects and proposals within the South Tees industrial zone including:
  - Cultural heritage desk based assessment for the NGCT (AOC Archaeology Group, 2005);
  - Archaeological assessment for the Anglo American Harbour Facility (Royal HaskoningDHV, 2015)
  - Geoarchaeological assessment for the Anglo American Harbour Facility (Cotswold Archaeology, 2014); and
  - QEII Berth Development ES (Royal Haskoning, 2009).

16.3.3 Impact assessment methodology

The general method for impact assessment is set out in **Section 5**. The specific approach to the assessment of impacts for archaeology and cultural heritage are detailed below.

The impact assessment defines heritage assets, and their settings, likely to be impacted by the proposed scheme and assesses the level of any resulting benefit, harm or loss to their significance. The assessment is not limited to direct (physical) impacts, but also assesses possible indirect (physical) impacts upon heritage assets which may arise as a result of changes to hydrodynamic and sedimentary processes and indirect (non-physical) impacts upon the setting of heritage assets, whether visually, or in the form of noise, dust and vibration, spatial associations and a consideration of historic relationships between places and the historic seascape character.

The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected. However, while impacts to a heritage asset's setting or character can be temporary, impacts which result in damage or destruction of the assets themselves, or their relationship with their wider environment and context, are permanent. Once destroyed an asset cannot recover. On this basis, the assessment of the significance of any identified impact is largely a product of the heritage significance (importance) of an asset (rather than its sensitivity) and the perceived magnitude of the effect on it, assessed and qualified by professional judgement.

Specifically, therefore, the impact assessment will present:

- The heritage significance (importance) of any heritage assets identified as being affected;
- The anticipated magnitude of effect (change) upon those assets and their settings;
- The significance of any identified impacts upon those assets and their settings; and
- The level of any harm (or benefit) and loss of heritage significance (importance).

The criteria for determining the heritage significance of assets is set out in **Table 16.3**.

Table 16.3 Criteria for determining heritage significance

Heritage significance	Definition/example assets
High (perceived International/National Importance)	Assets of acknowledged international/national importance (e.g. World Heritage Sites, Scheduled Monuments, Protected Wreck Sites and currently non-designated assets (including previously unrecorded assets) of the quality and importance to be designated under national and international legislation). Assets that can contribute significantly to acknowledged international/national research objectives.
Medium (perceived Regional Importance)	Assets that contribute to regional research objectives. Assets with regional importance, educational interest or cultural appreciation.
Low (perceived Local Importance)	Assets that contribute to local research objectives. Assets with local importance, educational interest or cultural appreciation. Assets that may be heavily compromised by poor preservation and/or poor contextual associations.
Negligible	Assets with no significant importance or archaeological/historical interest.
Unknown	The importance/existence/level of survival of the asset has not been ascertained (or fully ascertained/understood) from available evidence.

The classification of the magnitude of effect on heritage assets takes account of such factors as:

- The physical scale and nature of the anticipated disturbance; and
- Whether specific features or evidence would be lost which are fundamental to the historic character and integrity of a given asset, including its understanding and appreciation.

The finite nature of archaeological remains means that direct physical impacts (e.g. those arising as a result of intrusive groundworks) are almost always adverse, permanent and irreversible; the ‘fabric’ of the asset and, hence, its potential to inform our historical understanding, will be removed. By contrast, indirect non-physical effects upon the setting of heritage assets will depend upon the scale and longevity of the potential effect. Similarly, indirect physical impacts (e.g. increased burial or exposure of heritage assets arising as a by-product of changes to hydrodynamic and sedimentary regimes resulting from a project) may also depend upon scale and longevity.

The criteria used for assessing the magnitude of effect with regard to archaeology and cultural heritage are presented in **Table 16.4**.

Table 16.4 Criteria for assessing magnitude of effect

Magnitude	Definition
High adverse	Key elements of the asset’s fabric and/or setting are lost or fundamentally altered, such that the asset’s heritage significance is lost or severely compromised.
Medium adverse	Elements of the asset’s fabric and/or setting which contribute to its significance are affected, but to a more limited extent, resulting in an appreciable but partial loss of the asset’s heritage significance.
Low adverse	Elements of the asset’s fabric and/or setting which contribute to its heritage significance are affected, resulting in a slight loss of heritage significance.
Negligible	The asset’s fabric and/or setting is changed in ways which do not materially affect its heritage significance.
Low beneficial	Elements of the asset’s physical fabric which would otherwise be lost, leading to a slight loss of cultural significance, are preserved *in situ*; or Elements of the asset’s setting are improved, slightly enhancing its cultural significance; or

Magnitude	Definition
	Research and recording leads to a slight enhancement to the archaeological or historical interest of the asset. This only applies *in situ*ations where the asset would not be otherwise harmed i.e. it is not recording in advance of loss.
Medium beneficial	Elements of the asset's physical fabric which would otherwise be lost, leading to an appreciable but partial loss of cultural significance, are preserved *in situ*; or Elements of the asset's setting are considerably improved, appreciably enhancing its cultural significance; or Research and recording leads to a considerable enhancement to the archaeological or historical interest of the asset. This only applies in situations where the asset would not be otherwise harmed i.e. it is not recording in advance of loss.
High beneficial	Elements of the asset's physical fabric which would otherwise be lost, severely compromising its cultural significance, are preserved *in situ*; or Elements of the asset's setting, which were previously lost or unintelligible, are restored, greatly enhancing its cultural significance.
No Impact	No change to the assets fabric or setting which affects its heritage significance.

The significance of any identified impact, expressed as a product of the heritage significance (importance) of an asset and the perceived magnitude of the effect on it will be determined in accordance with the significance matrix presented in **Table 16.5**. The impact significance categories are divided as shown in **Table 16.6**. The outcome will thereafter be assessed and qualified by expert judgement, expressed as a narrative description of the level of harm and/or benefit to heritage significance of identified assets.

Table 16.5 Impact significance matrix

Heritage Significance	Magnitude of effect			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Table 16.6 Significance of effect definitions

Significance of Effect (level)	Definition
Major	Change in heritage significance, both adverse or beneficial, which are likely to be important considerations at an international, national or regional level because they contribute to achieving national or regional objectives. Effective/acceptable mitigation options may still be possible, to offset and / or reduce residual impacts to satisfactory levels.
Moderate	Change in heritage significance, both adverse and beneficial, which are likely to be important considerations at a local level. Effective / acceptable mitigation options may still be possible, to offset and / or reduce residual impacts to satisfactory levels.
Minor	Change in heritage significance, both adverse or beneficial, which may be raised as local issues but are unlikely to be material considerations in the decision making process. Industry standard mitigation measures may still apply.
Negligible	No material change to heritage significance.
No effect	No change to heritage significance.

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For the purposes of EIA, 'major' and 'moderate' impacts are generally deemed to be significant (in EIA terms). In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant (negligible) impacts as they may contribute to significant impacts cumulatively or through interactions between heritage assets or elements of the historic environment (historic landscape / seascape).

Where uncertainty occurs, a precautionary approach has been taken to ensure that impacts are not under assessed. Where the extent of harm is uncertain, either because an asset is not fully understood (i.e. if further investigation is required to establish the significance of an asset) or the magnitude of the impact is unclear (i.e. because the design is not yet finalised), the precautionary approach is to assume the potential for major (substantial) harm.

16.4 Existing environment

16.4.1 Known heritage assets

The locations of designated heritage assets were mapped against the footprint of the proposed scheme using GIS, which demonstrated the presence of nine Listed Buildings within 3km of the proposed scheme footprint. There are listed in **Table 16.7** and illustrated on **Figure 16.2**.

Table 16.7 Designated heritage assets within the 3km study area

List entry	Name	Location	Grade
1139267	Transporter Bridge	Billingham, Stockton-on-Tees, TS2	II*
1139622	Church of St Peter	Redcar and Cleveland, TS6	II
1139850	Church of the Holy Trinity	Middlesbrough, TS3	II
1139871	Dock clock tower	Middlesbrough, TS2	II*
1160378	War memorial circa 5m south west of Church of St Peter	Redcar and Cleveland, TS6	II
1160408	Baptist church	Redcar and Cleveland, TS6	II*
1310598	1, Milbank Street	Redcar and Cleveland, TS6	II
1329634	War memorial	Redcar and Cleveland, TS6	II
1329635	Church of St John the Evangelist	Redcar and Cleveland, TS6	II

None of these Listed Buildings are within the proposed scheme footprint and the closest to the site are those within South Bank (Redcar and Cleveland, TS6), approximately 1.5km to the south. There are no other types of designated heritage assets (e.g. protected wrecks, scheduled monuments) within the study area.

A search of the Redcar and Cleveland Historic Environment Record (HER) was undertaken by Prospect Archaeology to inform the planning application submitted by Lichfield's for the landside development in June 2020. As the search area also covered the proposed scheme footprint which is the subject of this report, the search has not been repeated. The distribution of the HER records have been **Figure 16.1**. Of these, nine fall within (or in the immediate vicinity of) the proposed scheme footprint. These nine are listed in **Table 16.8**.

Table 16.8 HER Records within the proposed scheme footprint

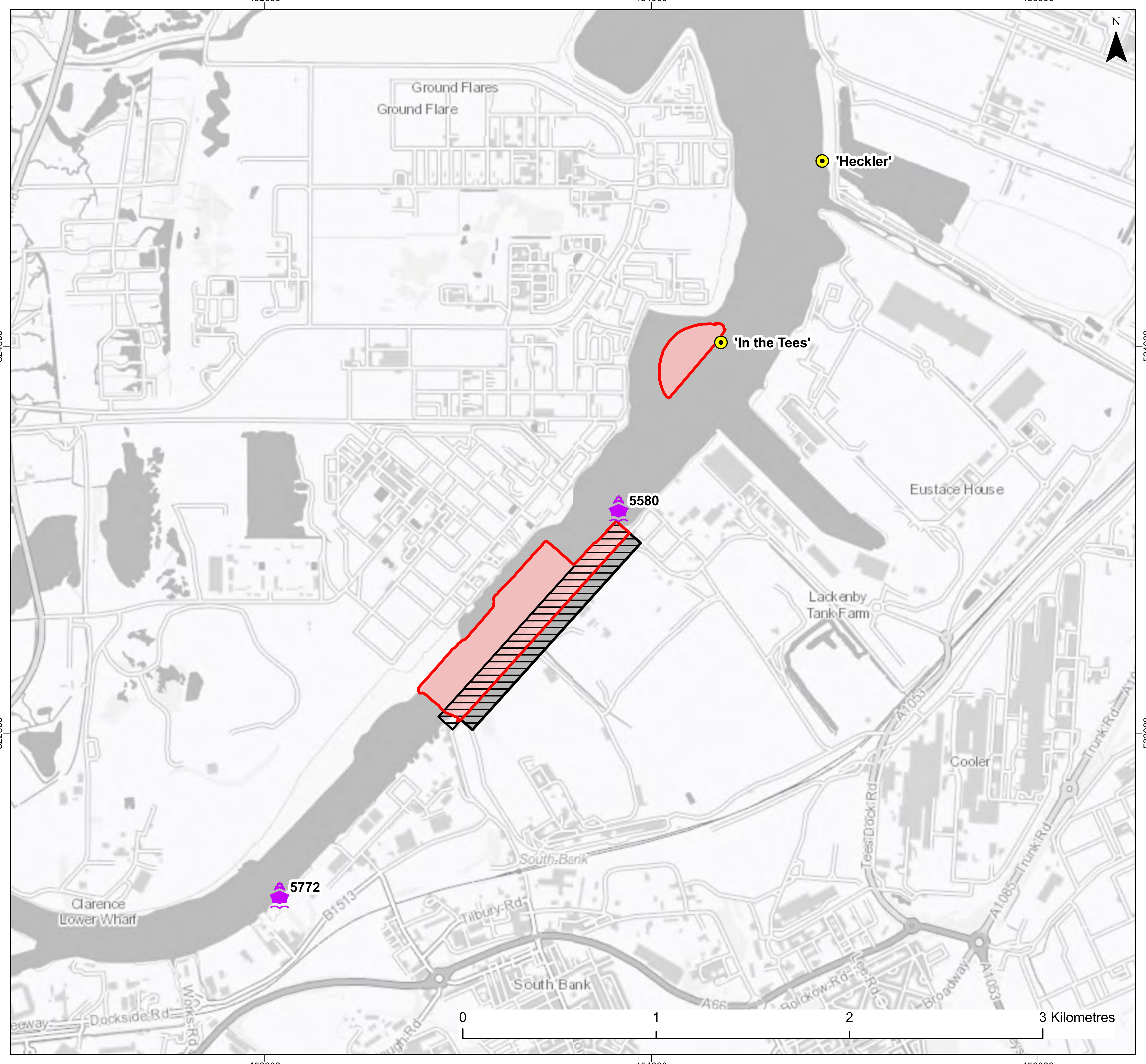
HER no.	Name / description	Date / Period
5610	Eston Wharf	19th century
5611	Custom House	19th century
5612	Eston Jetty	19th century
5613	Mooring Stage	19th century
6046	Reclamation Wall	19th century
6048	Beacon	19th century
6049	Beacon	19th century
6050	Beacon	19th century
6051	Beacon	19th century

The four HER records of Beacons relate to former marker beacons marked on the Ordnance Survey 1st Edition (1857) and do not represent extant heritage assets. Similarly, as discussed by Prospect Archaeology for the landside application, jetties and wharves constructed in the 19th century (including Eston Wharf, Eston Jetty and the Mooring Stage in **Table 16.8**) were all gone by 1915, when reclamation was extended to its current boundary, and do not, therefore, represent extant heritage assets. Similarly, reclamation walls (including HER6046 within the proposed scheme footprint) are marked along the riverbank dating from the 19th century. Assessment undertaken for the QEII Berth (Royal HaskoningDHV, 2009), which overlaps with the current study area, states that, according to the Harbour Master, no existing evidence of these recorded assets remains at the recorded locations (Royal Haskoning, 2009). The Custom House (HER5611), which had been built between Eston Wharf and Clay Wharf, was replaced by a new Custom House further to the North East along the riverbank.

HER data for the northern bank of the River Tees is maintained by Tees Archaeology. The online terrestrial map shows that there are no HER records located on the opposite bank of the river (www.teesarchaeology.com/projects/HER/HER.html) and a formal search of the Tees Archaeology HER was not, therefore, progressed. Similarly a search of the Heritage Gateway online database (www.heritagegateway.org.uk) shows no records from local or national sources on the northern bank of the Tees across the river from the proposed scheme footprint.

The CITiZAN interactive coastal map and the NERCZA GIS (and associated reporting) were also checked for any records of finds or features. No records additional to those reported from the HER were identified.

The 'Wrecks within UK EEZ' GIS data demonstrates the presence of a single wreck, outside but in the vicinity of the proposed scheme footprint (**Figure 16.3**). This wreck is also recorded on the Tees Archaeology HER maritime map (http://www.teesarchaeology.com/maps/marinemap.html). This corresponds to the remains of a Seaplane located WSW of Tees Dock, close to the existing dilapidated South Bank Wharf (which is to be demolished as part of the proposed scheme) in the intertidal zone. During the First World War there was a seaplane station at Seaton Carew (Archaeological Research Services, 2008). The position is, however, reported to be unreliable and no further details are known. This recorded wreck is not, therefore, considered to represent extant, existing remains but is considered as a potential heritage asset, as discussed in **Section 16.4.2** below.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- UKHO Wreck
- NRHE Maritime Record

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Wrecks and Reported Losses

Figure: 16.3

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	VC	A3	1:20,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Although there are no previously recorded, extant non-designated heritage assets within the proposed scheme footprint, the site of the proposed scheme is currently occupied by the dilapidated wharf, three jetties and various buildings and structures on the riverbank. As STDC has prior approval for the demolition of existing infrastructure within the landward part of the proposed scheme footprint (with the exception of an electrical substation and pipework associated with the pumping station), these buildings and structures are not considered further here.

However, the South Bank Wharf itself, first appears on historic Ordnance Survey mapping from 1913 (**Figure 16.4**), presumably associated with the phase of reclamation which extended the dry land to its current boundary. Jetties are first marked in the locations downstream of the wharf in 1927 (**Figure 16.5**). Although these are not recorded by the HER, both the wharf and the jetties should be considered as early 20th century heritage assets of low heritage significance in accordance with the definitions in **Table 16.3** (assets with local importance and compromised by poor preservation).

16.4.2 Potential heritage assets

The anticipated geology of the site comprises made ground overlying superficial Tidal Flat Deposits which in turn overlie the Mercia Mudstone Group. Geoarchaeological assessment of vibrocore and borehole logs undertaken for the Anglo American Harbour Facility to the north of the currently proposed (Cotswold Archaeology, 2014) suggested the presence of five sedimentary units:

- Unit 1 Weathered Bedrock;
- Unit 2 Estuarine alluvium and peat (possible mid-Holocene sediments);
- Unit 3 Marine sediments/ Estuarine alluvium;
- Unit 4 Estuarine alluvium/ polluted fluvial sediments; and
- Unit 5 Made ground (20th century).

The desk-based assessment for the NGCT (AOC, 2005) highlighted that within the Tees estuary the presence of peat and alluvial deposits 'may preserve evidence of early use of the Tees and as such should be subject to further investigation'. Estuaries were often a focus for prehistoric settlement due to the prevalence of natural resources and, in the wider vicinity of the study area, a Neolithic stone axe head is known to have been found during dredging within the river channel and there is a submerged forest is located near Hartlepool on the north bank. Although extensive dredging and reclamation has taken place within the Tees estuary, as highlighted in various previous studies (i.e. AOC Archaeology, 2005), the potential for the presence of prehistoric land surfaces (indicated by for example surviving peat deposits) still remains, preserved beneath later sediments. Given this potential, geoarchaeological assessment of geotechnical vibrocores/boreholes, planned as part of a marine ground investigation to be undertaken in November 2020 will be carried out.

Within the area to be excavated behind the proposed combi-wall there are no previously recorded, extant heritage assets which require further consideration as part of this assessment. As part of the landside planning application submitted by Lichfields in June 2020, it has been recommended that the 20th century Riverside Pumping House and Custom House, which do fall within the proposed scheme footprint, should be recorded using photogrammetric / measured survey techniques (it should be noted that a prior notification application has been submitted to RCBC for the demolition of the pumping station in September 2020). Due to the reclamation of this area in the early 20th century, the potential for buried archaeological remains is limited to former industrial uses of the site post c. 1915 in date. There are no previously recorded military heritage assets within the proposed scheme footprint.

Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Historic Mapping 1913 with South Bank Scheme Boundary

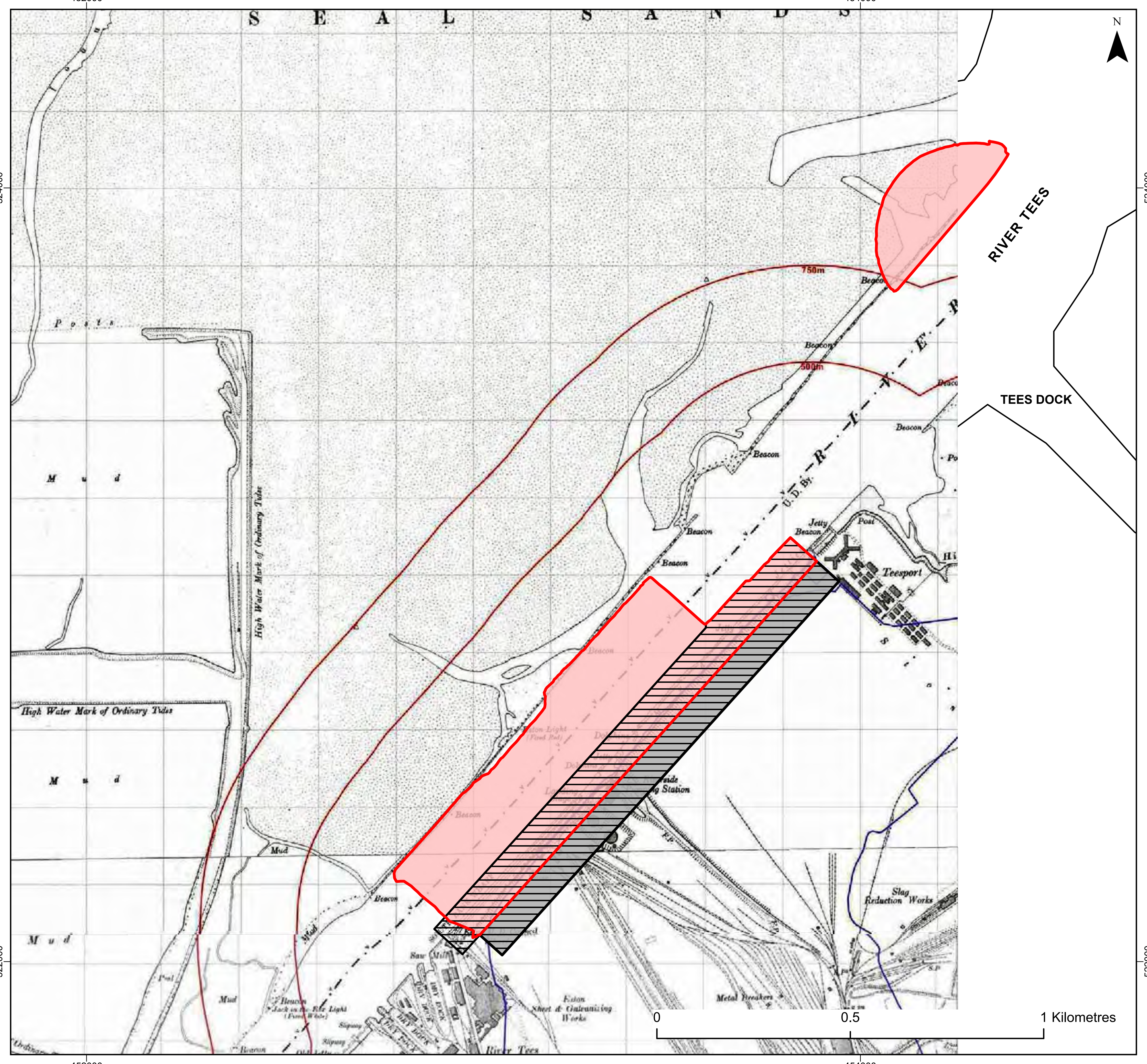
Figure: 16.4

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	VC	A3	1:10,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Historic Mapping 1927
with South Bank Scheme Boundary

Figure: 16.5

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

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Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

With regard to the potential for previously undiscovered wrecks, and wreck related material, to be present within the study area, the assessment undertaken for the Anglo American Harbour Facility (Royal HaskoningDHV, 2014) makes reference to 20 recorded losses of ships and boats recorded by the National Record of the Historic Environment (NRHE) within the River Tees (**Figure 16.4**). These are losses which have been documented historically but for which the remains of the recorded ships and boats have never been found. For example, Heckler (NRHE 908826/HER 3119) was a wherry, a type of boat traditionally used for carrying cargo or passengers within rivers or canals, that sank in River Tees in the fairway in the vicinity of Teesport in 1960. Nineteen further vessels are recorded as lost between 1751 and 1921, arbitrarily grouped by the NRHE at a 'Named Location' just to the north of the entrance to Tees Dock.

These losses are a useful indicator of the high potential for the presence of previous unidentified wreck remains within the River Tees. Furthermore, the use of the estuary as a historic shipping, transport and trade route, and also as a port from at least the medieval period onwards, points to the potential for greater numbers of vessels to have been lost within the Tees, but perhaps not officially reported, and for which surviving wreck material may potentially be present within the footprint of the proposed scheme.

There may also be archaeological remains associated with military activity with both the First and Second World Wars. As mentioned above, during the First World War there was a seaplane station at Seaton Carew (Archaeological Research Services, 2008) and the reported location of a seaplane seen in the intertidal zone is located in the vicinity of the proposed scheme footprint (**Figure 16.3**). Although the reported position is unreliable, and the position, nature and extent of this previously reported seaplane are unclear, remains may be present, possibly buried or fragmented, and potentially within the proposed scheme footprint. Prospect Archaeology also note that the area that went on to become Teesport was used as a submarine base during the First World War, with properties understood to have been used as accommodation and administrative buildings for a Heavy Anti-Aircraft Gun Battery during the Second World War. As a major port and industrial centre, Teesport was a bombing target during the Second World War and a number of military defences including bombing decoy sites were constructed at this time (AOC, 2005).

This potential for buried/submerged archaeological material, however, is significantly reduced by the historic reclamation and disturbance from previous dredging within the channel. Although there is high potential for losses of wrecks and aircraft, for example, there is reduced potential for remains of these vessels to have survived *in situ* within the river channel. However, archaeological material may still survive, albeit fragmentary and dispersed, or potential preserved within intertidal areas along the riverbank, as suggested for the reported Seaplane.

The heritage significance of such remains is unknown, and would be established on a case by case basis if such a discovery should occur. However, such remains could be of high significance, particularly so given that all crashed aircraft in military service are automatically protected under the Protection of Military Remains Act 1986, even if such remains are fragmentary and dispersed.

16.4.3 Historic character

The historic landscape of the South Bank area is one of 19th and 20th century industrial heritage, and industry still defines and dominates the region today.

The study area is covered by both historic landscape and historic seascape character mapping.

The National Historic Landscape Characterisation (HLC) open source data for ArcGIS shows that the dominant HLC types within and in the vicinity of the site are defined as:

- Commerce (Unspecified), Victorian to 21st Century (Mixed commercial and Estuary);

- Manufacturing Industry, Victorian/Post-war to 21st Century (Steel Works, Docks, Chemical Industry and Estuary); and
- Coastal and Intertidal Rough Ground, Victorian/Post-war to 21st century (Estuary, Docks, Steel Works, Chemical Industry and Mixed Commerce).

The National Historic Seascape Characterisation (HSC) GIS dataset shows that the dominant HSC types within and in the vicinity of the proposed scheme footprint are defined as:

- Industrial production, Processing Industry (Teesside Works (Corus), large area of active Steel Industry), Modern (AD1900 – Present);
- Chemical works, Processing industry (large active chemical industry at Tees Mouth), Modern (AD1900 – Present);
- Dockyard, Ports and Docks (area of docks at Teesport), Modern (AD1900 – Present);
- Navigation Route, Navigation Activity (Main commercial shipping routes), Modern (AD1900 – Present);
- Dredged channel/area, Navigation feature (Section of navigable waters), Modern (AD1900 – Present); and
- Wreck hazard, Navigation hazard (Wreck, Aircraft, SEAPLANE), Unknown.
- Additional and previous character types are listed as:
- Fishing Grounds (Medieval (AD1066 – 1540);
- Longlining, Post Medieval (AD1540 – 1750);
- Fishing (Inshore vessels mainly cobbles. Set Netting and lining. Haddock, Whiting, Coalfish, Pollack, Wrasse, and Cod) Early Modern (AD1750 – 1900); and
- Palaeolandscapes, Mesolithic (10,000BC – 4000BC).

The non-technical summary text from the HSC previous character type descriptions (provided with the GIS dataset by Historic England) state that historically, longlining for white fish from cobles was the most common fishing activity in the north east. The character area defined immediately upstream from the proposed scheme footprint describes high potential for the existence and survival of archaeological evidence for Mesolithic human habitation based on documentary research and available models (see **Section 16.4.2** above).

The historic landscape character and seascape character described above show that elements of the proposed scheme (dredging and construction of the new quay) are in keeping with the historic (and current) character of the study area and that both the historic landscape and seascape character of the study area have capacity to accommodate this change in line with the ongoing industrial uses of the wider locality.

16.4.4 Setting

The MMO and RCBC requested that the potential impacts upon the setting of heritage assets be considered as part of the assessment.

The Setting of Heritage Assets Historic Environment Good Practice Advice in Planning 3 (Historic England, 2017) provides guidance on setting and development management, including on assessing the implications of development proposals. The setting of a heritage asset is described as the surroundings in which a heritage asset is experienced and elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral. This industry-standard guidance document recommends a stepped (stage-based) approach for assessing the heritage setting implications of development proposals, as follows:

- Step 1: identify those heritage assets whose setting might be affected;
- Step 2: assess whether, how and to what degree setting makes a positive contribution to the value of those heritage assets;
- Step 3: assess the effect of the proposed development on the significance of those assets as a result of changes to setting;
- Step 4: maximise enhancement and minimise harm; and
- Step 5: make and document decisions and monitor outcomes.

There are nine designated heritage assets within 3km of the proposed scheme footprint which have been examined as part of Step 1 for the purposes of the assessment. Although a site visit was not carried out explicitly for the purposes of the heritage assessment, online mapping and digital imagery and photographs of the site, including the results of the LVIA assessment (**Section 19**) have been used to inform an initial screening exercise for Step 1. The results are detailed in **Table 16.9**.

Table 16.9 Settings assessment Step 1

List entry	Name	Grade	Settings assessment
1160378	War memorial circa 5m south west of Church of St Peter	II	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 9 and 10 (**Section 19**).
1139850	Church of the Holy Trinity	II	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 3, 4 and 5 (**Section 19**)
1329634	War memorial	II	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 9 and 10 (**Section 19**)
1160408	Baptist church	II*	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 9 and 10 (**Section 19**)
1310598	1, Milbank Street	II	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 9 and 10 (**Section 19**)
1329635	Church of St John the Evangelist	II	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 9 and 10 (**Section 19**)
1139267	Transporter Bridge	II*	Heavy lifting cranes and the temporary storage of two sets of full wind turbine towers will be visible and impacts upon the setting of the Transporter Bridge may be discernible, See viewpoint 12 (**Section 19**)
1139622	Church of St Peter	II	No intervisibility due to intervening urban development. Existing traffic (A66) and urban/industrial activities. No impact on setting. See viewpoints 9 and 10 (**Section 19**)
1139871	Dock clock tower	II*	Elements of proposed infrastructure will be indiscernible due to distance from site and existing industrial setting. See viewpoints 3 and 12 (**Section 19**)

Following the completion of Step 1, therefore, only the Transporter Bridge has been taken forward for further consideration under Step 2.

With regard to the positive contribution that setting makes to the heritage value of the Transporter Bridge, the List Entry for 1139267 described the key features of the Bridge as its design in 1911 by G.C. Imbault (Cleveland Bridge and Engineering Co.Ltd.) and construction by Sir William Arrol and Company Limited (Glasgow). The bridge was opened by Prince Arthur of Connaught and built of plated and riveted steel with two pairs of tapering towers on steel and concrete caissons, supported by main cantilevered trusses. The Middlesbrough Council website (https://www.middlesbrough.gov.uk/parking-roads-and-footpaths/tees-transporter-bridge) describes the bridge as, *the area's landmark since opening in 1911. It is the longest working transporter bridge in the world and an iconic symbol of Teesside's engineering and industrial heritage. The Tees Transporter Bridge has played an important role in the area's history for over a century and continues to provide an important and unique crossing over the River Tees.* Following receipt of the Heritage Lottery Fund (HLF) Grant in 2011, the bridge has emerged as a leading historic visitor attraction and is one of the UK's major sites for extreme sports including abseils, bungee jumps and zip-slides. Although a key feature of the visitor attraction since 2011 is a glass lift from which visitors can experience views of the surrounding area, in terms of its heritage value, its landmark position across the River Tees, within the commercial and industrial heritage setting to which its function pertains, forms the primary contribution of its setting to that value.

The effect of the proposed development on the significance of the bridge as a result of changes to setting during construction and operation are assessed below.

16.5 Potential impacts during the construction phase

The dilapidated remains of the early 20th century South Bank Wharf and three jetties will be demolished as part of the proposed scheme. As described in **Section 16.4.1**, these are assessed as being of low heritage significance. However, due to the proposed destruction of these structures, in accordance with the definitions in **Table 16.4**, the magnitude of effect is considered to be high resulting in a **moderate adverse** impact. In order to mitigate this impact, a suitable record of the structures will be prepared prior to demolition, anticipated to comprise a photographic record and drone footage of the wharf and jetties. The suitability of this record will be confirmed in advance of demolition with RCBC and submitted to the RCBC HER. With appropriate mitigation, the residual impact will be reduced to **minor adverse** and not significant in EIA terms.

The removal of the buildings and other infrastructure including the live electrical substation, conveyor at the extreme downstream end the proposed scheme footprint and the pipework associated with the pumping station, which are not considered to be of heritage value in themselves, will result in **no impact**. The grubbing out / excavation / diversion / capping of underground utilities as part of the demolition process prior to construction of the quay will disturb only made ground / reclaimed land, whilst the 20th century riverside pumping station will be recorded in advance of demolition in accordance with mitigation measures agreed through the landside planning application.

Direct (physical) impacts to potential submerged or buried archaeology may occur as a direct result of construction activities including:

- removal of the piles supporting the jetties and wharf and pipework feeding the pumping station;
- capital dredging (to deepen the northern half of the Tees Dock turning circle, a section of the existing approach channel and to create a berth pocket);
- construction of the new quay (to be set back into the riverbank); and

- placement of jack up feet/vessel anchors.

As the significance of potential archaeological remains cannot be known until such remains are encountered, each discovery would need to be considered on a case by case basis. Also, as discussed in **Section 16.4.4** above, the potential for buried/submerged archaeological material is significantly reduced by the historic reclamation and disturbance from previous dredging within the channel.

Buried archaeological remains within the area behind the proposed combi-wall for the proposed new quay are limited to post 1915 industrial uses of the site, although prehistoric deposits may survive beneath reclaimed materials, or within the river channel and intertidal areas. Planned geoarchaeological assessment of geotechnical boreholes and vibrocores will both facilitate current understanding of the nature of sub-surface deposits within the proposed development site, and consequently the potential for previously undiscovered prehistoric remains, and palaeoenvironmental material including potential peat deposits and buried land surfaces, and provide an appropriate record of such deposits and their geoarchaeological potential.

With regard to wreck or aircraft remains within the channel and intertidal areas, although there is limited potential for remains to be present, if such remains are encountered during dredging or during excavations associated with the construction of the proposed new quay and berth pocket, these could be of potentially high heritage significance (as a worst case).

If present, dredging within the turning circle and approach channel and dredging / excavation to create the berth pocket has the potential to have a medium or high magnitude of effect upon these types of remains, potentially resulting in a **moderate or major adverse** impact. As such, it is proposed that an archaeological reporting protocol is adopted to mitigate the potential impact on any as yet unidentified marine archaeological remains arising from construction activities. Ensuring that any new discoveries are quickly and efficiently reported and addressed through the protocol would result in a reduced residual impact, predicted to be of **minor adverse** significance. It is proposed that this protocol would be formalised in a Written Scheme of Investigation (WSI) which would be produced by a suitably qualified marine archaeological specialist.

Indirect physical impacts to heritage assets can occur if the proposed scheme also has the potential to directly and indirectly change the hydrodynamic and sedimentary process regimes, both locally and regionally. Changes in estuarine processes can lead to re-distribution of erosion and accretion patterns, while changes in tidal currents, for example, may affect the stability of nearby morphological and archaeological features. Indirect impacts to heritage assets may occur if buried heritage assets become exposed to marine processes, due to increased wave/tidal action for example, as these will deteriorate faster than those protected by sediment cover. Conversely, if increased sedimentation results in an exposed site becoming buried this may be considered a beneficial impact.

Potential effects upon the hydrodynamic and sedimentary regime are assessed in **Section 6**. With regard to effects during construction it is concluded that, other than within the dredged areas, sediment deposition on the river bed will be of very minor magnitude and that, where this occurs in the river channel or at jetties, it will subsequently be dredged as part of ongoing maintenance dredging regimes, whilst material deposited back into the newly dredged areas will be re-dredged during the capital works in order to achieve the desired design depths. During the demolition of the existing wharf and jetties, the spud legs of the jack-up barge, anchors of the vessels and bow thrusters of the vessels, as well as the pile removal activities themselves, will result in some disturbance to the existing estuary bed, but this will be minor and highly localised and not significant. Furthermore, as the new quay will be built from land, using predominantly land-based plant, with no construction activity in the river, there will be no impacts during construction of the quay on the hydrodynamics and sedimentary regime of the Tees estuary. Consequently, there is no pathway for additional, indirect impacts to heritage assets associated with changes in sediment deposition, over and above the direct impacts associated with the construction of proposed scheme discussed above.

With regard to the setting of the Transporter Bridge during construction, the distance from the proposed scheme means that any noise or dust, for example, or activities associated with construction will be virtually indiscernible over and above existing industrial and navigation activities within this area of the River Tees. Furthermore, any changes to the setting during construction will be temporary and short term. Significant changes to the setting of the Transporter Bridge during construction, therefore, are not anticipated to occur.

16.6 Potential impacts during the operational phase

Any potential direct impacts to archaeology and cultural heritage are expected to occur during the construction phase and no additional direct impacts would occur during operation.

With regard to indirect physical impacts, the principal findings from the numerical hydrodynamic modelling undertaken in **Section 6** are:

- The proposed new quay alignment and capital dredging to deepen the Tees Dock turning circle and approach channel and to create a berth pocket will not significantly affect the existing baseline hydrodynamic conditions. Therefore, there will be **no impact** upon heritage assets.
- Reductions in baseline current speeds may lead to a slight increase in deposition of sediment:
    - in areas adjacent to the north bank opposite the quay, this will help the existing mudflat be sustained in light of sea level rise. This could be considered a **minor beneficial** impact to any buried archaeology within these mudflats (in maintaining ongoing burial rather than erosion and exposure), although there are no existing records of archaeological material from this area of the north bank; and,
    - in the main channel the deposition will require periodic dredging to maintain the design depths which would result in no additional impact over and above that assessed above for construction as impacts are expected to already have occurred during the capital dredge
- There is no measurable change caused by the capital dredging at the Tees Dock turning circle. Therefore, there will be **no impact** upon heritage assets;
- There is no predicted effect on local wind-generated waves at the site since the changes in hydrodynamics are so small and localised. Therefore, there will be **no impact** upon heritage assets;
- There are no estuary scale effects on baseline hydrodynamic conditions. Therefore, there will be **no impact** upon heritage assets;

Potential visual impacts from the proposed scheme are assessed in **Section 19**. Specifically, as requested by the MMO in their consultation response (**Table 16.2**), views of the Grade II* Transporter Bridge have been assessed to determine the likely impact of the crane and other tall features in the proposal. Viewpoint 12 shows the view looking east from the Transporter Bridge viewing area and concludes that the likely magnitude of effect upon views will be low. Although the proposed quayside and associated ground level activity will not be visible, the heavy lifting cranes and temporary storage of two sets of full wind turbine towers will be visible. However, these will be set behind the middle-distance Teesside Bio Mass building that will substantially screen the northernmost crane and quayside components. Whilst the crane towers will appear lower than the biomass building, the steel lattice crane arms will extend higher into the skyline, although these visually 'lighter' structures will appear less prominent. It is concluded, therefore, that given the relative distance to the site and juxtaposition with the Teesside Bio Mass building the proposed scheme will not incur significant adverse visual effects from this location, with proposed features appearing similar in character and visually integrating with existing industrial features.

Most importantly for the assessment of heritage setting, it is concluded for viewpoint 12 that, *the focus of the viewer is the view of the Tees Transporter Bridge and the existing character of those views will not be significantly affected*. Consequently, there will be **no impact** upon the heritage value of the bridge as a result from changes to its setting.

17 NOISE AND VIBRATION

17.1 Introduction

This section of the EIA Report considers the potential airborne noise and vibration impacts of the proposed scheme. Specifically, this section provides an overview of the baseline noise environment, identifies potentially sensitive receptors to noise and vibration and predicts noise levels associated with construction and operational phases of the propoposed scheme at the receptor locations.

The assessment focuses on noise and vibration impacts at human receptors only. Noise predictions at waterbird and seabird receptor locations are outlined in this section; however, their impacts are assessed in **Section 12**. Cumulative noise and vibration impacts are addressed in **Section 27**.

17.2 Policy and consultation

17.2.1 Policy

Environmental Protection Act 1990

Section 79 of the Environmental Protection Act 1990 ('the EPA 1990') defines statutory nuisance with regard to noise and determines that local planning authorities have a duty to detect such nuisances in their area.

The EPA 1990 also defines the concept of 'Best Practicable Means' (BPM) as:

- *"'Practicable" means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;*
- *The means to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures;*
- *The test is to apply only so far as compatible with any duty imposed by law; and,*
- *The test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances."*

Section 80 of the EPA 1990 provides local planning authorities with powers to serve an abatement notice requiring the abatement of a nuisance or requiring works to be executed to prevent their occurrence.

The Control of Pollution Act 1974

Section 60 of the Control of Pollution Act 1974 provides powers to local planning authority officers to serve an abatement notice in respect of noise nuisance from construction works.

Section 61 provides a method by which a contractor can apply for 'prior consent' for construction activities before commencement of works. The 'prior consent' is agreed between the local planning authority and the contractor and may contain a range of agreed working conditions, noise limits and control measures designed to minimise or prevent the occurrence of noise nuisance from construction activities. Application for a 'prior consent' is a commonly used control measure in respect of potential noise impacts from major construction works.

National Planning Policy Framework 2019

The National planning Policy Framnework (NPPF) was introduced in March 2012 replacing the former Planning Policy Guidance 24: Planning and Noise. It was revised in July 2018 and again in February 2019.

This document now forms the basis of the Government's planning policies for England and how these should be applied.

Paragraph 170 of the NPPF states planning policies and decisions should contribute to and enhance the natural and local environment by:

"……preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution……"

Furthermore, Paragraph 180 of the NPPF states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation."

The NPPF also refers to the Noise Policy Statement for England (NPSE) (Defra, 2010).

National Planning Practice Guidance for Noise

The National Planning Practice Guidance for Noise (NPPG Noise, December 2014), issued under the NPPF, states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or making decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

Noise Policy Statement for England 2010

The Noise Policy Statement for England (NPSE) was published by Defra in 2010 and paragraph 1.7 states three policy aims:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life."*

The first two points require that significant adverse impacts should not occur and that, where a noise level falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect:

"…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur." (Paragraph 2.24, NPSE, March 2010).

Section 2.20 of the NPSE introduces key phrases including 'significant adverse' and 'adverse' and two established concepts from toxicology that are being applied to noise impacts:

"NOEL – No Observed Effect Level; this is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise; and,

"LOAEL – Lowest Observed Adverse Effect Level; this is the level above which adverse effects on health and quality of life can be detected".

Paragraph 2.21 of the NPSE extends the concepts described above and leads to a significant observed adverse effect level (SOAEL), which is defined as the level above which significant effects on health and quality of life occur. The NPSE states:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations". (Paragraph 2.22, NPSE, March 2010).

Furthermore, paragraph 2.22 of the NPSE acknowledges that:

"Further research is required to increase understanding of what may constitute a significant adverse effect on health and quality of life from noise".

However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

17.2.2 Guidance

The guidance outlined in **Table 17.1** has been applied to the noise and vibration assessment.

Table 17.1 Relevant noise and vibration guidance

Document	Policy / guidance purpose
BS 5228-1:2009+A1:2014 (BS 5228-1) Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise	Part 1 provides recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels. The legislative background to noise and vibration control is described and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and Local Planning Authorities. This British Standard provides guidance on methods of predicting and measuring noise and assessing its impact on those exposed to it.
BS 7445-1:2003 (BS 7745-1) and BS 7445-2:1991 (BS 7445-2) – Description and Measurement of Environmental Noise	Provides details of the instrumentation and measurement techniques to be used when assessing environmental noise and defines the basic noise quantity as the continuous A-weighted sound pressure level (L_{Aeq}). BS 7445-2 replicates International Standards Organisation (ISO) 1996-2:1987.

Document	Policy / guidance purpose
Calculation of Road Traffic Noise (CRTN) 1988	Provides a method for assessing noise from road traffic in the UK and a method of calculating noise levels from the Annual Average Weekday Traffic (AAWT) flows and from measured noise levels. Since publication in 1988 this document has been the nationally accepted standard in predicting noise levels from road traffic. The calculation methods provided include correction factors to take account of variables affecting the creation and propagation of road traffic noise, accounting for the percentage of heavy goods vehicles (HGV), different road surfacing, inclination, screening by barriers and relative height of source and receiver.
Design Manual for Roads and Bridges (DMRB), 2020	LA111 Noise and Vibration, Revision 2 (formerly HD 213/11, IAN 185/15) provides guidance on the environmental assessment of noise impacts from road schemes. DMRB contains advice and information on transport-related noise and vibration, which has relevance regarding the construction and operational traffic impacts affecting sensitive receptors adjacent to road networks. It also provides guideline significance criteria for assessing traffic related noise impacts.
ISO 9613-2:1996 (ISO 9613-2)	Specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a noise source.
WHO Guidelines for Community Noise, 1999 (WHO 1999)	These guidelines present health-based noise limits intended to protect the population from exposure to excess noise. They present guideline limit values at which the likelihood of particular effects, such as sleep disturbance or annoyance, may increase. The guideline values are 50 or 55dB L_{Aeq} during the day, related to annoyance, and 45dB LAeq or 60dB L_{Amax} at night, related to sleep disturbance.
WHO Night Noise Guidelines for Europe, 2009 (WHO 2009)	An extension to the WHO Guidelines for Community Noise (1999). It concludes that: "Considering the scientific evidence on the thresholds of night noise exposure indicated by L_{night} outside as defined in the Environmental Noise Directive (2002148/EC), an Lnight outside of 40dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. L_{night} outside value of 55dB is recommended as an interim target for those countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach."
WHO Environmental Noise Guidelines for the European Region, 2018 (WHO 2018)	The guidance states: “The main purpose of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway and aircraft) noise, wind turbine noise and leisure noise. They provide robust public health advice underpinned by evidence, which is essential to drive policy action that will protect communities from the adverse effects of noise.”

17.2.3 Consultation

Consulation with regards to noise and vibration has been undertaken with RCBC, the MMO and Natural England. Noise Sensitive Receptor (NSR) locations and the methodology for the impact assessment were agreed with the following elements of the proposed scheme to be considered: road traffic noise associated with the construction phase; on-site construction noise at offices and other noise sensitive areas within the nearby industrial and business park (South Tees Business Parks); on-site construction noise at the identified waterbird and seabird receptor sites; and operational phase noise at the identified waterbird and seabird sites.

It has been agreed with the Environmental Health Officer (EHO) at RCBC that the following elements are not considered necessary within the assessment due to the seperation distance between the proposed scheme and potential sensitive receptors: vibration impacts, as well as construction and operational phase noise impacts at residential dwellings (**Appendix 3)**. In addition, it was agreed with the EHO that the assessment of operational phase noise impacts at commercial premesis is not necessary (see **Appendix 3**).

During the operational phase, the proposed scheme would generate approximately 20 vehicle movements per day; therefore, road traffic noise associated with the operational phase are deemed **not significant** and have not been considered further in the asessment.

17.3 Methodology

17.3.1 Study area

The study area for this section of the EIA Report is the area that has the potential to be directly and/or indirectly affected by noise associated with the proposed scheme during construction and operational phases. The study area comprises of noise sensitive receptors within South Tees Business Parks and the local road network affected by construction traffic.

17.3.2 Existing environment

Consideration of the existing noise environment was initially conducted by undertaking a desk-based study of existing available geographical information (including aerial and satellite photography and mapping data) in order to determine the nearest NSRs and noise sources present within the noise and vibration study area.

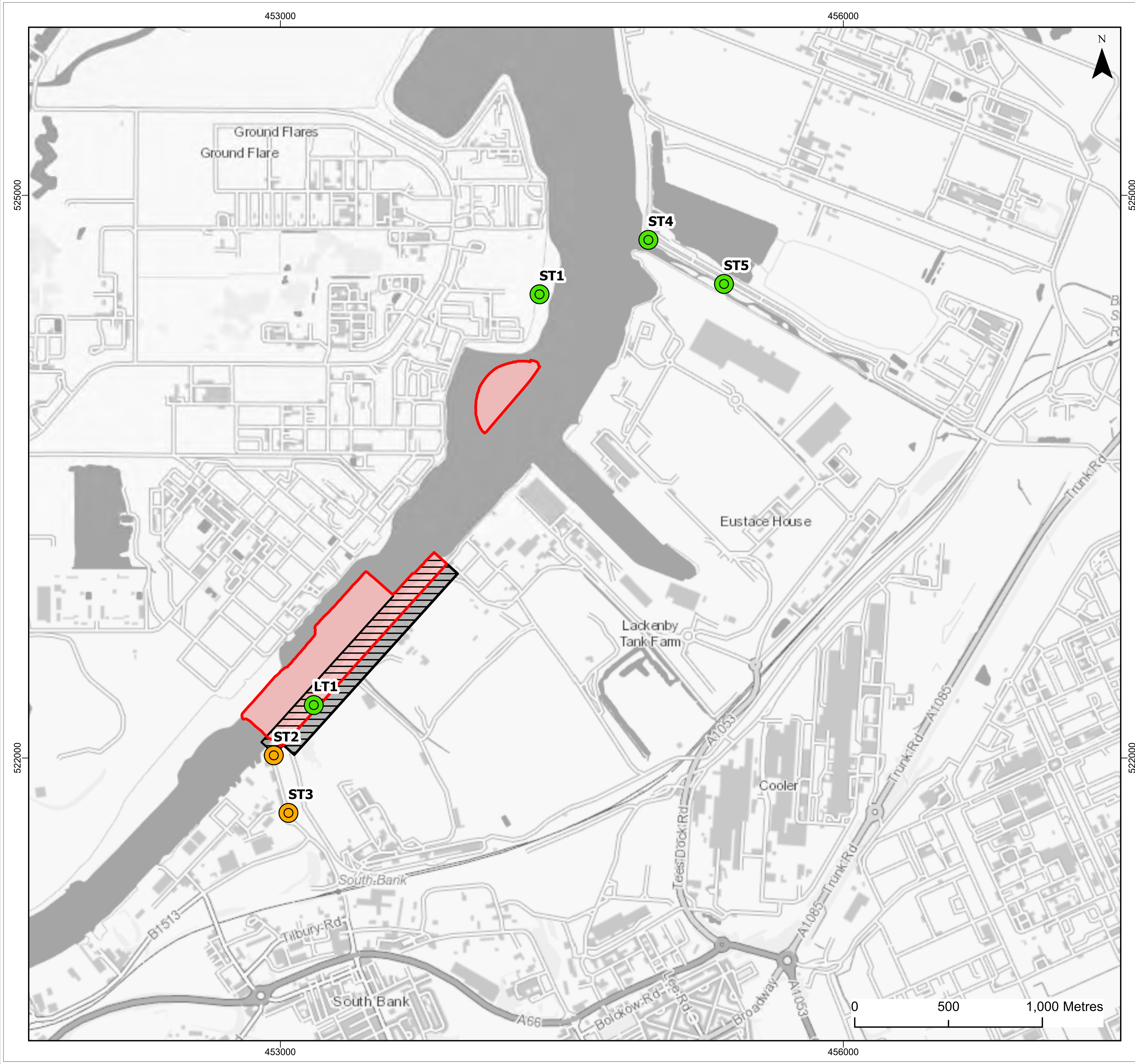
From the desk-based study and consultation with RCBC and Natural England, the NSR locations outlined in **Table 17.2** were identified.

Table 17.2 Noise sensitive receptor locations

Receptor ID	Description
NSR1	Offices and other noise sensitive areas within South Tees Business Parks
ECO1	Waterbird and seabird site at North Tees Mudflat
ECO2	Waterbird and seabird site at Vopak foreshore
ECO3	Waterbird and seabird site at Dabholme Gut

A baseline noise survey was undertaken between 10th and 11th September 2020 to determine the existing noise environment at the site and the surrounding area. Measurements of the ambient noise level were taken both on-site and at off-site locations that were representative of nearby NSRs that had the potential to be affected by the construction and operation of the proposed scheme. The nearest potential noise sensitive area within South Tees Business Parks was taken into account, on the premise that receptors further from the site will experience lower noise effects due to the increased separation distance.

Baseline noise survey monitoring locations are detailed in **Table 17.3** and displayed in **Figure 17.1**.



Legend

Proposed Dredge and Excavation Envelope (including side slopes)

Proposed Quay Envelope

Proposed Demolition Area

Noise Monitoring Locations

Receptor type

Ecological

Human

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Baseline Noise Survey Locations

Figure: 17.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	SC	A3	1:20,000

Co-ordinate system: British National Grid

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

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Table 17.3 Baseline noise survey locations

Measurement location	X	Y	Description	Dominant noise sources
LT1	453178	522282	Long term monitoring location at the proposed scheme footprint. Representative of receptor ECO1.	Noise from nearby industrial sites on both sides of the River Tees.
ST1	454381	524472	Short term monitoring at Vopak foreshore, representative of noise receptor ECO2.	Noise from wildlife and tidal movements. Noise from mechanical plant associated with nearby industrial premises audible and constant.
ST2	452965	522014	Short term monitoring at South Tees Business Parks / Teesport Commerce Park (Smith's Dock Road) representative of noise receptor NSR1.	Noise from adjacent industrial premises dominant. Impulsive noise from crane and material movements highly perceptible.
ST3	453043	521707	Short term monitoring at South Tees Business Parks / Teesport Commerce Park (Smith's Dock Road) representative of noise receptor NSR1.	Noise from adjacent industrial premises dominant. Impulsive noise from crane and material movements highly perceptible. Noise from safety alarms and mechanical plant also clearly audible.
ST4	454961	524762	Short term monitoring at the confluence of Dabholme Gut, representative of noise receptor ECO3.	Noise from mechanical plant associated with the nearby tunnel head house dominant. Impulsive noise from other nearby industrial just perceptible.
ST5	455364	524527	Short term monitoring at the centre of Dabholme Gut, representative of noise receptor ECO3.	Noise from nearby industrial premises dominant; specifically, noise from safety alarms, movement of materials/goods. Noise from wildlife also perceptible.

Sound Level Meters (SLM) were fully calibrated, traceable to UKAS standards and satisfied the requirements of BS EN 61672-1:20131F for a 'Class 1' SLM. The measurements were taken using a SLM and associated equipment detailed in **Table 17.4**.

Table 17.4 Noise survey instrumentation

Instrument	Type	Serial number	Calibration due date at time of survey
Sound Level Meter	Rion NL-52	00864982	2 November 2020
Preamp	Rion NH-25	65109	2 November 2020
Microphone	Rion UC-59	09912	2 November 2020
Sound Level Meter	Rion NL-52	00864983	30 October 2020
Preamp	Rion NH-25	65110	30 October 2020
Microphone	Rion UC-59	13790	30 October 2020
Calibrator	Rion NC-75	01020506	21 January 2021

Baseline survey measurements were conducted in accordance with the procedure described in BS 7445 parts 1 & 2, with the SLMs mounted on tripods at a height of between 1.2m and 1.5m above ground level and 3.5m away from any reflecting surface other than the ground, i.e. in free-field conditions. The instruments were calibrated before and after the survey using a portable calibrator with no significant drift noted.

For all measurement locations during the noise survey, SLMs were set to record the following:

- L_{Aeq} – the equivalent continuous sound pressure level over the measurement period. This parameter was standardised as pertinent for land use within BS 7445;
- L_{Amax} – the maximum sound pressure level occurring within the defined measurement period;
- L_{A90} – the sound pressure level exceeded for 90% of the measurement period and is indicative of the background noise level; and,
- L_{A10} - the sound pressure level exceeded for 10% of the measurement period. The L_{A10} index is used within the CRTN as an appropriate descriptor of traffic noise.

A weather station was employed to record of the meteorological conditions during the survey. All noise monitoring periods during adverse weather conditions (i.e. precipitation or when average wind speeds exceed 5 m/s) have been removed and are not considered within the baseline noise survey results; as per the guidance within BS 7445.

17.3.3 Noise propogation calculations

Construction road traffic noise

In order to assess the noise impact of increased traffic flows along the local road network, Basic Noise Level (BNL) calculations were undertaken in accordance with CRTN using the 18-hour AAWT traffic flows. BNL calculations, outlined in CRTN Charts 3 applying HGV percentage corrections from Chart 4, were conducted for baseline, and construction phase traffic flows. The calculation uses the 18-hour AAWT traffic flows, HGV percentage and average vehicle speed to calculate the $L_{A10,18hour}$ at a reference distance of 10m from the nearest carriageway.

On-site construction and operational phase noise

To predict the noise from on-site plant to be used for the proposed scheme, the assessments utilised SoundPLAN noise modelling software. The software implements accepted national and international acoustic calculation standards.

Predicted noise levels at waterbird and seabird sites were undertaken in accordance with ISO 9613-2 for both construction and operational phases; accounting for spherical propagation, air absorption and acoustic screening due to the intervening buildings and structures between the receptor points and the on-site noise sources.

Predicted noise levels for on-site construction noise at human receptor locations were undertaken in accordance with the methodology described in BS 5228-1. On-site operational levels at human receptors were undertaken in accordance with ISO 9613-2.

A three-dimensional model was created using geo-referenced OS mapping data, topographical data of the local area incorporating buildings, plans and elevations of the site. All identified receptor points within the noise model were positioned at heights of 1.5m above the local ground level; keeping consistency with the measured baseline noise levels. Ground surfaces within the study area are generally considered ‘hard’ such as paved areas and waterbodies; therefore, an assumed ground factor of 0.0 was employed.

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17.3.4 Impact assessment methodology

Receptor sensitivity

Definitions relating to the sensitivity of receptors considered within the noise assessment are presented in **Table 17.5**.

Table 17.5 Sensitivity level for noise receptors

Sensitivity	Definition	Examples
High	Receptor has very limited tolerance of effect.	Noise receptors have been categorised as high sensitivity where noise may be detrimental to vulnerable receptors. Such receptors include certain hospital wards (e.g. operating theatres or high dependency units) or care homes at night.
Medium	Receptor has limited tolerance of effect	Noise receptors have been categorised as medium sensitivity where noise may cause disturbance and a level of protection is required but a level of tolerance is expected. Such subgroups include residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, (during the day); and temporary holiday accommodation at all times.
Low	Receptor generally tolerant of effect.	Noise receptors have been categorised as low sensitivity where noise may cause short duration effects in a recreational setting although particularly high noise levels may cause a moderate effect. Such subgroups include offices, shops, outdoor amenity areas, long distance footpaths, doctor's surgeries, sports facilities and places of worship.

Magnitude of effect - construction road traffic noise

Increases in road traffic associated with the proposed scheme are determined by assessing the change in BNL. Impact magnitude criteria for construction traffic, as detailed in Table 3.17 of the DMRB, are displayed in **Table 17.6**. For clarity, an additional magnitude of effect criterion of **no impact** is introduced to represent no change in the predicted BNL.

Table 17.6 Construction road traffic noise magnitude of effect

Magnitude of effect	Increase in BNL of closest public road used for construction traffic (dB)
Major / high - very high	> 5.0
Moderate / medium	3.0 - 4.9
Minor / low	1.0 - 2.9
Negligible / very low	< 1.0
No change / no impact	0.0

It is believed that there are residential dwellings along several of the identified road links; therefore, a **medium** receptor sensitivity, as defined in **Table 17.5**, is assumed for the construction road traffic noise assessment.

Magnitude of effect - on-site construction noise

BS 5228-1 describes several methods for assessing noise impacts during construction projects. The assessment approach utilised in this assessment defines fixed noise thresholds for human receptors within the nearby business parks based on the example criteria provided in BS 5228-1.

The "5 dBA change" method, described in BS 5228-1 E3.3, specifies a construction noise limit based on the existing ambient noise level and for different periods of the day with respect to the pre-construction ambient noise level. The guidance states:

"Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively"

Therefore, daytime construction noise levels below the lower cut-off value, 65 dB $L_{Aeq.T}$, are considered **very low** magnitude at human NSRs within the nearby business park.

The "fixed noise limit" method, described in BS 5228-2 E.2, is derived from the Wilson Committee report where it is stated:

"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. The noise can be measured with a simple sound level meter, as we hear it, in A-weighted decibels (dB(A))– see note below. Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- *70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas.*

These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments."

Daytime construction noise levels greater than 75 dBA at human NSRs within the nearby business park are therefore considered **very high** magnitude.

Guideline values in specific environments are outlined in WHO Guidelines for community noise (WHO 1999) with potential effects within industrial areas occurring at 70 dBA. A value of greater than 70 dBA is therefore considered **high** impact magnitude.

Receptors within the business park are only considered noise-sensitive during "typical" daytime office hours; between 07:00 and 19:00 hrs.

Construction phase noise impacts were assessed using the derived impact magnitude presented in **Table 17.7** for the daytime period.

Table 17.7 Daytime construction noise magnitude of effect

Magnitude of effect	Construction noise level, decibels (dB) ($L_{Aeq,T}$)
Very low	≤65
Low	>65 - <68
Medium	>68 - ≤70
High	>70 - ≤75
Very high	≥75

Human noise sensitive receptors for the on-site construction noise assessment are offices and other noise sensitive areas within the nearby business park; therefore, **low** receptor sensitivity is assumed in the subsequent assessment, as defined in **Table 17.5**.

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17.4 Existing environment

Results from the baseline noise survey undertaken between 10th and 11th September 2020 are displayed in **Table 17.8**.

Table 17.9 Baseline noise survey results, dB

Measurement Location	Start Date and Time	Duration (hh:mm:ss)	$L_{Aeq,T}$	L_{AFmax}	L_{A10}*	L_{A90}*
LT1	10/09/20 11:09:00	11:51:00	49.3	74.6	49.2	45.8
LT1	10/09/20 23:00:00	03:36:00**	44.1	60.9	44.9	42.4
ST1	10/09/20 12:43:01	00:33:04	44.3	57.7	44.3	42.9
ST2	10/09/20 14:02:52	00:08:12	51.3	63.0	51.8	50.3
ST2	10/09/20 14:42:02	00:15:06	52.5	70.2	52.4	51.2
ST3	10/09/20 14:15:14	00:15:31	50.2	64.8	50.5	48.2
ST3	10/09/20 14:59:15	00:16:02	49.1	63.7	49.4	48.2
ST4	11/09/20 09:57:18	00:16:05	63.3	65.9	63.9	62.8
ST5	11/09/20 10:21:51	00:18:13	49.9	65.8	50.5	49.0

** Displayed as the as the arithmetic mean of the results during the reference period*
*** Measurements affected by prolonged period of adverse weather conditions*

17.5 Potential impacts during the construction phase

17.5.1 Construction road traffic noise

To inform the road traffic noise assessment, construction traffic data in the form of Annual Average Weekday Traffic (AAWT) flows and percentage Heavy Goods Vehicles (HGVs) on the surrounding road network were used; values are presented in **Table 17.9**.

Table 17.9 18-hour AAWT construction traffic flows

Link	Link description	Average speed (kph)	Baseline traffic flows		Baseline + construction traffic flows	
			18hr AAWT	HGV%	18hr AAWT	HGV%
1	Tees Dock Road	48.3	5,408	30.8	5,649	30.2
2	Old Station Road	48.3	5,612	15.9	5,854	15.9
3	Dockside Road	80.5	6,098	14.3	6,339	14.4
4	A66 (East)	80.5	53,719	7.8	53,896	7.9
5	A66 (West)	80.5	25,062	13.4	25,203	13.5
6	A1053	112.7	25,056	7.8	25,197	7.9

In accordance with the DMRB guidance, the change in predicted BNL along each link were calculated using the methodology outlined in CRTN. The calculation method accounts for HGV percentage and average road speed. Results for predicted construction road traffic impacts are shown in **Table 17.10**.

Table 17.10 Construction road traffic noise impact assessment

Link	Baseline BNL, $L_{A10,18hr}$ (dB)	Baseline + construction BNL, $L_{A10,18hr}$ (dB)	Change BNL (dB)	Magnitude of effect	Impact
1	69.7	69.8	0.1	Very low	Negligible
2	67.8	68.0	0.2	Very low	Negligible
3	70.3	70.5	0.2	Very low	Negligible
4	78.7	78.7	0.0	No Change	No Impact
5	76.3	76.4	0.1	Very low	Negligible
6	78.1	78.1	0.0	No Change	No Impact

Predicted changes in BNL, displayed in **Table 17.10**, indicate impacts of **negligible** significance at worst from the short term, local and reversible construction phase road traffic at the human receptors. This is considered **not significant**.

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

17.5.2 On-site construction noise

To inform the on-site construction noise assessment, an indicative construction programme and construction plant estimate was developed based on previous experience of similar projects within the Tees estuary. The period during the indicative construction programme whereby the greatest number of construction plant and piling rigs has been used in the construction phase noise assessment to assess a wort-case scenario.

The works during this period consist of:

- Demolition of the existing South Bank Wharf;
- Installation of tubular king piles and spigots;
- Installation of infill sheet piles;
- Installation of anchor wall;
- Installation of heavy load area piles;
- Heavy load slab;
- Filling and compaction;
- Installation of pile plugs and cope beam;
- Installation of quay furniture;
- Lighting and ducts;
- Excavation of front wall;
- Dredging; and
- Vessel deliveries

It is understood that construction works are to be undertaken 24 hours a day and therefore this has been included within the model.

Table 17.11 outlies the assumed construction plant that informed the noise predictions. Noise levels associated with construction plant were derived from the values provided in BS 5228-1 and from Royal HaskoningDHV's library from previous projects; maximum sound power level data, L_{WAmax}, for percussive piling activities were also included in the noise predictions. On-times for construction plant were generally assumed to be 60% with 30% on-time for percussive piling activities. Where construction plant is to be shared between two separate working areas, 2 no. noise sources were input into the model with 30% on-time each.

From the construction programme there will be approximately 1 vessel call per day on average during the construction phase to deliver materials to the site. Assuming an unloading time of 3 - 6 hours within a 24-hour period, an on-time of 25% was implemented for the noise predictions.

Table 17.11 Assumed construction plant and equipment list

Activity	Plant	Number of plant	BS 5228 reference	On-time (%)	Sound Power (dB)
Demolition of existing South Bank Wharf	Jack up with crawler crane	1	C4.50	60	98.6
	Slave barge (400t)	1	C7.2	60	110.3
	Safety/workboat	1	C7.2	60	110.3
	Concrete crusher	1	C1.14	60	109.4
	Excavator	1	C5.18	60	108.1
Installation of tubular king piles and spigots	Percussive piling rig	1	C3.2 / RHDHV Library	30	115.3 140.0 L_{WAmax}
	Piling rig power pack	1	C3.5	60	96.8
	Excavator (shared with anchor wall)	1	C5.18	30	108.1
	Dump truck	1	C6.24	60	114.5
	Crane	1	C3.28	60	94.5
Installation of infill sheet piles	Percussive piling rig	1	C3.2 / RHDHV Library	30	115.3 140.0 L_{WAmax}
	Piling rig power pack	1	C3.5	60	96.8
	Crane	1	C3.28	60	94.5
Installation of anchor wall	Percussive piling rig	1	C3.2 / RHDHV Library	30	115.3 140.0 L_{WAmax}
	Piling rig power pack	1	C3.5	60	96.8
	Excavator (shared with tubular king piles and spigots)	1	C5.18	30	108.1
	Dump truck (shared with heavy load area)	1	C6.24	30	114.5
	Crane	1	C3.28	60	94.5
Installation of heavy load area piles	Auger piling rig	1	C3.21	60	107.3
	Concrete pump	1	C3.26	60	102.9

Activity	Plant	Number of plant	BS 5228 reference	On-time (%)	Sound Power (dB)
	Excavator	1	C5.18	30	108.1
	Dump truck (shared with anchor wall)	1	C6.24	30	114.5
Heavy load slab	Excavator (shared with tie rod and pile plug and cope beam)	1	C5.18	30	108.1
Filling and compaction	Excavator	1	C5.18	60	108.1
	Dump Truck	1	C6.24	60	114.5
	Roller	1	C5.20	60	103.0
Installation of pile plugs and cope beam	Excavator (shared with heavy load slab)	1	C5.18	30	108.1
Installation of quay furniture	Crane	1	C3.28	60	94.5
	JCB	1	C4.14	60	94.8
Lighting and ducts	Dump truck	1	C6.24	60	114.5
	JCB	1	C4.14	60	94.8
Excavation of front wall	Excavator	1	C5.18	60	108.1
	Dump truck	1	C6.24	60	114.5
Dredging	THSD/backhoe	1	C7.2	60	110.3
Vessel deliveries	Vessel	1	RHDHV Library	25	103.0

Predicted noise levels at the identified receptors, using the methodologies described in **Section 17.3.3**, are displayed in **Table 17.12**.

Table 17.12 On-site construction noise predictions

Receptor ID	Predicted $L_{Aeq,T}$ (dB)	Predicted L_{AFmax} (dB)
NSR1	52.2 - 59.2	71.8 - 81.0
ECO1	46.8 - 59.5	68.8 - 80.0
ECO2	38.5	56.6
ECO3	35.5 - 36.8	53.1 - 56.4

Table 17.13 demonstrates the predicted impact at human receptors.

Table 17.13 On-site construction phase noise impact assessment

Receptor ID	Predicted $L_{Aeq,T}$ (dB)	Magnitude of effect	Impact
NSR1	52.2 - 59.2	Very low	Negligible

Predicted noise levels displayed in **Table 17.13** with regard to human receptors are below 65 dB; therefore, indicating **negligible** impact at human receptor locations. This is considered **not significant** and impact is deemed short-term, local and reversible.

The predicted noise levels to ecological receptors from construction phase noise are considered in detail in **Section 12**.

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Mitigation measures and residual impact

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

17.6 Potential impacts during the operational phase

Operational phase noise sources associated with the proposed scheme that were considered in within the noise predictions relate to the following activities:

- Movement of materials over the quay via crane;
- Operation of the substation on the quay and use of shore power; and,
- Vessel movements and docking.

Noise predictions were undertaken assuming two cranes operating in the heavy load areas, both operating with an on-time of 100%. Substation and shore power infrastructure are also assumed to operate 100% of the time. Both of these on-times represent a very worst-case scenario and therefore the assessment is precautionary.

It is estimated that there will be approximately 390 vessel calls per year at the proposed quay. The duration that vessels will remain at the port is unknown; therefore, four vessels are assumed to be docked and connected to shore power within the noise model with 100% on-time. It is anticipated that whilst connected to the onshore power, vessels will turn engines off but ancillary operations such as ventilation systems and pumps will still be operating.

Operational phase noise predictions have been undertaken assuming the plant and equipment displayed in **Table 17.13**, below, with assumed sound power levels and operational on-time.

Table 17.13 Assumed operational phase noise sources

Plant	Number of plant	On-time (%)	Sound Power (dB)
Crawler crane	4	100	106.2
Crane winch	2	100	104.2
Material handling	2	100	123.0 L_{WAmax}
Substation	1	100	80.0
Cold ironing transformers	4	100	80.0
Vessels - ancillary operations	4	100	91.0

Predicted operational phase noise levels at the identified receptors, using the methodologies described in **Section 17.3.3**, are displayed in **Table 17.14**.

Table 17.14 Operational phase noise predictions

Receptor ID	Predicted $L_{Aeq,T}$ (dB)	Predicted L_{AFmax} (dB)
NSR1	42.5 - 48.4	52.2 - 61.7
ECO1	36.8 - 49.3	50.0 - 61.9
ECO2	29.5	40.6
ECO3	26.1 - 26.9	37.2 - 38.1

As noted earlier, the assessment of operational phase noise impacts at human receptors was not considered necessary following discussion with RCBC's Environmental Health Officer. However, an assessment has been included for completeness.

WHO 1999 provides a guideline external noise level at industrial and commercial premises of 70 dB $L_{Aeq,T}$ during both daytime and night time reference periods. **Table 17.15** displays the predicted noise level at the eastern boundary of South Tees Business Parks in addition to the logarithmically averaged ambient sound level from the baseline survey, displayed in **Table 17.3**. Cumulative noise levels were calculated by the logarithmic sum of the existing ambient sound level and the predicted noise level associated with the proposed scheme.

Table 17.15 Operational phase noise impact assessment

Receptor ID	Existing ambient sound level $L_{Aeq,T}$ (dB)	Predicted $L_{Aeq,T}$ (dB)	Cumulative noise level $L_{Aeq,T}$ (dB)
NSR1	51.0	48.4	52.9

The predicted cumulative noise level at NSR1 is 17.1 dB below the guideline level provided in WHO 1999; therefore, operational phase noise impacts at South Tees Business Parks are considered **not significant**.

18 AIR QUALITY

This section of the EIA Report provides an overview of baseline air quality within the area, identifies appropriate receptors to air quality impacts and considers the potential for impacts on these receptors as a result of the following:

- construction phase dust and particulate matter emissions;
- construction and operational phase plant exhaust emissions;
- construction and operational phase vessel exhaust emissions; and,
- construction and operational phase road traffic exhaust emissions.

18.1 Policy and consultation

18.1.1 Legislation

European Union (EU) legislation forms the basis for UK air quality policy. The EU Air Quality Framework Directive 96/62/EC on Ambient Air Quality Assessment and Management entered into force in September 1996 (European Parliament, 1996). This was a framework for tackling air quality through setting European-wide air quality limit values in a series of Daughter Directives, prescribing how air quality should be assessed and managed by the Member States. Directive 96/62/EC and the first three Daughter Directives were combined to form the new EU Directive 2008/50/EC (European Parliament, 2008) on Ambient Air Quality and Cleaner Air for Europe, which came into force June 2008.

The 1995 Environment Act (HMSO, 1995) required the preparation of a national Air Quality Strategy (AQS) which set air quality standards and Objectives for specified pollutants. The Act also outlined measures to be taken by local planning authorities in relation to meeting these standards and Objectives (the Local Air Quality Management (LAQM) system).

The UK AQS was originally adopted in 1997 (DoE, 1997) and has been reviewed and updated in order to take account of the evolving EU Legislation, technical and policy developments and the latest information on health effects of air pollution. The strategy was revised and reissued in 2000 as the AQS for England, Scotland, Wales and Northern Ireland (DETR, 2000). This was subsequently amended in 2003 (DETR, 2003) and was last updated in July 2007 (Defra, 2007).

The UK Government published its Clean Air Strategy (CAS) in January 2019 (Defra, 2019a), which reset the focus for the first time since the 2007 Air Quality Strategy revision. The CAS identifies a series of 'new' air quality issues, including biomass combustion, shipping emissions and releases from agricultural activities. There is a recognition that the effects of pollutant deposition on sensitive ecosystems and habitats needs greater focus. The concept of an overall exposure reduction approach is raised, in recognition that numerical standards are not safe dividing lines between a risk and a safe exposure, within a population with a varying age and health profile. The CAS is supplemented by an Industrial Strategy, policy guidance for the ports sector, a developing approach for aviation and by plans for road transport fuels shift to zero emissions by 2040.

The standards and Objectives relevant to the LAQM framework have been prescribed through the Air Quality (England) Regulations (2000) (HMSO, 2000), and the Air Quality (England) (Amendment) Regulations 2002 (HMSO, 2002); the Air Quality Standards Regulations 2010 set out the combined Daughter Directive limit values and interim targets for Member State compliance (HMSO, 2010).

The current air quality standards and Objectives (for the purpose of LAQM) of relevance to this assessment are outlined in **Table 18.1**. Pollutant standards relate to ambient pollutant concentrations in air, set based on medical and scientific evidence of how each pollutant affects human health. Pollutant Objectives however incorporate future dates by which each standard is to be achieved, taking into account economic considerations, practicability and technical feasibility.

Where an air quality Objective is unlikely to be met by the relevant deadline, local authorities must designate those areas as Air Quality Management Areas (AQMAs) and take action, along with others, to work towards meeting the Objectives. Following the designation of an AQMA, local authorities are required to develop an Air Quality Action Plan (AQAP) to work towards meeting the Objectives and improve air quality locally.

Possible exceedances of air quality Objectives are usually assessed in relation to those locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the Objective.

Table 18.1 Air quality strategy Objectives (England) for the purpose of local air quality management

Pollutant	Air Quality Objective		To be achieved by
	Concentration	Measured as*	
Nitrogen dioxide (NO_2)	200µg.m^{-3}	1 hour mean not to be exceeded more than 18 times per year	31/12/2005
	40µg.m^{-3}	Annual mean	31/12/2005
Particles (PM_{10})	50µg.m^{-3}	24-hour mean not to be exceeded more than 35 times per year	31/12/2004
	40µg.m^{-3}	Annual mean	31/12/2004
Particles ($PM_{2.5}$)	25µg.m^{-3}	Annual mean (target)	2020
	15% cut in annual mean (urban background exposure)		2010 - 2020

Note: * how the Objectives are to be measured is set out in the UK Air Quality (England) Regulations (2000)

18.1.2 National planning policy

National Policy Statement for Ports

The NPS for Ports (Department for Transport, 2012) sets out the requirements for air quality assessments of port developments. These are summarised in **Table 18.2**.

Table 18.2 Summary of NPS for Ports requirements with regard to air quality

NPS requirement	NPS reference	Section of EIA report where requirement has been addressed
Where the project is likely to have adverse effects on air quality, the applicant should undertake an assessment of the impacts of the proposed project as part of the Environmental Statement (ES).	Section 5.7.4	**Sections 18.5** and **18.6**

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NPS requirement	NPS reference	Section of EIA report where requirement has been addressed
The ES should describe: • any significant air emissions, their mitigation and any residual effects, distinguishing between the construction and operation stages and taking account of any significant emissions from any road traffic generated by the project; • the predicted absolute emission levels from the proposed project, after mitigation methods have been applied; and • existing air quality levels and the relative change in air quality from existing levels.	Section 5.7.5	Existing air quality levels are detailed in **Section 18.4** Impacts and any required mitigation measures are detailed in **Section 18.5** and **18.6**.
The applicant should assess the potential for insect infestation and emissions of odour, dust, steam, smoke and artificial light to have a detrimental impact on amenity, as part of the Environmental Statement.	Section 5.8.4	Impacts of dust emissions are considered in **Section 18.5.1**
In particular, the assessment provided by the applicant should describe: • the type, quantity and timing of emissions; • aspects of the development which may give rise to emissions; • premises or locations that may be affected by the emissions; • effects of the emission on identified premises or locations; and • measures to be employed in preventing or mitigating the emissions.	Section 5.8.5	The methodology for the assessment is set out in **Section 18.3**. Potential impacts of air emissions are detailed in **Section 18.5** and **18.6**, in addition to required mitigation measures.
The applicant is advised to consult the relevant local planning authority and, where appropriate, the Environment Agency (EA) about the scope and methodology of the assessment.	Section 5.8.6	Consultation was undertaken with the Environmental Protection department at RCBC via email, as discussed in **Section 18.2.4**.

National Planning Policy Framework

The NPPF (MHCLG, 2019a) was updated in February 2019 and refers to the LAQM process by recognising that:

> *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas".*

The NPPF identifies that local planning authorities should maintain consistency within the Local Air Quality Management process and states that:

> *"Planning decisions should ensure that any new development within Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

The requirements of the NPPF were considered within this assessment.

Planning Practice Guidance

The UK Government Planning Practice Guidance (MHCLG, 2019b) provides guidance on how the planning process can take account of the impact new development may have on air quality. The guidance states that air quality may be relevant to a planning application where:

- traffic in the vicinity of the development may be affected by increasing volume or congestion or altering the fleet composition on local roads;
- new point sources of air pollution are to be introduced;
- people may be exposed to existing sources of pollution including dust;
- potentially unacceptable impacts (such as dust) may arise during construction; and
- biodiversity may be affected.

These aspects were considered within this air quality assessment.

18.1.3 Local planning policy

RCBC adopted its Local Plan in May 2018 (RCBC, 2018) which sets out the development strategy across the borough until 2032. A review of the Local Plan identified the following policy of relevance to air quality:

> *"**Policy SD4 General Development Principles***
> *In assessing the suitability of a site or location, development will be permitted where it:*
>
> > *[…]*
> > *b. will not have a significant adverse impact on the amenities of occupiers of existing or proposed nearby land and buildings;*
> > *[…]*
> > *e. avoids locations that would put the environment, or human health or safety, at unacceptable risk;*
> > *[…]*
> > *h. will not result in an adverse effect on the integrity of a Natura 2000 site, either alone or in combination with other plans or projects.*
>
> *All development must be designed to a high standard. Development proposals will be expected to:*
>
> > *[…]*
> > *n. minimise pollution including light and noise and vibration levels to meet or exceed acceptable limits;*
> > *[…]"*

The requirements of this policy were considered within this assessment.

18.1.4 Consultation

Details of the consultation undertaken and the responses received with regard to air quality are detailed in **Table 18.3**.

Table 18.3 Consultation responses

Consultation method	Consultee	Response received	How the response has been addressed
Scoping consultation response to RCBC 12 August 2020	Natural England	Air quality in the UK has improved over recent decades but air pollution remains a significant issue; for example over 97% of sensitive habitat area in England is predicted to exceed the critical loads for ecosystem protection from atmospheric nitrogen deposition (England Biodiversity Strategy, Defra 2011). A priority action in the England Biodiversity Strategy is to reduce air pollution impacts on biodiversity. The planning system plays a key role in determining the location of developments which may give rise to pollution, either directly or from traffic generation, and hence planning decisions can have a significant impact on the quality of air, water and land. The assessment should take account of the risks of air pollution and how these can be managed or reduced. Further information on air pollution impacts and the sensitivity of different habitats/designated sites can be found on the Air Pollution Information System (www.apis.ac.uk). Further information on air pollution modelling and assessment can be found on the Environment Agency website.	A review of sensitive habitats which required consideration in the assessment has been undertaken using the Air Pollution Information System (APIS) website, as discussed in **Section 18.4.4**. The potential for impacts to occur at designated ecological sites is considered in **Section 18.5** and **18.6.**
Scoping consultation response to RCBC received June 2019	RCBC Environmental Protection	Advised that the applicant contact the Environmental Protection department to discuss and agree methodology for air quality and noise and vibration assessments	Consultation was undertaken with the Environmental Protection department at RCBC via email, as discussed in **Section 18.2.4**.
Scoping consultation response to RCBC received August 2020	RCBC Environmental Protection	Raised no objections to the proposals.	
Scoping Opinion 2 August 2019	MMO	The inclusion of an air quality assessment within the EIA was agreed	Comment noted
Consultation on assessment scope and methodology via email	RCBC Environmental Protection	The environmental protection department confirmed that the assessment methodology as set out in this Section is acceptable.	As per the methodology set out in **Section 18.2.**

18.2 Methodology

The assessment methodologies set out in this section were agreed with RCBC's environmental protection department, as detailed in **Table 18.3**. The assessment was undertaken with reference to information from a number of sources, as detailed in **Table 18.4.**

Table 18.4 Key information sources

Data Source	Reference
Centre for Ecology and Hydrology (CEH)	Air Pollution Information System (APIS) http://www.apis.ac.uk
Department for Environment Food and Rural Affairs (Defra)	Local Air Quality Management (LAQM) Technical Guidance TG(16) (Defra, 2018)
Defra's LAQM Support Tools	LAQM 1 km x 1 km grid background pollutant maps (Defra, 2020)
Institute of Air Quality Management (IAQM)	Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2016)
RCBC	2020 Annual Status Report (RCBC, 2020)

18.2.1 Baseline air quality conditions

Monitoring data collected by RCBC were reviewed to establish baseline air quality conditions at receptors. In addition, background pollutant concentrations were obtained from Defra mapping for the 1km x 1km grid squares covering the study area (Defra, 2020) to determine background pollutant concentrations across the site.

18.2.2 Construction phase dust and particulate matter assessment

An assessment of potential impacts associated with the construction phase was undertaken in accordance with IAQM guidance (IAQM, 2016). A summary of the assessment process is provided below:

Construction phase assessment steps:

1) Screen the need for a more detailed assessment;
2) Separately for demolition, earthworks, construction and trackout:
   A. determine potential dust emission magnitude;
   B. determine sensitivity of the area; and
   C. establish the risk of dust impacts.
3) Determine site specific mitigation; and
4) Examine the residual effects to determine whether or not additional mitigation is required.

In assessing the significance of construction dust and particulate matter impacts using the IAQM guidance (IAQM, 2016), the dust emission magnitude is combined with the sensitivity of the area to determine the risk of impacts prior to mitigation. Once appropriate mitigation measures were identified, the significance of construction phase impacts was determined.

It should be noted that trackout is defined as the transport of dust and dirt from the construction site onto the public road network. Full details of the assessment methodology are provided in **Appendix 11**.

18.2.3 Construction phase plant emissions assessment

Defra technical guidance (Defra, 2018) states that emissions from Non-Road Mobile Machinery (NRMM) used on construction sites are unlikely to have a significant impact on local air quality where relevant control and management measures are employed. As such, emissions from NRMM were not considered quantitively in this assessment, and the relevant control measures to be employed are detailed in **Section 18.5.4**.

18.2.4 Construction and operational phase road traffic emissions assessment

The potential impact on local air quality as a result of traffic movements generated by the proposed scheme were screened using the methodology detailed in the latest IAQM and EPUK guidance (IAQM and EPUK, 2017).

The aforementioned guidance document sets out criteria for increases in Light Duty Vehicles (LDV) and Heavy Duty Vehicles (HDV) movements, above which a detailed assessment of air quality impacts may be required. If increases in LDV and HDV movements are below the criteria, there are unlikely to be any significant air quality impacts as a result of the proposed scheme and detailed assessment of air quality is not necessary. The assessment criteria are detailed in **Table 18.5**.

Table 18.5 IAQM and EPUK road traffic assessment criteria

Vehicle type	Criteria
LDV	A change in annual average daily traffic (AADT) of more than 100 within or adjacent to an AQMA or more than 500 elsewhere
HDV	An increase in HGV movements of more than 25 per day within or adjacent to an AQMA, or more than 100 elsewhere

18.2.5 Construction and operational phase vessel emissions assessment

The construction and operational phases of the proposed scheme will generate additional vessel movements. A qualitative assessment of the potential for significant impacts to occur due to increased vessel movements has been undertaken, taking into account the number of vessels generated during construction and operation, the duration that vessels would be used, aspects of the scheme design that would reduce these emissions and the distance to sensitive receptors.

18.2.6 Operational phase plant emissions assessment

Plant used during the operational phase may give rise to increases in air emissions. A qualitative assessment has been undertaken to consider the potential for significant impacts to occur, taking into account the number and types of plant to be used, how the plant would be powered (i.e. diesel or electricity) and the distance to sensitive receptors.

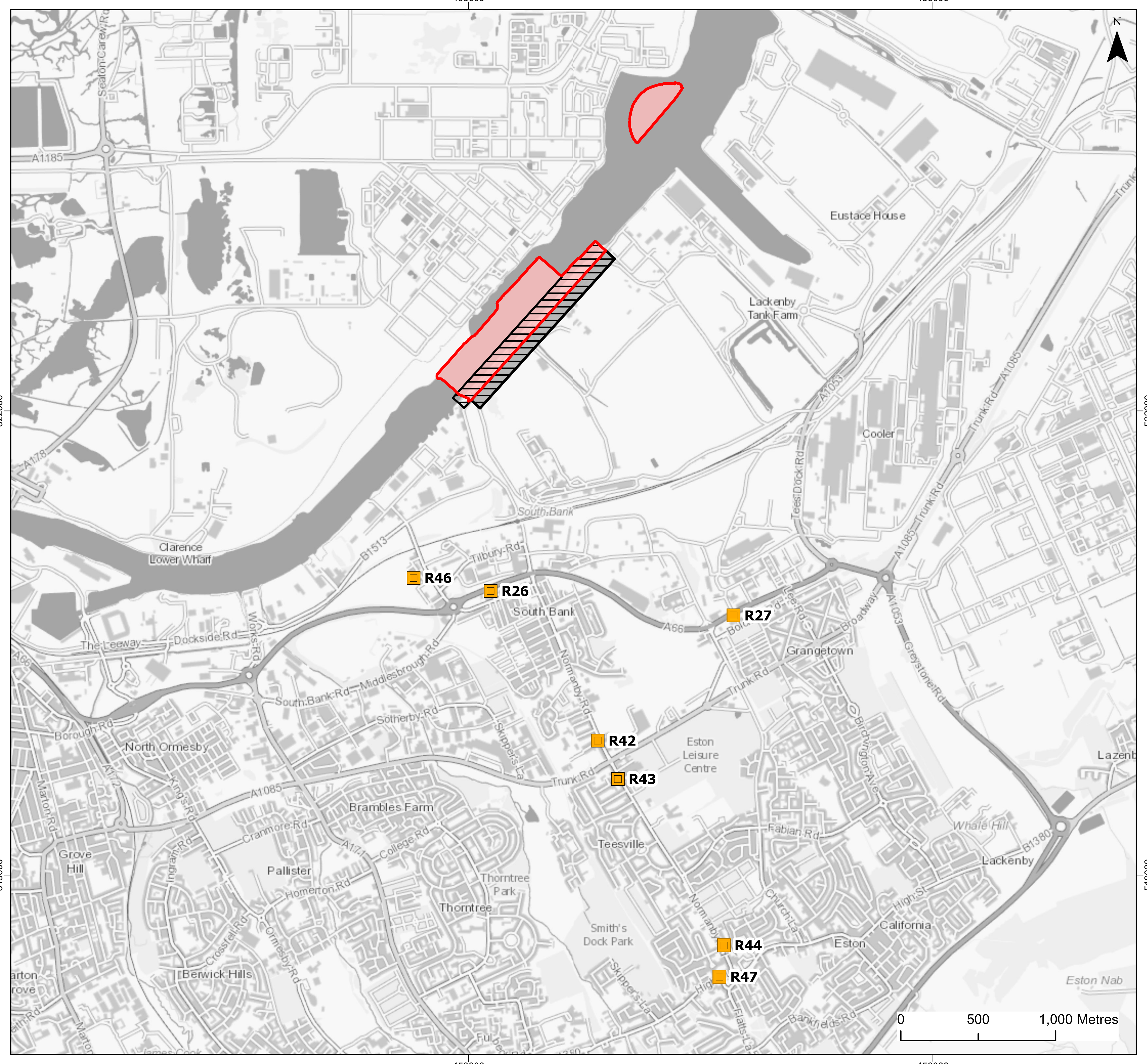
18.3 Existing environment

18.3.1 Local air quality management

The proposed scheme footprint is not located within or in the vicinity of any AQMAs; RCBC has not declared any AQMAs within its area of jurisdiction.

18.3.2 Air quality monitoring

RCBC undertakes monitoring using both automatic and passive methods within the Teesside area. The closest monitoring locations to the proposed scheme are NO_2 diffusion tubes, as shown in **Figure 18.1**. Recent monitoring data were obtained from the latest Annual Status Report published by RCBC (RCBC, 2020) and are reported in **Table 18.6**.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Air Quality Monitoring Locations

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Air Quality Monitoring Locations

Figure: 18.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	CG	A3	1:25,000

Co-ordinate system: British National Grid

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Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Table 18.6 RCBC monitoring data

Site ID	Location	Site type	Annual Mean Concentration (µg.m^{-3})				
			2015	2016	2017	2018	2019
R26	South Bank, Trunk Road	Roadside	21.9	20.5	19.8	24.7	19.5
R27	West Lane, Grangetown	Roadside	30	26.4	25.5	29.8	24.8
R42	Primrose Court	Roadside	-	-	-	16.6	13.9
R43	Normanby Road	Roadside	-	-	-	16.1	15.2
R44	Normanby Road	Roadside	-	-	-	15.7	12.9
R46	Haven Site	Suburban	-	-	-	-	16.1
R47	Whitehouse Café	Roadside	-	-	-	-	20.3

As shown in **Table 18.6**, annual mean concentrations of NO_2 have been below the Objective of 40 µg.m^{-3} over the last five years, indicating that air quality in the area is generally good.

18.3.3 Background pollutant concentrations

The 2020 background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were obtained from the latest 2018-based air pollutant concentration maps provided by Defra for the 11 grid squares covering the proposed scheme footprint. The maximum, minimum and average values are detailed in **Table 18.7**.

Table 18.7 2020 background pollutant concentrations (µg.m^{-3}) obtained for 1km x 1km grid squares covering the scheme boundary

Pollutant	2020 Background Concentration (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$
Maximum	27.36	11.52	7.02
Minimum	12.76	9.88	6.62
Average	17.19	10.31	6.82

Background concentrations of NO_2, $PM_{2.5}$ and PM_{10} within the proposed scheme footprint are 'well below' (i.e. less than 75% of) their respective annual mean air quality Objectives. These mapped background concentrations of NO_2 are generally consistent with those monitored by RCBC (**Table 18.6** above).

18.3.4 Identification of sensitive receptors

The UK's health-based air quality Objectives only apply where there is relevant human exposure; annual mean Objectives apply at locations were members of the public may be regularly exposed, such as residential properties, schools, hospitals and care homes. Short-term averaging periods apply at the aforementioned locations, in addition to hotels, gardens of residential properties, outdoor areas of bus and railway stations, outdoor seating areas and busy shopping streets.

The proposed scheme is located in an industrial area with no residential receptors in the vicinity; the only receptors present are those at places of work at which the public would not have regular access. The closest sensitive residential receptors are located along the A66 in South Bank, approximately 1.1km south of the proposed scheme. Receptors in places of work are, however, sensitive to emissions of dust, and are present within 350m of the proposed construction works.

The River Tees and the area of shoreline at the mouth are designated as the Teesmouth and Cleveland Coast SPA, SSSI and Ramsar site. A review of these designated sites has been undertaken to determine whether there were any habitats sensitive to air pollution effects which required consideration in the assessment.

The proposed scheme is located opposite an area of mudflat (North Tees Mudflat) used by birds and there are other such areas of this habitat within the River Tees. As the mudflats within the estuary are intertidal and, therefore, 'washed' by estuarine waters twice a day, it is considered that these areas would not experience any significant effects as a result of pollutant or dust deposition.

Towards the mouth of the estuary, there are some areas of saltmarsh habitat at Seal Sands and dune habitats are present along the coastline, both of which are reported on the APIS website as sensitive to changes in pollutant concentrations and deposition. These areas are located approximately 1.7km north-west of the closest part of the scheme boundary (the Tees Dock turning circle) and 2.7km north respectively. Across these distances, it is not anticipated that emissions from activities within the proposed scheme footprint during construction or operation would give rise to significant effects in these areas. The habitats present in relation to the proposed scheme are shown in **Figure 18.2**.

The potential for significant impacts to occur as a result of movements of construction and operational phase vessel movements, which would occur closer to the saltmarsh and dune habitats as vessels enter the River Tees, has been considered in the assessment.

18.4 Potential impacts during the construction phase

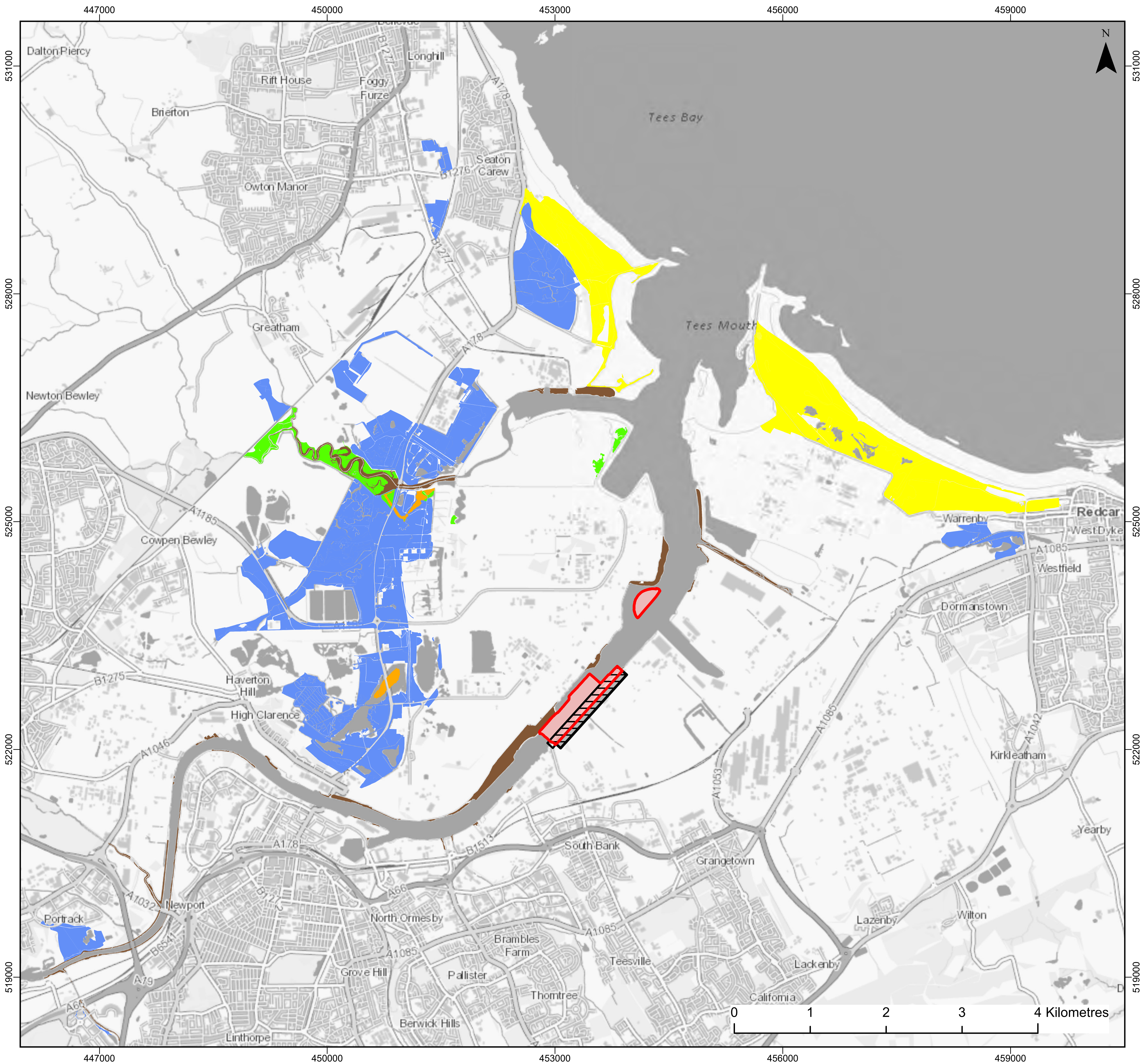
18.4.1 Construction dust and particulate matter assessment

A qualitative assessment of construction phase dust and PM_{10} emissions was carried out in accordance with the IAQM guidance (IAQM, 2016). The methodology for the dust assessment is provided in **Appendix 11**.

The construction works associated with the proposed scheme have the potential to impact on local air quality conditions as follows:

- Dust emissions generated by demolition, excavation, construction and earthwork activities required during the construction phase have the potential to cause nuisance to, and soiling of, sensitive receptors.
- Emissions of exhaust pollutants, especially NO_2 and PM_{10} from construction traffic on the local road network, have the potential to adversely impact local air quality at sensitive receptors situated adjacent to the routes utilised by construction vehicles.
- Emissions of NO_2 and PM_{10} from NRMM operating within the proposed scheme footprint have the potential to adversely impact local air quality at sensitive receptors in close proximity to the works.

The potential for sensitive receptors to be affected will depend on where within the site the dust raising activity takes place, the nature of the activity and controls, and meteorological dispersion conditions.



Legend

Proposed Dredge and Excavation Envelope (including side slopes)

Proposed Quay Envelope

Proposed Demolition Area

Priority Habitat Inventory

- Coastal and floodplain grazing marsh
- Coastal saltmarsh
- Coastal sand dunes
- Mudflats
- Saline lagoons

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Air Quality - Habitat Locations

Figure: 18.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	CG	A3	1:50,000

Co-ordinate system: British National Grid

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Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

18.4.1.1 Step 1: Screen the need for a Detailed Assessment

The IAQM guidance (IAQM, 2016) states that a Detailed Assessment is required if there are human receptors located within 350m and / or ecological sites within 50m of the site boundary. There are human receptors in places of work present within 350m, therefore a Detailed Assessment has been undertaken. The site is also located within the Teesmouth and Cleveland Coast SPA, SSSI and Ramsar site; however, as the immediate area is intertidal and is washed by the sea on a daily basis it is unlikely that significant impacts associated with dust deposition would occur. However, this receptor has been included to provide a conservative assessment. Distance buffers around the proposed scheme footprint are shown in **Figure 18.3**.

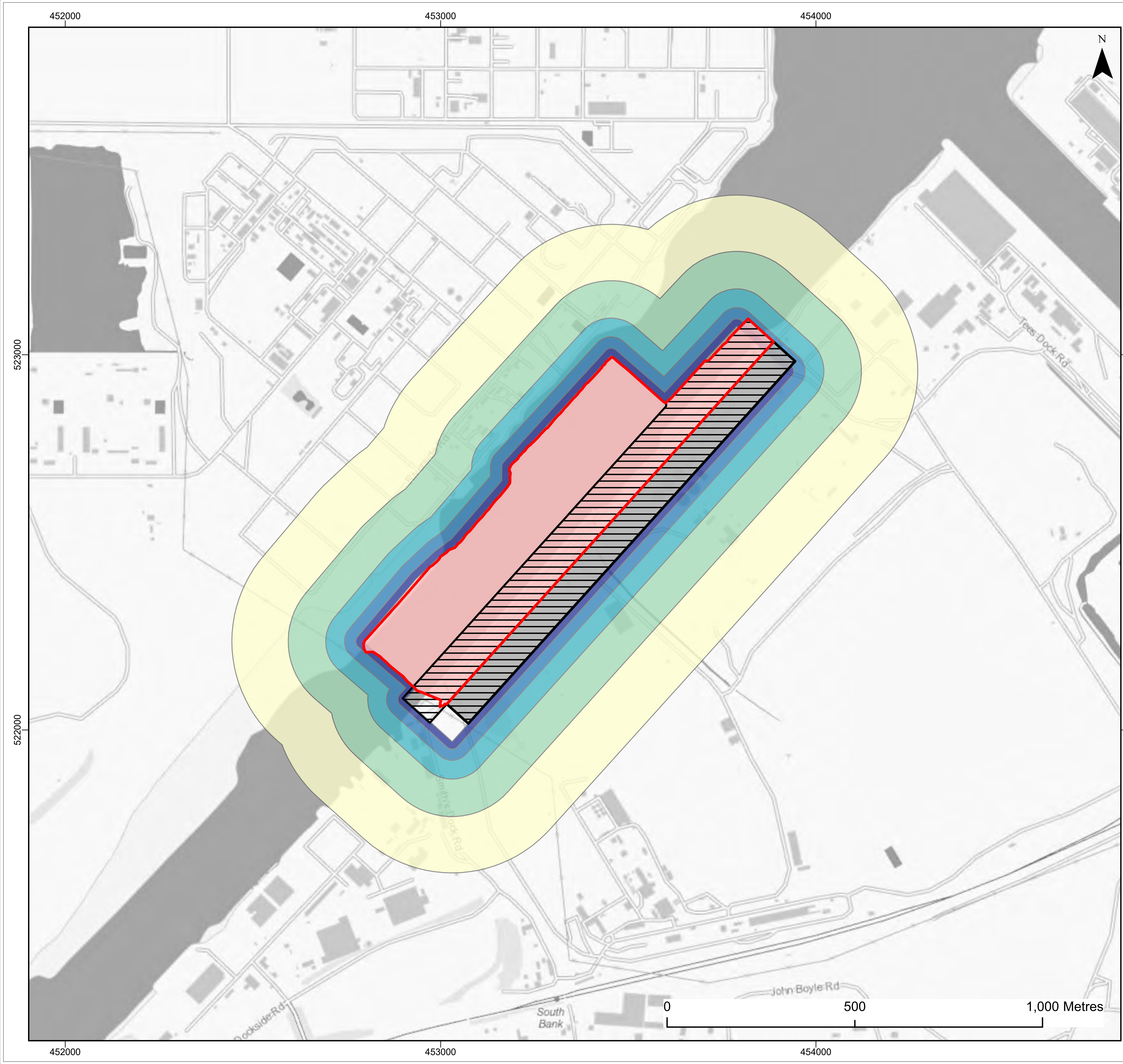
18.4.1.2 Step 2A: Define the potential dust emission magnitude

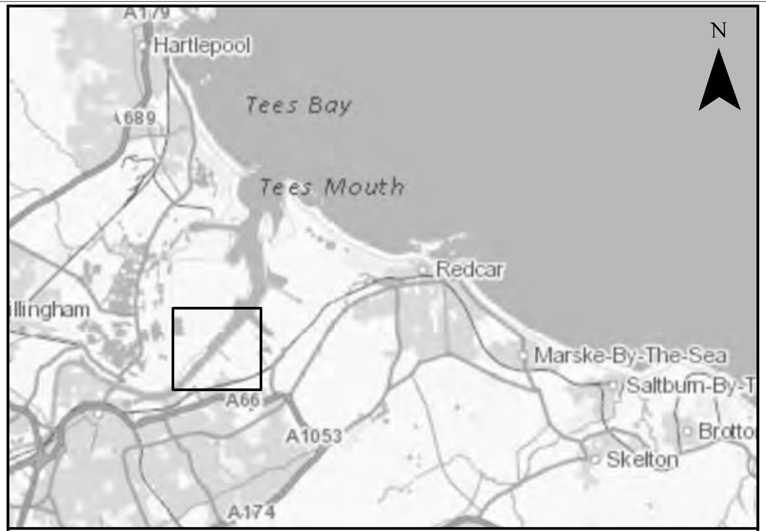
The IAQM guidance recommends that the dust emission magnitude is determined for demolition, earthworks, construction and trackout. The dust magnitudes for these activities were determined from site plans and in accordance with the IAQM methodology and are summarised in **Table 18.8**.

The risk of potential impact of construction phase dust and particulate matter emissions during earthworks, construction and trackout is used to recommend appropriate mitigation measures. The dust magnitude for construction activities has been categorised as **large** for demolition, earthworks and construction and **small** for trackout.

Table 18.8 Dust emission magnitude for the site

Construction activity	Dust emission magnitude	Reasoning
Demolition	Large	The concrete decks of the existing jetties and the wharf will be broken up, which is potentially dusty. It is proposed that all material (except timber) would be crushed on site and re-used as fill for the proposed scheme.
Earthworks	Large	Approximately 275,000m^3 of soils would be excavated to install the tie rods between the combi-wall and the anchor structure. Approximately 1,140,000m^3 of soils/landside material would need to be excavated to create the berth pocket.
Construction	Large	The quay would be constructed using concrete which is potentially dusty. There are limited landside structures/features to be constructed which are largely prefabricated (e.g. mooring bollards, lighting towers and an electrical substation). The total volume of concrete used for the proposed scheme would be greater than 100,000m^3.
Trackout	Small	There are paved access roads to the proposed scheme footprint; any unpaved roads within the site itself would be relatively short.





Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area

Construction Dust Distance Boundaries

Distance (metres)

- ≤20
- ≤50
- ≤100
- ≤200
- ≤350

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: Air Quality Construction Dust Distance Boundaries

Figure: 18.3

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

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ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

18.4.1.3 Step 2B: Define the sensitivity of the area

The sensitivity of human receptors to dust soiling and health effects of particulate matter associated with demolition, earthworks and trackout activities during construction of the proposed scheme are detailed below and summarised in **Table 18.9**.

Sensitivity of people to dust soiling

- Demolition, construction and earthworks: the only receptors within 350m are places of work which are categorised by the IAQM as medium sensitivity receptors. These are located within 20m of the proposed scheme boundary; the sensitivity is therefore considered to be **medium**.
- Trackout: construction access routes would also pass within 20m of medium-sensitivity places of work, up to 500m from the site entrance. The sensitivity is therefore considered to be **medium**.

Sensitivity of people to health effects of PM_{10}

- Demolition, construction and earthworks: receptors in adjacent places of work are considered to be of medium sensitivity to health effects of PM_{10}. The annual mean PM_{10} concentration at the site is less than 24µg.m^{-3}, and therefore the sensitivity is **low**.
- Trackout: the annual mean background PM10 concentration at the site is less than 24µg.m^{-3}, and there are medium sensitivity workplace receptors within 20m of the routes that construction vehicles will use to access the site. The sensitivity is therefore **low**.

Sensitivity of receptors to ecological effects

- Demolition, earthworks, construction and trackout: the proposed scheme is located within the Teesmouth and Cleveland Coast SPA, SSSI and Ramsar site; as described previously, mudflat features are intertidal and therefore unlikely to be affected by dust deposition. The sensitivity was therefore classified as **low**.

Table 18.9 Outcome of the sensitivity assessment of the area

Potential impact	Sensitivity of the surrounding area			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium	Medium	Medium	Medium
Human health	Low	Low	Low	Low
Ecological effects	Low	Low	Low	Low

18.4.1.4 Step 2C: Define the risk of impacts

The dust emission magnitude detailed in **Table 18.8** is combined with the sensitivity of the area detailed in **Table 18.9** to determine the risk of impacts with no mitigation applied. The risks concluded for dust soiling and human health are detailed in **Table 18.10**.

Table 18.10 Summary of risk table to define site-specific mitigation

Potential impact	Risks			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	High Risk	Medium Risk	Medium Risk	Negligible Risk
Human health	Medium Risk	Low Risk	Low Risk	Negligible Risk
Ecological effects	Medium Risk	Low Risk	Low Risk	Negligible Risk

The risk of dust soiling impacts during the construction phase were therefore described as ‘high risk’ for demolition, ‘medium risk’ for earthworks and construction, and ‘negligible risk’ for trackout. The impacts on human health and ecological receptors were described as 'medium risk' for demolition, 'low risk' for earthworks and construction and 'negligible risk' for trackout.

18.4.1.5 Step 3: Site-specific mitigation

Step three of the IAQM guidance (IAQM, 2016) identifies appropriate site-specific mitigation. These measures are related to the site risk for each activity.

The dust assessment determined that there was a risk of impacts resulting from construction activities without the implementation of mitigation measures. Additional guidance has been provided by the IAQM in relation to dust and air mitigation measures. It is recommended that the good practice measures outlined in the IAQM guidance are followed.

The recommendations below will be included in a CEMP to prevent or minimise the release of dust entering the atmosphere and/or being deposited on nearby receptors. The effective implementation of the CEMP will ensure that any potential dust releases associated with the construction phase will be reduced.

Highly recommended mitigation measures

A list of mitigation measures that are highly recommended for a **high risk** site by the IAQM, as determined by Step 2 of the construction dust and particulate matter assessment, is provided below. The mitigation measures have been tailored to the proposed scheme and therefore do not comprise a definitive list of all mitigation measures listed in the guidance.

Communications

- Display the head or regional office contact information and display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.

Dust management

- Develop and implement a CEMP, which may include measures to control other emissions, approved by the Local Authority.
- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
- Carry out regular site inspections to monitor compliance with the CEMP and record the results. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced, and 10 mph on unsurfaced, haul roads and work areas.
- Implement a Travel Plan that supports and encourages sustainable travel for contractor operatives and staff (public transport, cycling, walking, and car-sharing).
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Erect solid screens or barriers around dusty activities where practicable.
- Take measures to control site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Remove materials that have a potential to produce dust from site as soon as possible.
- Ensure all vehicles switch off engines when stationary - no idling vehicles.

- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use covered skips where practicable.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Bonfires and burning of waste materials should not be permitted.

Measures specific to demolition

- Soft strip inside any buildings or structures before demolition.
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Measures specific to earthworks

- Re-vegetate earthworks and exposed areas to stabilise surfaces as soon as practicable, or use hessian, mulches or trackifiers.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- Only remove the cover in small areas during work and not all at once.

Measures specific to construction

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

Measures specific to trackout

- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul routes where practicable, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Install a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site) where reasonably practicable.
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Locate site access gates at least 10 m from receptors where possible.

Measures specific to NRMM

NRMM and plant should be well maintained. If any emissions of dark smoke occur, then the relevant machinery should stop immediately, and any problem should be rectified. In addition, the following controls should apply to NRMM:

- All NRMM should use fuel equivalent to ultralow sulphur diesel (fuel meeting the specification within EN590:2004).
- All NRMM will comply with regulation (EU) 2016/1628 of the European Parliament and of the European Council.
- All NRMM should be fitted with Diesel Particulate Filters (DPF) conforming to defined and demonstrated filtration efficiency (load/duty cycle permitting).
- The ongoing conformity of plant retrofitted with DPF, to a defined performance standard, should be ensured through a programme of onsite checks.
- Implementation of energy conservation measures including:
    - instructions to throttle down or switch off idle construction equipment;
    - switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded; and
    - ensure equipment is properly maintained to ensure efficient energy consumption.

18.4.1.6 Step 4: Determine significant effects

With the implementation of the above mitigation measures, the residual impacts from the construction phase of the proposed scheme are considered to be **not significant**, in accordance with IAQM guidance (IAQM, 2016).

18.4.2 Construction phase road traffic emissions

A review of the expected vehicle movements generated during the construction phase of the proposed scheme has been undertaken to determine whether the screening criteria detailed in **Table 18.5** would be exceeded. The number of daily vehicles generated during construction of Phases 1 and 2 concurrently are detailed in **Table 18.11**.

Table 18.11 Construction phase traffic generation

Road link	Construction traffic generation (2022)	
	AADT	HDVs
Tees Dock Road	241	41
Old Station Road	241	41
Dockside Road	241	41
A66 (East)	177	41
A66 (West)	141	41
A1053	141	41

As detailed in **Table 18.11**, the traffic generated by the proposed scheme does not exceed the screening criteria detailed in **Table 18.5**. The proposed schemes impact on local air quality can therefore be considered as **not significant**. A detailed impact assessment of road traffic exhaust emissions was therefore not required.

18.4.3 Construction vessel exhaust emissions

The proposed scheme would generate additional vessel movements during the construction phase. These have been quantified by the project team for each activity, as detailed in **Table 18.12**.

Table 18.12 Construction phase vessels generated by the proposed scheme

Activity	Number of vessels used	Duration (Phase 1 and 2 constructed concurrently) (weeks)
Demolition	3	52
Quay Wall	1	14
Dredging (one backhoe, one TSHD, two safety/workboats and three disposal barges)	6	20
Deliveries	29	-

As shown in **Table 18.12**, the construction of the proposed scheme would require few vessel movements for the duration of construction. With the exception of delivery vessels, these vessels would be operating in a localised area within and around the proposed scheme footprint, which is situated at a distance from sensitive human and ecological receptors.

Vessels used for the proposed dredging would be in use for a relatively short amount of time (approximately four months) and vessels required to transport construction materials to site would make one-off visits to either an existing berth on the Tees or part of the new wharf once constructed; emissions from such vessel movements are unlikely to have a significant effect on annual mean pollutant concentrations or deposition at human and ecological receptors. Whilst short-term emissions may be of a higher magnitude, given that air quality within RCBC's area of jurisdiction is relatively good, it is unlikely that any exceedances of the short-term air quality Objectives would be experienced. Furthermore, the North Sea is designated as an Emissions Control Area (ECA) under Annex VI of the International Maritime Organisation (IMO) Maritime pollution (MARPOL) Convention, and therefore vessels must comply with fuel quality standards which will minimise air emissions.

Demolition vessels would be in operation for a larger proportion of the year; however, given the low number of these vessels in operation and the distance to sensitive receptors, significant impacts are unlikely. Furthermore, these emissions would be temporary in nature and would only be experienced for the duration of the construction phase.

Given the above, impacts at human and ecological receptors as a result of construction phase vessel emissions are considered to be **not significant**.

18.5 Potential impacts during the operational phase

18.5.1 Operational phase road traffic emissions

During the operational phase, the proposed scheme would generate approximately 10 employees, which would generate 20 vehicle trips per day. This increase in vehicle trips is below the criteria detailed in **Table 18.5** and, as such, impacts of these emissions would be **not significant**.

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18.5.2 Operational phase vessel emissions

As noted in **Section 3**, the scheme is predicted to generate up to 390 vessel calls per year, or just over one vessel call per day. Data obtained from PDT shows that in 2019 there were 16,433 vessel movements within the River Tees. Given this existing level of vessel activity, it is not anticipated that this increase in movements would give rise to a significant change in pollutant concentrations above the existing baseline at sensitive receptors, particularly as emissions from moving vessels would only be experienced at receptors for a short period of time; as a vessel moves past the receptor, the emissions would become subject to greater dispersion and dilution over an increased distance.

The proposed quay has been designed to provide shoreside power (termed 'cold ironing') and therefore vessels are not envisaged to require the use of main or auxiliary engines whilst berthed. Whilst it is acknowledged that some vessels may not have the capability to utilise this technology, it is likely to lead to a significant reduction in emissions from berthed vessels.

Given the number of vessel movements predicted during operation, the inclusion of shoreside power into the proposed scheme design and the distance to receptors, impacts during operation are considered to be **not significant**.

18.5.3 Operational phase plant emissions

The proposed scheme would utilise cranes, SPMTs and generators to power small tools and welding equipment. SPMTs would be electrically powered, in addition to some cranes. Therefore, during the operational phase, cranes and small generators may give rise to increases in air emissions. However, given the distances to sensitive receptors and the intermittent nature of the use of this equipment, it is unlikely that significant increases in pollutant concentrations would occur at sensitive receptors. Impacts are therefore considered to be **not significant**.

19 LANDSCAPE AND VISUAL

19.1 Introduction

This section of the EIA Report presents the findings of a Landscape and Visual Impact Assessment (LVIA) undertaken by DRaW (UK) Ltd. The section considers the following potential environmental impacts during the construction and operational phases of the proposed scheme:

- direct impact to physical landscape features;
- direct and indirect effects on landscape character;
- effects on views, as experienced by a range of receptors within the study area.

The LVIA is supported by the following appendices and figures:

- Representative Viewpoint Analysis Tables (**Appendix 12**).
- LVIA Methodology (**Appendix 13**)

- Figure 19.1: Landscape & Visual Receptors
- Figure 19.2: Zone of Theoretical Visibility & Representative Viewpoint Locations
- Figure 19.3A: Viewpoint 1 – Existing View.
- Figure 19.3B: Viewpoint 1 – Verified View.
- Figure 19.4A: Viewpoint 2 – Existing View.
- Figure 19.4B: Viewpoint 2 – Verified View.
- Figure 19.5A: Viewpoint 3 – Existing View.
- Figure 19.5B: Viewpoint 3 – Verified View.
- Figure 19.6: Viewpoint 4 – Existing View.
- Figure 19.7: Viewpoint 5 – Existing View.
- Figure 19.8A: Viewpoint 6 – Existing View.
- Figure 19.8B: Viewpoint 6 – Verified View.
- Figure 19.9A: Viewpoint 7 – Existing View.
- Figure 19.9B: Viewpoint 7 – Verified View.
- Figure 19.10: Viewpoint 8 – Existing View.
- Figure 19.11A: Viewpoint 9 – Existing View.
- Figure 19.11B: Viewpoint 9 – Verified View.
- Figure 19.12A: Viewpoint 10 – Existing View.
- Figure 19.12B: Viewpoint 10 – Verified View.
- Figure 19.13A: Viewpoint 11 – Existing View.
- Figure 19.13B: Viewpoint 11 – Verified View.
- Figure 19.14A: Viewpoint 12 – Existing View.
- Figure 19.14B: Viewpoint 12 – Verified View.

Figure 19.1 and **19.2** are contained within the body of this report, however given the number of viewpoints documented above, these have been presented in **Appendix 14.**

19.2 Legislation, policy and consultation

This section summarises current legislation, planning policy and guidance, relevant to landscape and visual issues.

19.2.1 Legislation

Various European Union (EU) Directives underpin the requirement for EIA (which includes LVIA) and are consolidated in Directive 2011/92/EU*; The assessment of effects of certain public and private projects on the environment*. The EU Directive is interpreted and implemented in UK Country Regulations in each devolved country. Landscape is specifically identified as an environmental topic to be investigated under EIA.

The European Landscape Convention (ELC, Council of Europe, 2000) highlights the importance of all landscapes within the member states and encourages their protection, management and planning. The UK signed up to the Convention in 2006.

19.2.2 National Planning Policy

National planning policy guidance in relation to landscape and visual matters is set out in NPPF (Ministry of Housing, Communities and Local Government, 2019) as follows:

Chapter 11 'Making effective use of land', paragraph 118 notes that planning policies and decisions should:

"c*) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land*."

Chapter 12 'Achieving well-designed places', paragraph 127 states that planning policies and decisions should ensure that developments:

"a) will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development;

c) are sympathetic to local character and history, including the surrounding built environment and landscape setting […]"

Chapter 15 'Conserving and enhancing the natural environment', paragraph 170 states that planning policies and decisions should contribute to and enhance the natural and local environment by:

"a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);

b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including… trees and woodlands; […]

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 of the NPPF states that planning policies and decisions should also take into account the potential sensitivity of a site, or the wider area, to impacts that could arise from new development. In doing so they should:

"c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes […]"

19.2.3 Planning Practice Guidance

The NPPF is supported by PPG notes. Landscape is covered under the Natural Environment PPG. The introductory section to the Natural Environment PPG reflects NPPF guidance in that:

“planning should recognise the intrinsic character and beauty of the countryside.”

The PPG notes *“This includes designated landscapes but also the wider countryside.”*

19.2.4 Local planning policy

The site lies within the administrative area of RCBC. The adopted Development Plan for the borough currently comprises a number of documents, of which the following are relevant to this section:

- Redcar and Cleveland Local Plan (2018);
- South Tees Area SPD (2018); and
- Redcar and Cleveland Landscape Character SPD (2010).

Redcar and Cleveland Local Plan (2018)
Planning decisions within Redcar and Cleveland Borough are guided by the Redcar and Cleveland Local Plan, adopted by the Council in May 2018 and accompanied by a Policies Map.

Key policies relating to landscape and visual matters are summarised below. The proposed scheme is included within the area of South Tees Development Corporation and is allocated for economic growth. The site also adjoins the Teesmouth and Cleveland Coast SPA, Ramsar site and SSSI.

Policy SD4 (General Development Principles) – This policy lists various environmental-based criteria which development proposals must accord with if they are to be permitted. This includes avoiding an unacceptable loss or significant adverse impact on environmental, built or heritage assets which are considered important to the quality of the local environment.

New development will also be expected to comply with various design-based criteria. This includes respecting or enhancing the character of the site and its surroundings (in terms of size, scale, massing, density, materials, etc.); taking opportunities available to improve the character and quality of the surrounding area; and respecting or enhancing the landscape, biodiversity and geological features and the historic environment.

Policy LS4 (South Tees Spatial Strategy) – This policy includes the STDC area (which includes the current and former steel works at South Tees and Redcar). It seeks to deliver various economic benefits to the area and improve connectivity. It also seeks to deliver environmental improvements and enhance the environmental quality of the River Tees.

Policy N1 (Landscape) – This policy seeks to protect and enhance the borough’s (rural) landscapes. Development proposals will not be permitted where they would lead to the loss of features important to the character of the landscape, its quality and distinctiveness (as identified in the Redcar and Cleveland Landscape Character Assessment) unless the benefits of the development clearly outweigh landscape considerations. In such cases appropriate mitigation will be required. Landscapes designated at a national and local level will be afforded additional protection commensurate with their status. Wherever possible, new development should include measures to enhance, restore or create new landscape features.

South Tees Area Supplementary Planning Document (SPD) 2018
This SPD was adopted by the Council in May 2018. It supports the economic and physical regeneration of the South Tees Area, which includes the site, setting out the vision and core objectives for the area and providing greater detail on how the adopted policies of the Local Plan will be interpreted.

The SPD outlines a number of development principles to guide the regeneration of the area, of which the following are relevant to this section:

Development Principle STDC1 (Regeneration Priorities) – This policy lists the key priorities identified for the South Tees Area. These include the protection of heritage assets and the historic environment and the protection and enhancement of landscape character.

19.3 Methodology

The methodology for the LVIA is based on current best practice guidance produced by the Landscape Institute in the third edition of its '*Guidelines for Landscape and Visual Impact Assessment*' (GLVIA3, 2013). The guidelines are not prescriptive and set out a general approach that should be tailored to the specific circumstances of the project that is being assessed. The methodology adopted for this assessment is set out in detail in **Appendix 13**. Briefly, the assessment process comprises the following stages:

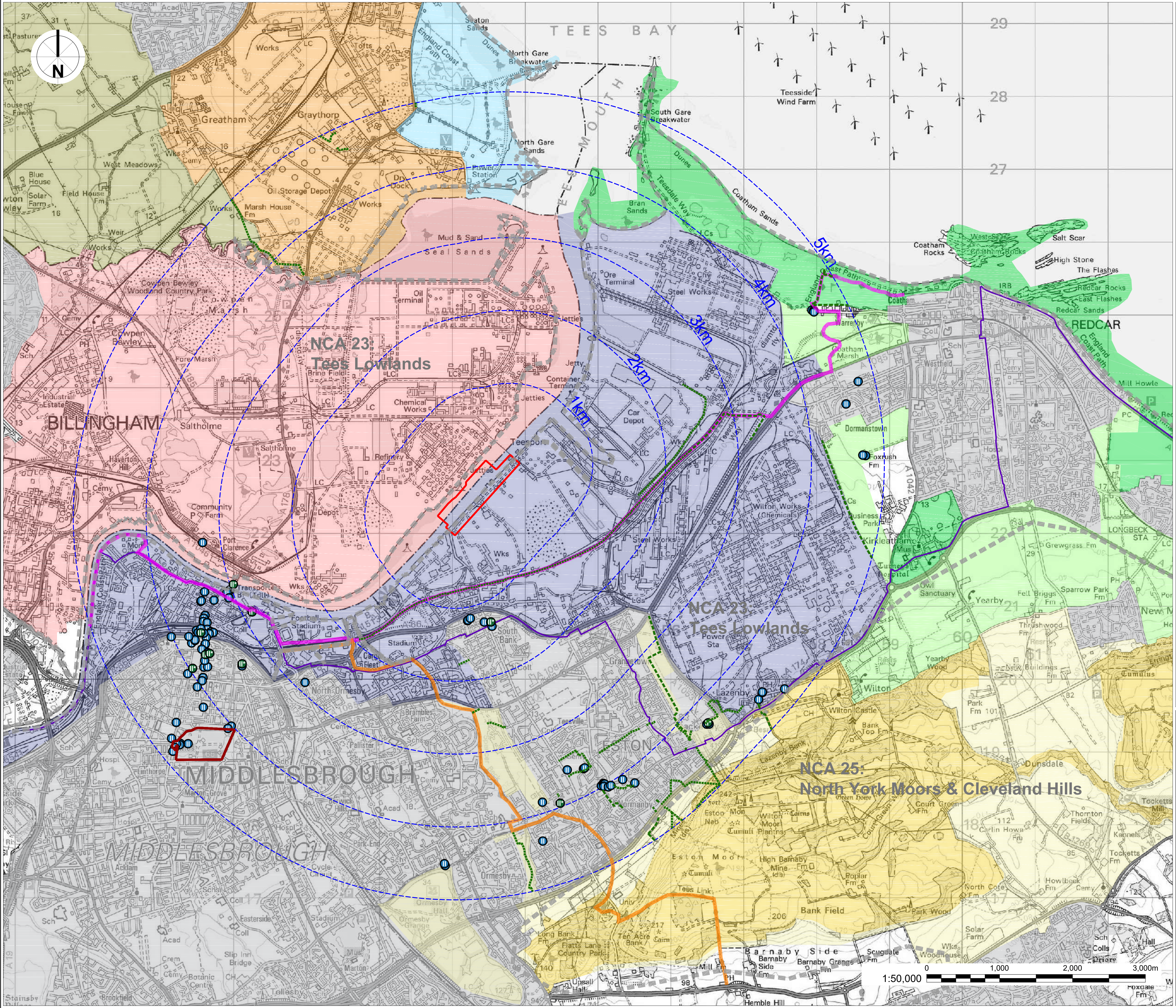
- Determining the likely extent of influence of the proposed scheme (or the study area boundaries).
- Establishing the landscape and visual baseline. Identifying and evaluating the current attributes and characteristics of the site and wider study area and establishing the likely extent of visibility of the proposed scheme and people likely to be affected. Understanding the policy context is also important.
- Identifying landscape and visual receptors with most potential to be affected by the proposed scheme together with an assessment of their 'sensitivity.
- Assessing the likely 'magnitude of effects' of the proposed scheme on identified landscape and visual receptors during the construction and operational stages.
- Determining the significance of effect for each landscape and visual receptor assessed and whether these are significant in terms of EIA.

It should be noted that landscape effects include changes to the constituent elements and features that make up the landscape (for example loss of existing trees), as well as changes to its character and any perceptual qualities (sense of place, tranquillity, etc.). Visual effects relate solely to changes in views and visual amenity experienced by various receptors (people) at different locations.

Change can affect landscape character regardless of whether it can be seen and as such GLVIA3 recommends that landscape and visual effects (although interrelated) are treated as separate topics.

19.3.1 Study area

The study area adopted for this assessment is shown on **Figure 19.1**. Based upon site observation and assessment of desktop information the potential for *significant* effects on landscape and visual receptors was predicted to be within a 2km zone of the proposed scheme footprint and this forms the focus of the assessment. However, certain high sensitivity receptors within the wider study area are also identified and considered in the assessment.



Legend

- Proposed Scheme Boundary
- 5km Study Area
- Footpath / Bridleway
- National Cycle Route 1
- England Coast Path / Teesdale Way
- Tees Link
- Listed Buildings
- Registered Park & Garden

Landscape Character

- National Character Area Boundary (NCA profile 23: Tees Lowlands) (NCA profile 25: North York Moors & Cleveland Hills)

Redcar and Cleveland Landscape Character SPD (2010)

- Redcar Flats: Sensitive / Restoration Landscape
- Eston Hills Sensitive / Restoration Landscape

Stockton -on-Tees Landscape Character Assessment (2011)

- East Bellingham to Teesworth

Hartlepool Landscape Assessment (2000)

- Seaton Sands Coastal Fringe
- Newton Bewley Undulating Farmland
- South Hartlepool to Teesmouth

Additional LCA's

- Urban Area (not included in landscape assessment)
- North Middlesbrough to Teeside

Client	Tees Valley Combined Authority			
Project	South Bank quay Environmental Statement			
Drawing Title	Landscape & Visual Receptors			
Created by CL	Reviewer MCE	Sheet Size A3	Scale 1:50,000	Date Created 06.07.20
Figure Nr. 19.1				Revision 00

DRaW (UK) ltd
Morwick Hall
York Road
Leeds
LS15 4TA
t: 0113 8232871
www.draw-ltd.com

DRaW Design & Assessment

The following techniques were used to inform the LVIA:

Zone of Theoretical Visibility mapping and limitations

To assist in identifying the area within which the proposed scheme is likely to be visible and help determine the locations of receptors that may be affected, a Zone of Theoretical Visibility (ZTV) map has been prepared (**Figure 19.2**). The ZTV is computer generated from a digital terrain model of the study area (using Ordnance Survey Terrain 5 data) with analysis points based upon the heights of the tallest structures. Terrain 5 data is based on a grid of heighted points, at 5m intervals and is considered to be a mid-resolution DTM product, suitable for use across wide study areas. The following limitations should be noted:

- Buildings, woodland and other significant areas of vegetation were incorporated into the DTM model using digital OS data. ZTV mapping cannot incorporate the myriad of varying features and heights of those features. Heights used for both vegetation and buildings are generic and considered to be conservative estimates.
- The ZTV output is based on analysis points set to the tops of tallest proposed structures and does not differentiate between the full extent of a proposed structure being visible or only the very top section being visible.
- ZTVs are not 'distance sensitive' in that they do not take account of the effect of increasing distance on visibility and the magnitude of effect arising from this; what can be seen at 500m will differ markedly from what can be seen at 5km.

The ZTV map is therefore assumed to present a 'worst case' scenario and is used as a general guide and an aid to site-based survey.

Representative viewpoint assessment and photography

The assessment of predicted visual effects is based on a series of 'representative viewpoints' (**Figures 19.3A** to **19.14B**). These were selected to represent the experience of different types of visual receptor, including users of public rights of way, residential properties, transport routes, heritage and recreational sites. Selected viewpoints include specific locations that are popular vantage points or tourist destinations. Viewpoints may also be used to illustrate landscape character effects or discuss cumulative effects of the proposed scheme.

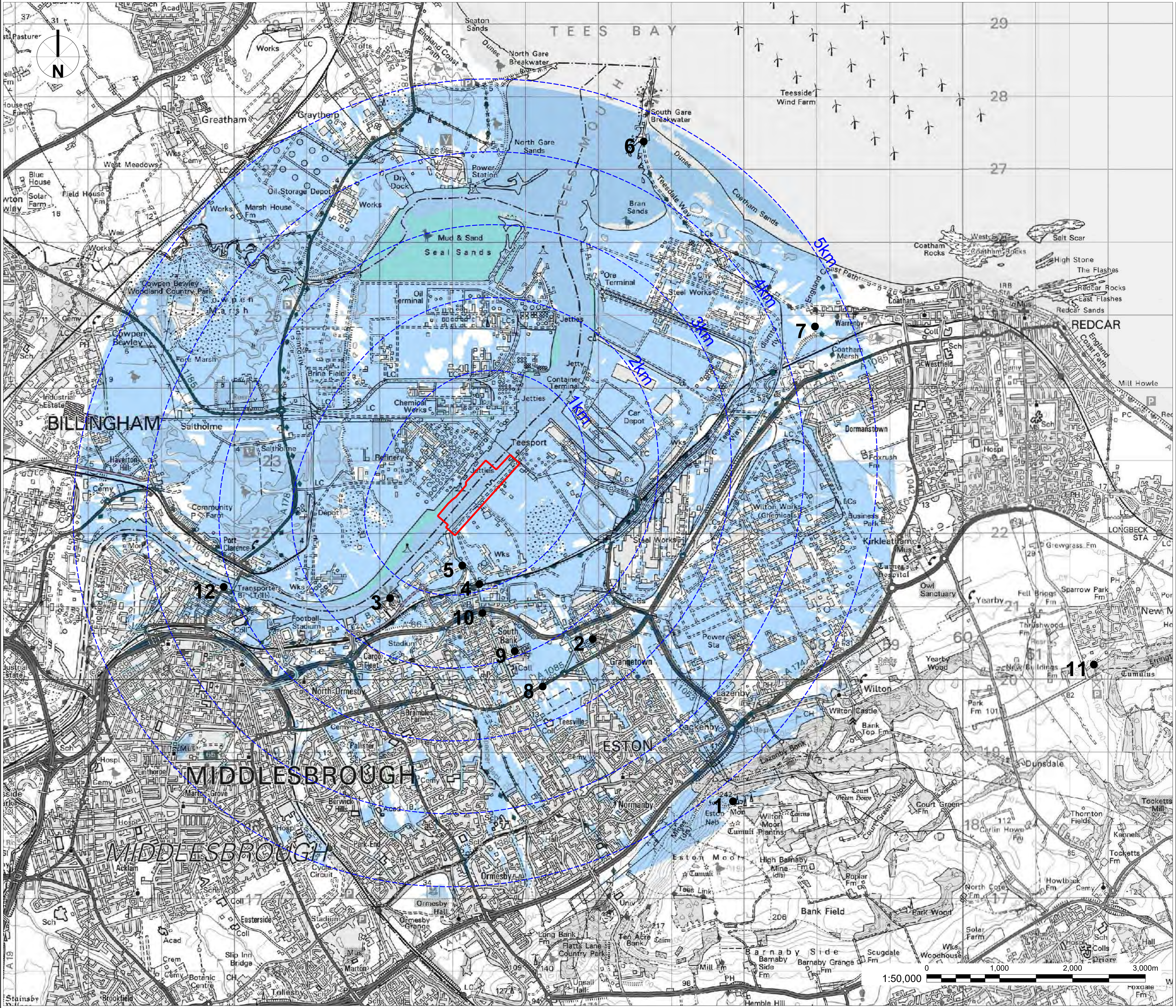
Viewpoint locations are based on those previously agreed with RCBC in connection with the recent South Industrial Zone planning application on the adjacent landside site (planning application reference R/2020/0357/OOM). Two additional viewpoints have been included in this LVIA:

- residential and amenity receptors at Argyle Road, Grangetown and;
- a view from the Grade II* listed Tees Transporter Bridge.

The locations of the viewpoints included in the assessment are identified on **Figure 19.2**. Description and analysis of the viewpoints is included in the *Representative Viewpoint Analysis Tables* at **Appendix 12**.

Photomontage visualisations

To illustrate the appearance of the proposed scheme, computer generated photomontages were produced for selected viewpoints (Viewpoints 1, 2, 3, 6, 7, 9, 10, 11 & 12). The rendered computer model was digitally aligned to the viewpoint photographs, using identifiable reference points to accurately match the computer render with the photographs. The photomontages are shown in conjunction with the baseline photographs in **Appendix 14** (**Figures 19.3 to 19.14**).



Legend

- Proposed Scheme Boundary
- 1km — 5km Study Area
- 1 ● — Proposed Representative Viewpoint Location

Zone of Theoretical Visibility

- Theoretical visibility of analysis points used

ZTV Parameters

- Digital Terrain Model is based on Ordnance Survey Terrain 5 data.
- ZTV analysis points for the proposed Crane tower, arm and turbine components are based on heights of 106m, 192m and 150m above ground level of 5.79mAOD.
- Existing buildings and selected woodland areas are included in the DTM modelled at 10m above ground level.
- Observers eye level 1.7m

Client	Tees Valley Combined Authority			
Project	South Bank quay Environmental Statement			
Drawing Title	Zone of Theoretical Visibility & Representative Viewpoint Locations			
Created by	Reviewer	Sheet Size	Scale	Date Created
CL	MCE	A3	1:50,000	28.09.20
Figure Nr.	19.2		Revision	00

DRaW (UK) ltd
Morwick Hall
York Road
Leeds
LS15 4TA
t: 0113 8232871
www.draw-ltd.com

19.3.2 Baseline data collection

Information relevant to the LVIA has been gathered through a combination of desktop research and field study. Desktop research included a review of the following information:

- NPPF, 2019;
- Redcar and Cleveland Local Plan, 2018;
- South Tees Area SPD, 2018;
- National Character Area Profile NCA 23: Tees Lowlands, 2013;
- National Character Area Profile NCA 25: North York Moors and Cleveland Hills, 2015;
- Stockton-on-Tees Landscape Character Assessment, 2011;
- Redcar and Cleveland Landscape Character SPD, 2010;
- Hartlepool Landscape Assessment, 2000;
- The Multi-Agency Geographical Information for the Countryside (MAGIC) database;
- OS 1:50,000 and 1:25,000 scale site-centred digital raster map; and,
- Aerial photography: Google Maps (http://maps.google.co.uk/) and Google Earth.

Field studies were undertaken in June and September 2020 to:

- verify existing landscape/ townscape characteristics and their present condition;
- verify the extent of the ZTV taking account of screening by buildings and vegetation;
- confirm key viewpoints and photograph the existing views; and,
- conduct a viewpoint assessment from each viewpoint.

The field study was restricted to publicly accessible locations within the study area (roads, footpaths, public open spaces, etc.).

19.4 Existing environment

This section of the assessment summaries the existing landscape and visual baseline of the study area and the proposed site against which the potential impacts of the proposed scheme were identified. Baseline conditions consider the following:

- existing physical landscape characteristics of the proposed scheme footprint and its immediate surroundings;
- surrounding landscape context, including physical and human characteristics, landscape character and planning context; and,
- visual analysis including factors which influence both the character and availability of views to the site (e.g. visual detractors, local horizons etc.).

19.4.1 Landscape designations and protected features

Landscape-related designations and protected features are identified within the site and study area using a search of the MAGIC website and websites for Redcar and Cleveland and Stockton-on-Tees Borough Councils. These are shown on **Figure 19.1** and listed in **Table 19.1** below.

Table 19.1 Landscape designations, protected features and access routes

Designation or feature	Present within the site boundary	Present within 2km of the site
Landscape designations		
National Park	No	No
Area of Outstanding Natural Beauty	No	No
Special Landscape Area (or equivalent)	No	No
Green Belt	No	No
Country Park	No	No
Protected heritage and nature conservation features		
World Heritage Site	No	No
Scheduled Monument	No	No
Conservation Area	No	No
Listed Building	No	Yes
Registered Historic Park And Garden	No	No
Historic Battlefield	No	No
Nature Reserve	No	Yes
Special Protection Area	Yes	Yes
Special Area of Conservation	Yes	Yes
Ramsar site	Yes	Yes
Site of Special Scientific Interest	Yes	Yes
Ancient Woodland	No	No
Access		
National/ Regional Walking or Cycling Route	No	Yes (refer details below)
Public Rights of Way	No	Yes (refer details below)

Listed buildings

Views from listed buildings and other cultural heritage assets are only considered in the LVIA where those features include recognised viewpoints, or the asset features in a specific viewpoint that is used or experienced by sightseers and other receptors. Effects on the 'setting' of cultural heritage assets are not considered in this section but are presented in **Section 16**.

A Grade II* Baptist Church on Redcar Road East at South Bank (on the north eastern edge of Middlesbrough) is located approximately 1.4km south of the site boundary. Four other Grade II listings are located in the vicinity of the Baptist Church. The sites do not include recognised viewpoints and they do not feature in specific views and are therefore not considered further in this section.

The Grade II* Tees Transporter Bridge is located approximately 3.2km to the west of the proposed scheme. The bridge is a regional landmark feature with cultural heritage associations and high value. A purpose built viewing area, in close proximity on the south bank of the River Tees, is a popular sightseer destination. This section includes an assessment of visual effects from the Tees Transporter Bridge viewing area.

Nature conservation

The study area includes numerous nature conservation designations of international and national importance. Teesmouth National Nature Reserve (NNR) lies approximately 2km north of the site boundary at its closest point. The backdrop to the area is industrial development at the mouth of the River Tees. The NNR forms part of the Teesmouth and Cleveland Coast SPA and Ramsar Site. The section of the River Tees between Stockton-on-Tees and the coast is designated as a SSSI and includes the northern riverside margin of the site.

National/ regional walking and cycling routes

Two routes cross the wider study area:

- England Coast Path, passes within approximately 800m to the south of the proposed scheme footprint where it closely follows a section of the Stockton to Redcar railway line. This section is also referred to as the Teesdale Way and known locally as the 'Black Path'. The England Coast Path also passes within approximately 2km of the proposed scheme footprint to the west where it follows the route of the A178 north to Hartlepool.
- National Cycle Route (NCR) 1, which follows local roads and streets through the built-up area of Eston on the north eastern edge of Middlesbrough and passes within approximately 1.3km of the proposed scheme footprint to the south where it follows a section of the A66.

Public Rights of Way

The proposed scheme footprint is not publicly accessible and there are no public rights of way that either cross it or pass alongside. Footpath 102/2/1 is in closest proximity and follows a section of railway line south of the proposed scheme footprint and forms part of the England Coast Path.

19.4.2 Landscape character

The assessment is informed by published landscape character assessments (LCAs) that exist at a national, regional or local level, supplemented by field observation. There are no designated areas of high landscape value within the study area. Landscape character areas are shown on **Figure 19.1** and discussed below.

National Character Area Profile 25: North York Moors and Cleveland Hills

A small section of NCA 25 falls within the outer, south eastern study area. Given the distance to the proposed scheme footprint and the strongly urban / industrial context of outward views, it is predicted that the proposed scheme will have negligible influence on this character area and is not considered further..

National Character Area Profile 23: Tees Lowlands

The proposed scheme footprint and study area falls within eastern extent of NCA 23: Tees Lowlands. The character area NCA 23 comprises of a broad, open plain dominated by the meandering lower reaches of the River Tees and its tributaries, with wide views to distant hills. The large urban conurbation at the mouth of the river contrasts with rural areas to the south and west, which are largely agricultural in character. A mosaic of inter-tidal and wetland habitats associated with the Tees estuary are also designated as a SPA and Ramsar Site due to their international importance to waterfowl. These areas are in close proximity to heavy industry, where industrial installations form dramatic skylines when viewed from the surrounding area and hills. Grasslands and scrub have also established on previously developed land and have significant biodiversity value.

The key characteristics of NCA 23 are set out in the supporting profile, which was updated by Natural England in 2013. The majority of these are represented to some extent in the study area. Those relevant are as follows:

- "*A broad, low-lying and open plain…..*
- *A large area of urban and industrial development around the Tees Estuary, much of which is on reclaimed land, contrasts with the quieter rural areas to the south and west.*
- *Major industrial installations around Teesmouth form a dramatic skyline, but are juxtaposed with expansive mudflats, sand dunes and salt marshes which are nationally and internationally designated for their assemblage of waterfowl.*
- *Slow-moving rivers Tees and Leven meander through the landscape…..*
- *Principal transport corridors, power lines and energy infrastructure are conspicuous elements in the landscape.*
- *Brownfield sites where semi-natural vegetation has started to regenerate on previously developed land.*
- *Green corridors such as minor valleys and former railway lines provide links between urban areas and the surrounding countryside*."

District level Landscape Character Assessment
Finer grained landscape character assessments have been undertaken at a district level. The 5km study area indicated on **Figure 19.1** encompasses landscape character areas within three planning authorities, described in separate reports:

Stockton on Tees Landscape Character Assessment, 2011 (Stockton on Tees Borough Council)

Landscape Character Areas
- East Billingham to Teesmouth (study area west of the River Tees).

Redcar and Cleveland LDF Landscape Character SPD, 2010 (Redcar & Cleveland Borough Council)

Broad Landscape Areas
- Eston Hills (the uplands at Eston).
- Redcar Flats (the coast and countryside around Redcar and Marske).

Hartlepool Landscape Assessment, 2000 (Hartlepool Borough Council)

Landscape Types
- Coastal Fringe
- Estuarine

Stockton-on-Tees Landscape Character Assessment
This assessment identifies and maps 7 broad LCAs, which reflect the varied character of the borough's landscapes, *outside* of urban areas. LCAs are distinct areas of landscape which display similar physical and cultural attributes such as geology, landform, land cover and historic evolution. The LCAs are uniquely named to reflect their geographical location within the borough.

LCA *East Billingham to Teesmouth*, extends east of the built-up edge of Billingham to the River Tees and the boundary with neighbouring RCBC.

Key characteristics of *East Billingham to Teesmouth LCA* are:

- "*Industrial landscape fringing Billingham integrated with large areas of open space including wetlands and reclaimed semi-improved pasture;*
- *Farmland is open and flat with minimal landscape features;*

- *Industry dominates the area to the east along the River Tees;*
- *Open spaces within industrial areas contain significant wildlife value with a number of ecological designations present including Sites of Special Scientific Interest, Site of Nature Conservation Importance, Special Protection Area, Ramsar Site and Teesmouth National Nature Reserve;*
- *Important 'ridge and furrow' within the field pattern around the settlement of Cowpen Bewley;*
- *The Stockton to Hartlepool railway line is a notable feature within the landscape, dividing the Landscape Character Area between estuarine and non-estuarine/rural fringe influences; and*
- *Cowpen Bewley Woodland Park provides the only wooded element within this Landscape Character Area."*

The general condition of this LCA ranges from areas with excellent ecological value, managed as an ecological resource, to areas devoid of natural features and dominated by industrial structures and hardstandings. Active landfill sites also punctuate the skyline, forming areas of temporary degraded landscapes.

Although the *East Billingham to Teesmouth LCA* extends as far as the administrative boundary with Redcar and Cleveland Borough, in practical terms the character area could be extended east to encompass similar areas of industrial and brownfield land that adjoin the east side of the River Tees. This is considered further below.

Redcar and Cleveland LDF Landscape Character SPD
The assessment identifies four Broad Landscape Areas (BLAs), each of which is uniquely named to reflect their geographical location within the borough. Within each BLA, the landscape is divided into one of two categories:

- 'sensitive' landscapes, in which much of the landscape structure is present and intact giving rise to a high strength of character which is sensitive to change; and,
- 'restoration' landscapes, in which much of the landscape structure has been lost and as a result would benefit from measures to restore it.

None of the BLAs identified in the Redcar and Cleveland Landscape Character SPD are directly relevant to this LVIA. The assessment excludes southern and eastern parts of the borough that fall within the North York Moors National Park. It also excludes the main urban areas within the borough and the complex of industrial and brownfield land that extends north of Middlesbrough to the Tees Estuary.

The Redcar Flats BLA extends to within approximately 3km of the proposed scheme footprint at its closest point along the low-lying coastline at Coatham Sands, northwest of Redcar. Redcar Flats is identified as a sensitive landscape, however, given the distance to the proposed scheme footprint and the strongly urban/ industrial context of outward views, it is predicted that the proposed scheme will have negligible influence on its character.

Similarly, the Eston Hill BLA is some distance from the proposed scheme, with the northern margin of the area located within the outer edge of the study area. Higher land is considered to be a sensitive landscape and reference is made to views north '*over the urban and industrial developments of Teesside and Redcar*'. Given the overall distance to site and existing influence exerted by industrial areas to the north no significant effects are predicted.

In order to address the absence of an existing local landscape character baseline study that encompasses the proposed scheme footprint and its immediate setting, this LVIA describes and names an additional character area; North Middlesbrough to Teesmouth, which extends from the northern conurbation of

Middlesbrough to the River Tees and the boundary with Redcar Flats. The naming of this character area is broadly consistent with the naming of character areas in the Stockton-on-Tees landscape character assessment.

Based upon desktop and field studies key characteristics identified for North Middlesbrough to Teesmouth character area include:

- *A broadly flat, industrial landscape associated with chemical and steel making industries;*
- *Mixture of working and disused industry intermixed with extensive areas of brownfield land;*
- *Major industrial installations dominate the area and form a dramatic skyline;*
- *Noise and smells associated with industrial processes reinforce the industrial character;*
- *The tidal nature of the River Tees is of national and international importance to waterfowl;*
- *Vegetation is limited to low growing scrub and early successional grassland, the result of natural colonisation of previously developed land;*
- *Some heritage assets present associated with past heavy industrial uses (Dorman Long Tower and South Bank Coke Ovens); and*
- *The England Coast Path/Teesdale Way provides the only recreational access where it closely follows the route of a railway line through the middle of the area.*

These key characteristics demonstrate that the landscape areas immediately north of Middlesbrough and either side of the River Tees are relatively uniform. The proposed scheme footprint and its setting is also consistent with the descriptions of the East Billingham to Teesmouth and North Middlesbrough to Teesmouth LCA's.

Hartlepool Landscape Assessment

The assessment focuses on '*relative landscape quality, as opposed to landscape character, as this is considered to be the driving issue behind the use of the assessment as an effective planning tool*'. It identifies seven generic landscape character types of which two fall within the study area:

- Coastal Fringe (coastal areas in the vicinity of Seaton Sands, approximately 3.5km north of the proposed scheme footprint).
- Estuarine (mouth of the River Tees as a linear strip, approximately 3km northwest of the proposed scheme footprint).

Both types include high value areas of landscape that are considered most sensitive to change. The assessment also identifies the negative visual effect of existing industrial areas to the south within Teesside. No significant effects are predicted given the overall distance to site and existing influence exerted by industrial areas to the north.

Character of the site and its immediate setting

The site comprises a section of the River Tees and adjoining riverbank extending to a distance of approximately 1.3km in length. The proposed scheme footprint is included within the area of the STDC and forms part of a wider development area, referred to as the SIZ. The SIZ is divided into three areas with the proposed scheme footprint located in South Bank, an area adjoining the southern bank of the River Tees previously used for heavy industrial purposes but mostly now demolished. Current uses include landfill operations and waste management.

The existing riverbank is hard edged and extensively modified. It includes jetties and a timber and concrete wharf along the riverbank. Several disused buildings and structures also adjoin the southern bank, including a group of five oil tanks that will be demolished outside of this proposed scheme. The landward side of the site includes areas of coarse grassland and scattered pockets of scrub. Overall, the site exhibits a flat, open and exposed character that is highly degraded as a result of past heavy industrial activity.

Various industrial uses and brownfield land adjoin the proposed scheme footprint and extend more widely. On the opposite, northern riverbank is an extensive oil refinery and chemical works, consisting of numerous large storage tanks, structures, stacks and pipework within extensive hardstandings. Several jetties project into the river, some of which support cranes and other tall structures. A landfill site is located to the west. Beyond this complex, are other large-scale industrial installations which sit immediately alongside areas of rough grassland, scrub and marshland and form prominent landmarks in the flat, open landscape.

Adjoining the proposed scheme footprint to the east is a small group of storage tanks and a brownfield site which extends to a linear quay excavated into the southern riverbank. Several large, modern warehouse-style buildings surrounded by hardstandings adjoin the quay and a number of cranes also line the quay on both sides, the largest of which move up and down the quayside and are prominent in views. Further to the east, large-scale chemical installations and steelworks intermixed with areas of rough grassland and scrub dominate the flat, open landscape as far as the coast and the built-up edge of Redcar.

Adjoining the proposed scheme footprint to the south, and forming the South Industrial Zone planning application which the proposed scheme would support (planning application reference R/2020/0357/OOM), is a group of five oil tanks and to the northwest of these is an active area of mounds, plant and equipment whilst to the southwest of the tanks is a flatter area substantially colonised by rough grass and patches of scrub. Further south, a more extensive area of spoil heaps in various stages of reclamation extend as far as a section of the Stockton to Redcar railway line which passes through the post-industrial landscape. This area also includes the locally prominent Dorman Long Tower and South Bank Coke Ovens as part of a disused steelworks beside the railway line. A mixture of modern retail and commercial development on the built-up edge of Middlesbrough gives way to extensive residential areas of relatively high density, intermixed with open amenity spaces.

Teesport Commerce Park adjoins the proposed scheme footprint to the west. The Park comprises several large, modern warehouse buildings surrounded by hardstandings and other infrastructure that extend to the southern riverbank. This section of the river is also highly modified and includes a number of dry docks, dockside cranes and a wharf parallel with the riverbank. To the west of this, more extensive retail and commercial development adjoins the south side of the river and merges with residential areas on the edge of the Middlesbrough conurbation. On the opposite side of the river, the landscape is more open with sizeable areas of rough grassland, scrub and marshland intermixed with landfill and other industrial developments.

The night-time character is a landscape that is extensively lit. Industrial zones and port facilities include high level lighting masts and floodlighting. Urban conurbations and transport corridors are also densely illuminated. Where pockets of landscape are less well-lit the night-time character remains dominated by extensive lighting in neighbouring areas.

In summary, the proposed scheme footprint and its immediate setting are located within an extensively modified landscape alongside the River Tees, historically supporting heavy industrial uses, including steel making. Although steel making has largely ceased, other heavy industries remain along with related infrastructure, intermixed with brownfield land and active landfill operations. Overall, the proposed scheme footprint and its setting exhibit a strong industrial character.

Landscape sensitivity
Landscape sensitivity is determined by professional judgment, combining levels of ‘susceptibility’ to the proposed change and ‘values’ attached to the landscape. Levels of susceptibility and landscape value are based upon analysis of information gathered during the baseline studies, as set out in the preceding sections, and criteria used in the LVIA methodology.

Susceptibility
The susceptibility of a landscape to development change is discussed in paragraph 5.40 of GLVIA3:

“This means the ability of the landscape receptor (whether it be the overall character or quality/ condition of a particular landscape type or area, or an individual element and /or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed facility without undue consequences for the maintenance of the baseline situation and /or the achievement of landscape planning policies and strategies.”

The local East Bellingham to Teesmouth / North Middlesbrough to Teesmouth LCA’s clearly have a long history of heavy industrial activity and the character remains strongly influenced by industry and associated infrastructure. Current planning policy is that the site and immediate environs will promote future economic growth facilitated through STDC. Existing planning designations and predicted future development within the area will further reinforce existing industrial character. The proposed scheme is consistent with planning policy and will be compatible with existing and future development.

The widespread presence of detractors which negatively influence the character and perceptual experience of the landscape is also important as is the absence of landscape characteristics, elements and features of value. Consequently, the landscape is judged to be able to accommodate the proposed scheme with negligible effect on the existing baseline.

Overall, the assessment concludes that the level of susceptibility of the local landscape to the proposed scheme is judged to be ***low***. The susceptibility of the site to the proposed scheme is also judged to be ***low***.

Value
The value attached to the local landscape is determined by the following:

- The landscape is non-designated.
- The quality (condition) of the landscape is mostly poor with the pattern of landscape elements / features either degraded, fragmented or missing altogether as a result of long-established industrial activity.
- Pockets of trees and scrub that have naturally regenerated on the site do not make a significant contribution to the landscape and are common features within the area.
- Scenic quality is poor due to the presence of many incongruous features and detractors.
- Few conservation interests exist, although those that do are of national or international importance.
- Recreational value and facilities are limited.
- Perceptual qualities are predominantly negative with high levels of landscape and visual disturbance and often a lack of tranquillity.

In terms of value attached to the site, its location within a highly degraded landscape with many incongruous features or detractors present in the immediate vicinity, ensures that certain factors are either reduced (scenic quality, representativeness) or absent entirely (landscape quality, rarity, conservation interests, recreational value, perceptual aspects).

Overall, the assessment concludes that the level of value attached to both the site and environs is judged to be ***low***.

Sensitivity
The landscape within the proposed scheme footprint and its environs is identified as being of ***low value*** and of ***low susceptibility*** to change. It is therefore considered to be of ***low sensitivity*** to change in respect of the proposed type of development.

19.4.3 Visual receptors

The visual assessment draws upon the ZTV, viewpoint analysis and computer-generated visualisations to determine the potential effects of the proposed scheme on views and visual amenity experienced by a range of receptors within the study area. Visual receptors are people who live or work in the area, visit the area for a specific reason or pass through the area on foot, cycle, car, etc. Key visual receptor groups are summarised below.

In general terms, views towards the proposed scheme footprint are limited by the combination of relatively flat topography and the screening effect of intervening features that includes large scale industrial / commercial development, urban conurbations and dense tree belts (often alongside main road corridors). Elevated vantage points are located to the south east, on steeply rising ground at Lazenby Bank, Eston Bank and Errington Wood. Whilst views are extensive, varied and dramatic they are also quite distant from the proposed scheme and the site is hard to differentiate amongst the surrounding myriad of urban and industrial features.

There is a virtual absence of receptor locations on the north bank of the River Tees, opposite the proposed scheme footprint. Land is security fenced with no public access and dominated by an oil refinery, silos and chemical works. A raised landfill site to the west of the site creates a local visual horizon.

Views from residential properties
Properties in closest proximity to the proposed scheme footprint are located between 1.3km to 2.5km distance, to the south at South Bank and Grangetown. Existing views are typically ordinary or poor in character, often including prominent tall industrial / infrastructure features that detract from the view. Viewpoints 2, 9 and 10 are considered representative of views obtained from residential properties and associated amenity areas in proximity to the site (**Figures 19.4A, 19.11A** and **19.12A** in **Appendix 14)**.

Views from recreational routes / public rights of way
Two long distance recreational routes cross the study area and are included in the assessment:

- England Coast Path/ Teesdale Way, which passes within approximately 800m of the proposed scheme footprint to the south where it closely follows a section of the Stockton to Redcar railway line. The coastal path also passes within approximately 2km to the west following the route of the A178.
- National Cycle Route (NCR) 1, which follows local roads and streets through the built-up area of Eston on the north eastern edge of Middlesbrough and passes within approximately 1.3km of the proposed scheme footprint to the south where it partly coincides with the route of the A66.

In addition to these long-distance recreational routes, one shorter public footpath crosses the study area: Footpath 102/2/1, which coincides with the route of England Coast Path/ Teesdale Way. For the purposes of this assessment, this public footpath is assessed as part of the coastal path. Viewpoint 4 is representative of a close range view from the England Coast Path (**Figure 19.6** in **Appendix 14)**.

The National Cycle route in closest proximity to the proposed scheme footprint follows roads at Grangetown and South Bank. Views are urban and industrial in character and often restricted by intervening buildings and vegetation.

Views from heritage assets
The primary heritage asset included in this section is the Tees Transporter Bridge, specifically from the viewing area at the foot of the bridge. Refer to Viewpoint 12, **Figure 19.14A** in **Appendix 14**.

Views from recreational sites
There are a number of locations within the study area that are frequented by sightseers and other recreational users. These include:

- Coastal margins at Coatham Sands, nature reserves at Bran Sands and North Gare Sands and the North / South Gare Breakwaters at Tees Mouth to the north east;
- Coatham Marsh Nature Reserve to the north east;
- Errington Wood, woodland walks with picnic areas and elevated views to the north and west;
- Lazenby Bank, Eston Nab and Eston Moor. The elevated and wooded escarpments offer distant views to the north within a woodland / moorland setting;
- Cargo Fleet River View Park. A small park located on the south bank of the River Tees south west of the site;
- RSPB Saltholme and neighbouring reserves, approximately 3km to the west. The area obtains distant views towards the site but the site itself is screened by a raised landfill site and other intervening features. The overall middle and far distant view to the east is dominated by a myriad of stacks, silos and pylons that project into the skyline.

Viewpoints 1, 3, 6, 7 and 11 are representative of key views from recreational sites (**Figures 19.3A, 19.5A, 19.8A, 19.9A** and **19.13A** in **Appendix 14**).

Views from local roads and railways
Local roads and railways which run through the study area and are included in the assessment are limited to:

- A66, which links Redcar with Middlesbrough and passes within approximately 1.3km of the proposed scheme footprint to the south where it skirts around South Bank;
- A178, which extends north of Middlesbrough to Hartlepool and passes within approximately 2km of the proposed scheme footprint to the west in the vicinity of Saltholme Marshes; and
- Stockton to Redcar railway, which passes within approximately 800m of the proposed scheme footprint to the south.

Viewpoints 4, 5, 8 and 10 are considered representative of views from roads and railway in closest proximity to the proposed scheme footprint (**Figures 19.6, 19.7, 19.10** and **19.12A** in **Appendix 14**).

19.4.4 Visual receptor sensitivity

Visual receptor sensitivity is determined by professional judgment, combining levels of 'susceptibility' to the proposed change and 'values' attached to the view. Levels of susceptibility and value are based upon analysis of information gathered during the baseline studies, as set out in the preceding sections, and criteria used in the LVIA methodology.

Visual receptor sensitivity at each of the representative viewpoints is summarised in the tables at **Appendix 12**. High sensitivity view receptor locations have been identified at Eston Nab (Viewpoint 1), Errington Wood (Viewpoint 11) and the Tees Transport Bridge viewing area (Viewpoint 12).

19.4.5 Future baseline

The proposed scheme lies within a wider area of future economic regeneration, to be delivered through the South Tees Regeneration Programme. The South Tees Regeneration Masterplan (STRM) identifies large tracts of land to the south of the River Tees that will be transformed into a world-class, modern and large-scale industrial business park. The proposed scheme falls within the SIZ of the STRM. Land adjoining the proposed scheme is currently in outline planning for the development of up to 418,000sqm of general industry, storage or distribution facilities with office accommodation, HGV and car parking and associated infrastructure works.

Although not yet determined, it is likely the proposed scheme will be seen in context of future development comprising of large scale warehouse and industrial buildings within the SIZ. As a result, the existing industrial character of the site and its surroundings is predicted to be further reinforced by future development.

The most significant potential aspect of the future baseline is that large scale buildings may alter the setting, screen, or partially screen views to the proposed scheme. Where appropriate the assessment includes commentary regarding potential effects of the SIZ development as a ‘future baseline’ to the proposed scheme.

19.5 Landscape and visual effects

This section describes the significance of landscape and visual effects on baseline conditions during the construction and operational phases of the proposed scheme. The significance of landscape and visual effects is determined by professional judgement, based on the sensitivity of the receptor, combined with the magnitude of the effect. Effects can be adverse or beneficial.

The ZTV shown on **Figure 19.2** illustrates the theoretical extent of the study area within which proposed tall structures may be seen. The combination of tall structures and flat surrounding landscape results in a ZTV that appears to be both extensive and relatively unbroken. The ZTV has some merit in demonstrating the screening effects of urban and industrial areas and was used to inform the selection of representative viewpoints, however, the extent of the ZTV should not be interpreted as a ‘degree of effect’.

Potential effects of the proposed scheme were assessed from a series of representative viewpoints located within the ZTV (see **Appendix 12 and 14** and **Figure 19.2**). The assessment of viewpoints identifies effects on specific receptors but may also inform professional judgement of the potential effects upon other receptors in similar geographical locations to the viewpoint.

19.5.1 Mitigation measures

Woodland, tree and shrub planting is a typical mitigation measure used to screen development and improve integration of a scheme within the landscape. Given the location of the proposed scheme, the ‘remoteness’ of the application boundary to receptor locations and very tall height of proposed structures, the use of landscape planting is not considered to be practical, effective or appropriate to the character of the site. Both short term and long term operational effects will therefore remain the same.

The future development of the SIZ scheme to the immediate south of the proposed scheme footprint may include landscape planting along the western site boundary, adjacent to Smith’s Dock Road. Long term establishment of planting could have a beneficial screening effect in views towards the proposed scheme from close range receptors travelling along the road. Given the lack of detail over future delivery, nature and extent of development this assessment assumes a 'worst case' scenario and does not include potential beneficial effects of planting within neighbouring sites.

19.6 Potential landscape and visual effects during the construction phase

Landscape and visual effects that result from the construction process will be temporary and short term. Physical effects to existing landscape features will occur during the site clearance phase of construction.

19.6.1 Effects on physical landscape features

There will be no loss of significant landscape features within the proposed scheme footprint. The proposed scheme will result in the loss of areas of rough grassland and scattered scrub and require minor alteration of existing topography. Existing features are considered to be of low sensitivity to change. Loss or alteration of those features will incur a low adverse magnitude of effect and a **negligible** overall significance of effect.

19.6.2 Effects on landscape character and visual receptors

Construction activity will include establishment of site cabins, vehicular parking, materials storage and processing facilities, hoarding and fencing. Vehicular access to site will be via Smith's Dock Road and / or Tees Dock Road. Site activity during construction will be varied and include stripping and temporary stockpiling of soils and materials. There will be constant and varied vehicular movements and on-site activity. Construction phases will require the use of relatively tall plant including cranes, piling rigs and a concrete crusher. Certain activity will require use of river barges.

Quayside construction activity will be at ground level. Use of taller plant will not be prominent in views from receptors. Views from close range residential receptors to the south of the site are screened by intervening features. Tall plant is unlikely to be seen above built and vegetative horizons and where there are glimpsed views to plant these will be seen in context of other comparable, visually distracting features. In views from high sensitivity visual receptor locations on distant, elevated ground to the south and east, construction activity will barley be perceptible in the wider scene, appearing indistinguishable from the complex visual pattern of existing infrastructure and industrial features.

Increased construction traffic at site entrances and local roads will not incur significant effects to other (low sensitivity) road users. Construction traffic will be typical of existing heavy goods and haulage vehicle movements that are synonymous with surrounding industry. There will be no discernible effect to users of the England Coast Path that runs alongside the Tees Dock Road; existing views are poor, dominated by transport infrastructure and industry. Effects on views from close range receptors will be low adverse magnitude and incur a **minor negligible adverse** significance of effect.

No significant effects are predicted to landscape character during the construction phase. The existing site and wider environs are heavily industrial in character, including disparate brownfield areas, buildings, very tall infrastructure, towers and stacks. Construction activity will not alter existing character, with plant, structures and activity being comparable in nature and appearance to the existing baseline.

Effects on landscape character during the construction phase will be low adverse magnitude and incur a **negligible** overall significance of effect.

19.7 Potential landscape effects during the operational phase

There will be no significant effects upon either the character of the proposed scheme footprint, its immediate environs or adjoining landscape character areas during the operational phase of the proposed scheme. The proposed scheme will be compatible with the existing, strongly industrial landscape that includes large-scale industrial buildings, infrastructure and transport corridors. Key characteristics of the existing landscape will not be significantly altered. The removal of derelict and disparate structures along the existing riverbank and introduction of the proposed new quay will be of some benefit to the river front character.

Potential effects to landscape character outside of the site, result from indirect visual effects of the proposed scheme, experienced by receptors within those surrounding landscape areas. In all cases, regardless of certain landscape areas being of high sensitivity or high value, existing character is strongly influenced by views towards extensive areas of industry and infrastructure. Despite proposed cranes and temporarily stored wind turbine components being very tall (theoretically visible across almost the entire study area) the effect of those features will not significantly alter existing visual character, as perceived from the surrounding landscape.

There will be no significant effect upon night-time character of the landscape. The proposed quay will be uniformly lit from high level masts, introducing more lighting than currently exists within the site. However, in context of the existing, extensively lit night-time character the magnitude of change will not be significant.

The proposed scheme will incur **low adverse** magnitude of effect on landscape character within the site and the wider environs, the overall significance of effect is considered to be **negligible**.

Effects will be permanent, lasting the duration that tall cranes and stored components are present as an operational feature of the proposed scheme.

19.8 Potential visual effects during the operational phase

This section summarises the effects of the proposed scheme on views within the study area and on visual receptors (people) who experience the view during the operational phase of the scheme. An assessment of visual effects was undertaken from 12 viewpoints, selected to represent typical views from key receptors at varying distances and orientations around the site. The locations of the viewpoints are identified on **Figure 19.3** in **Appendix 14.** Refer also to the Representative Viewpoint Analysis Tables (**Appendix 12 19.1**) and viewpoint photography / photomontage views (**Figures 19.3A to 19.14B** in **Appendix 14**).

General overview

Predicted visual effects are based upon a 'worst case' scenario that the proposed scheme will be used in support of the offshore wind farm industry, requiring pre-assembly and storage of very tall wind farm components, the use of tall cranes and mooring of large installation vessels at two berth points on the quayside. It should be noted that full height wind turbine towers (up to 150m high) stored vertically on the quayside will not be present at all times and that numbers of towers stored and out-loaded to vessels will be sequential and vary.

The operational effects of the proposed quay and other associated ground level features, will not incur significant visual effects. General views towards the proposed scheme footprint are often limited by intervening buildings and established belts of vegetation. There are no publicly accessible receptor sites that will obtain close range views of the quay. The proposed quay will be set into the riverbank and its appearance will be compatible with existing riverside structures. Where potential views do exist, they are at some distance and the quay and landside features will either not be visible or, at worst, barely discernible.

Manoeuvring and mooring of large installation vessels alongside the proposed quay is also considered visually compatible with existing vessels that make passage along the river and are an integral feature of the industrial River Tees. Similar (albeit smaller) vessels are often moored upstream at Normanby Wharf; tall jack up legs seen high in the skyline form part of the riverside visual character.

Potential significant visual effects will be derived from the operational use of very tall heavy lift cranes and the storage and assemblage of tall, large scale wind farm components. Tall features will potentially be seen rising above local visual horizons, or may be visible from elevated vantage points within the study area.

Figure 19.1 Example of a heavy lift crawler crane

The most visually prominent section of the heavy lift crane will be the main tower, standing approximately 106m above ground level with an 8m base diameter. The lattice boom can extend up to 192m and as a structure it is substantial but in distant views the open steelwork construction will be slightly 'lighter' in appearance. The crawler cranes can be moved along the quayside. During operational phases and out-loading to vessels the cranes will be stationed at each of the heavy lift platforms, approximately 300m apart.

Summary of visual effects

Effects on views from residential properties

The effects on representative views from residential receptors are illustrated in the computer generated photomontage images; **Figures 19.4B, 19.11B** and **19.12B** in **Appendix 14**.

Residential properties and associated amenity space in closest proximity to the proposed scheme footprint are at South Bank and Grangetown. Middle distant horizons are formed by residential property and vegetation. Industrial towers, stacks and pylons are often prominent in the skyline. Existing views towards the site from both of these communities are generally of ordinary or poor quality and the overall sensitivity of the receptor locations considered to be medium.

There will be no views to ground level activity within the proposed scheme. Effects will be derived from the visibility of proposed tall features (lifting cranes, the tallest stored wind turbine components and upper sections of installation vessel jack up legs) seen above middle distant horizon lines. The magnitude of change in views varies between medium to low adverse depending, in part, on the degree of visibility and intermix of proposed features seen against existing industry and infrastructure.

The overall assessment of the significance of effect in views from residential property to the south of the proposed scheme footprint ranges between **minor moderate adverse** to **minor adverse**. In terms of EIA these effects are not significant.

Views from recreational routes / public rights of way

Public rights of way are comparatively few within the central study area. In closest proximity to the proposed scheme footprint is the long distance England Coast Path / Teesdale Way. The route follows busy roads and the railway corridors to the south of the proposed scheme footprint. Existing views are highly industrial in character with perceptual attributes adversely affected by traffic movement, noise and smells. National Cycle Route 1 also follows busy urban road corridors. Potential views towards the proposed scheme will be transitory, varied and mostly screened by intervening built features.

There will be no views to ground level activity within the proposed scheme footprint. Upper sections of the proposed heavy lift cranes and the tallest stored wind turbine components will be seen above the middle distant horizon line and in the context of existing industrial and infrastructure features. The magnitude of change in views is predicted to be low adverse.

The overall assessment of the significance of effect in views from recreational routes to the south of the site is **minor adverse**. In terms of EIA these effects are not significant.

Views from heritage assets

The effects on the representative view from the viewing area is illustrated in the computer generated photomontage image, **Figure 19.14B** in **Appendix 14.**

Representative viewpoint 12 specifically addresses potential effects experienced by high sensitivity receptors at the viewing area on the southern river bank immediately adjacent to the Tees Transporter Bridge. The bridge dominates the foreground scene and the iconic structure is the focus of the viewer's attention.

There will be no views to ground level activity within the proposed scheme footprint. Lifting cranes, tall wind turbine components and upper sections of installation vessel jack up legs will be seen against the skyline. Proposed features will be partially screened by the Teesside BioMass building which will remain the more dominant feature in the middle distance. Proposed tall structures will be seen in context of the existing bio-mass facility, stacks, silos and very tall electricity pylons at the river crossing point.

The predicted magnitude of change in the view is low adverse. The assessment of the significance of effect in views from the site of the transporter bridge is **minor adverse**. In terms of EIA the effect is not significant.

Views from recreational sites

The effects on representative views from recreational sites are illustrated in the computer generated photomontage images; **Figures 19.3B, 19.5B, 19.8B, 19.9B** and **19.13B** in **Appendix 14**.

Representative viewpoint locations include high sensitivity receptor sites at Eston Nab and Errington Wood. Both are popular with walkers and other recreational users. They are located on steeply rising ground with extensive and elevated panoramic views that encompass coastal margins, farmland, dense urban conurbations and extensive industrial development in the River Tees plain.

Both locations are distant from the proposed scheme footprint and proposed taller features will be seen within a strongly industrial complex of buildings, towers, stacks and pylons. The distant view from Errington Wood is more strongly influenced by a foreground of arable fields and wooded slopes, although industrial and urban conurbations remain significant features in the view. Proposed taller structures will be seen in the distance and above the skyline.

The predicted magnitude of change in both the Eston Nab and Errington Wood views is considered low medium adverse. The assessment of the significance of effect in the views is **minor moderate adverse**. In terms of EIA these effects are not significant.

Cargo Fleet River View Park is located to the south west of the proposed scheme footprint on an elevated knoll of land. Outward views are limited by surrounding dense vegetation. The most open aspect, and focus of the view, is upstream, away from the proposed scheme footprint. Proposed taller features will be seen in filtered / glimpsed views through existing vegetation and in context of existing tall industrial and riverside features, including moored windfarm installation vessels and cranes. The assessment of the significance of effect in the view is **minor negligible adverse** and not significant.

Other recreational receptor sites include those within sensitive coastal margin landscapes to the north east of the site at South Gare peninsula and Coatham Marsh Local Nature Reserve. In both cases the existing view is strongly influenced by tall industrial features clearly seen in the skyline and often forming the visual horizon. The magnitude of change in these views is predicted to be low adverse and the assessment of the significance of effect in the view is **minor negligible adverse**. In terms of EIA these effects **are not significant.**

No significant effects visual will occur to road and rail users. Both receptor groups are considered to be low sensitivity and any magnitude of change in existing, transitory views towards site will **be low adverse or negligible.**

In summary, the range of representative viewpoints and associated varying experiences of receptors demonstrates that the proposed scheme will not incur significant adverse visual effects. Existing views towards the proposed scheme footprint are strongly influenced by industrial and urban features. There will be no views to ground level, quayside activity. Where proposed tall structures are visible in closer range views, they will be seen in context of other comparable tall features, either in the foreground or forming part of the existing horizon. In more distant or elevated views proposed tall structures may be seen in the skyline but the magnitude of change in the view will be diminished by the wide and varied context of the scene.

Effects will be permanent, lasting the duration that tall cranes and stored components are present as an operational feature of the proposed scheme.

The proposed heavy lifting cranes are some of the largest in the world and the wind turbine components are equally massive in size. Proposed features are matched in scale by the expansive industrial landscape. The predicted and planned future use of the site and surroundings is large scale, modern Industrial development. The proposed quayside, its potential use in support of the wind farm industry and requirement of large scale lifting cranes are considered to be both visually and contextually compatible with existing and future emerging industry.

19.9 Compliance with planning policy.

In **Table 19.2** the proposed scheme is assessed against planning policy relevant to landscape and visual matters summarised at **Section 19.2**.

Table 19.2 Compliance with planning policy

Policy / guidance	Compliance commentary
NPPF 2019	
Achieving well-designed places, Paragraph 127	Complies. The proposed scheme will replace existing derelict and degraded riverside structures with a new quay, appropriate to the industrial character and function of the River Tees.
Conserving and enhancing the natural environment, Paragraph 170	Complies. The scheme will introduce improvements to an existing degraded site and has no adverse effect upon landscape character or valued landscapes.
Paragraph 180: limiting the impact of light pollution.	Complies. The proposed scheme will not cause significant adverse effects to existing night time character. Proposed lighting will be seen in context of existing, extensive night time lighting within neighbouring industrial, port and urban conurbations.
Redcar and Cleveland Local Plan (2018)	
Policy SD4 (General Development Principles)	Complies. The proposed scheme will not incur significant adverse impact on environmental assets. The development is appropriate to the existing character of the site and its surroundings.
Policy LS4 (South Tees Spatial Strategy)	Complies. The proposed scheme is considered to represent an improvement of the environmental quality of the River Tees.
Policy N1 (Landscape)	Complies. The proposed scheme will not cause loss of features important to the character of the landscape. Landscape planting is not considered to be practical, effective or appropriate to the character of the site.
South Tees Area Supplementary Planning Document (SPD) 2018	
Development Principle STDC1 (Regeneration Priorities)	Complies. The proposed scheme will not cause loss of features important to the character of the landscape. The scheme will introduce improvements to an existing degraded site and has no adverse effect upon landscape character or valued landscapes.

The proposed scheme is considered to comply with current planning policy and future development strategies that relate to landscape and visual issues.

Royal HaskoningDHV

20 FLOOD RISK AND COASTAL DEFENCE

20.1 Introduction

This section of the EIA Report considers the following potential environmental impacts:

- Impacts to coastal / tidal protection and flood defence.
- Effects on the hydrodynamic and sedimentary regime.
- Effects on the integrity of flood defences and the risk of tidal flooding.
- Effect of fluvial flows on flood risk.
- Effects of the frequency of overtopping.

20.2 Policy, guidance and consultation

20.2.1 Policy

20.2.1.1 National Planning Policy Framework

The NPPF (Ministry of Housing, Communities and Local Government, 2019) and the accompanying PPG for Flood Risk and Coastal Change (2014) set out the requirements for Flood Risk Assessments (FRA) and provides technical guidance on flood risk management, including the Sequential and Exception Tests, consideration of climate change allowances and development classifications. The information contained in these documents form the basis of flood risk documentation.

The NPPF sets out the Government's planning policies for England and seeks to ensure that flood risk is considered at all stages of the planning and development process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at risk of flooding.

The PPG for Flood Risk and Coastal Change provides direction on how flood risk should be considered at all stages of the planning and development process, with additional guidance on flood risk vulnerability classifications and managing residual risks (**Table 20.1**). The PPG for Flood Risk and Coastal Change provides further description of Flood Zones, Vulnerability Classifications and their compatibility in order to assess the suitability of a specific site for a certain type of development.

Table 20.1 Summary of flood zone definitions

Flood zone	Probability of flooding	Return periods
1	Low	Land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
2	Medium	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%); or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%).
3a	High	Land having a 1 in 100 or greater annual probability of river flooding (≥ 1%); or Land having a 1 in 200 or greater annual probability of sea flooding (≥ 0.5%).
3b	High – Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

20.2.1.2 National Policy Statement for Ports

The assessment of potential impacts on flood risk and coastal defence has been made with reference to the policy guidance for this topic area contained within the NPS for Ports.

The “minimum requirements for FRAs” as outlined within the NPS for Ports Paragraph 5.2.5 state that they should:

- be proportionate to the risk and appropriate to the scale, nature and location of the project;
- consider the risk of flooding arising from the project, in addition to the risk of flooding to the project;
- take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;
- be undertaken by competent people, as early as possible in the process of preparing the proposal;
- consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;
- consider the vulnerability of those using the site, including arrangements for safe access;
- consider and quantify the different types of flooding (whether from natural or human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;
- consider the effects of a range of flooding events, including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the remaining (known as ‘residual’) risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;
- consider if there is a need to be safe and remain operational during a worst case flood event over the development’s lifetime; and
- be supported by appropriate data and information, including historical information on previous events.

The requirements identified above were incorporated into the FRA (**Appendix 15**) undertaken for the proposed scheme, which has in turn informed this section of the EIA Report.

Table 20.2 summarises the requirements of the NPS which are of relevance to this section of the EIA Report.

Table 20.2 Summary of NPS requirements with regard to flood risk

NPS for Ports requirement	NPS reference	EIA Report reference
The applicant and the decision-maker should take account of the policy on climate change adaption in section 4.13.	Section 5.2, Paragraph 5.2.2	**Section 20.4.3**, **Section 22** (climate change) and **Appendix 15** (Flood Risk Assessment)
The aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk.	Section 5.2, Paragraph 5.2.3	**Section 20.4** and **Appendix 15** (Flood Risk Assessment)

NPS for Ports requirement	NPS reference	EIA Report reference
Where new development is, exceptionally, necessary in such areas, including 'water compatible' development, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. Port development is water-compatible development and therefore acceptable in high flood risk areas.	Section 5.2, Paragraph 5.2.3	**Sections 20.4, 20.5 and 20.6** and **Appendix 15** (Flood Risk Assessment)
The decision-maker should not consent development in Flood Zone 2 (in England), unless it is satisfied that the Sequential Test requirements have been met. It should not consent development in Flood Zone 3 (or Zone C) unless it is satisfied that the Sequential and Exception Test requirements have been met.	Section 5.2, Paragraph 5.2.12	Section **20.5** and **Appendix 15** (Flood Risk Assessment)
Full account of climate change impacts and the increased probability of extreme weather events is taken in applications, in order to ensure, so far as reasonably possible, that no commercial loss will be experienced through inadequacy of infrastructure.	Section 5.2, Paragraph 5.2.17	**Section 20.4.3**, **Section 22** (climate change) and **Appendix 15** (Flood Risk Assessment)
The decision-maker should ensure that the applicant has considered the impact of the port development on the risk of flooding outside the port area and has taken reasonable measures to reduce this as far as possible.	Section 5.2, Paragraph 5.2.19	**Sections 20.5** and **20.6**

20.2.1.3 Flood Risk Assessments: Climate Change Allowances

The Environment Agency's online advice note 'Flood Risk Assessments: Climate Change Allowances', published in February 2016, and last amended in July 2020, has been used to inform this section.

This advice note provides guidance on the application of climate change allowances which considers the geographical location, lifespan of the proposed scheme, flood zones, vulnerability classification associated with the type of development and critical drainage areas. Guidance is provided for determining appropriate climate change allowances for fluvial events, tidal / sea level rise and peak rainfall intensities.

20.2.1.4 Local Policy and Guidance

This section of the EIA Report and the FRA has been guided and informed by relevant local policy, studies and guidance documents.

The following documents have been reviewed as part of the FRA and were then used to inform the assessment within both the FRA and the existing environment section, as well as the wider proposed scheme:

- River Tees Catchment Flood Management Plan (CFMP).
- Northumbria River Basin Management Plan.
- River Tyne to Flamborough Head SMP2 .
- Redcar and Cleveland Borough Council Local Flood Risk Management Strategy (LFRMS).
- Redcar and Cleveland Borough Council Preliminary Flood Risk Assessment (PFRA).
- Redcar and Cleveland Borough Council Level 1 Strategic Flood Risk Assessment (SFRA).
- Redcar Surface Water Management Plan.
- Tees Valley Water Cycle Study.
- Tees Valley Investment Plan 2019-29.
- Redcar & Cleveland Development Plan (Local Plan).
- South Industrial Zone Environmental Statement Volume 3 Technical Appendices (Water Management and Flooding).
- Tees Tidal Flood Risk Management Strategy.

- Tidal Tees Integrated Flood Risk Modelling Study.

20.2.2 Consultation

20.2.2.1 Environment Agency

The Environment Agency were contacted to request the Product 5 and 8 data packages relevant to the site. This was received from the Environment Agency on 22nd July 2020 and included the Tidal Tees Integrated Flood Risk Modelling Study as well as the data from the 2011 ISIS-TUFLOW model which covers the Tees Estuary from Teesmouth at the coast to the Tees Barrage upstream.

Additionally, as part of the September 2020 scoping consultation, the Environment Agency provided comments on their requirements when considering the potential impact of dredging on the estuary, the need to consider all sources of flooding, any mitigation measures required to ensure a safe development in a 1 in 200 year event, guidance on the climate change guidelines to be reviewed and information related to the potential consents / permits that may be needed for the proposed scheme. This scoping opinion was reviewed and used to inform the assessment for this section of the EIA Report and the FRA.

20.2.2.2 Lead Local Flood Authority

Following consultation with the Lead Local Flood Authority (LLFA) as part of the September 2020 scoping consultation, which for the proposed scheme is RCBC, they offered no additional comments regarding the contents and methodology outlined in the scoping report (submitted July 2020).

20.2.2.3 Canals and River Trust

The Canals and River Trust provided information relating to the flows and water levels upstream and downstream of the Tees Barrage. This information was used to inform this section of the EIA Report, as well as hydrodynamic and sedimentary plume modelling reported in **Section 6**.

20.3 Methodology

20.3.1 Study area

The study area for this section of the EIA Report comprises the area which has the potential to be both directly and indirectly impacted by the proposed scheme. In this case, the maximum extent of the potential impact has been determined to be the area over which the potential effects of the proposed scheme on flood risk may occur, which includes the Tees estuary and the land immediately to the east of the channel.

20.3.2 Methodology used to describe the existing environment

This section of the EIA Report has been informed through a combination of desk-based assessment and modelling studies. An FRA must consider the issues associated with all sources of flooding in accordance with NPPF and the supporting PPG for Flood Risk and Coastal Change. Therefore, the desk-based assessment has included a review of publicly available information, namely Environment Agency Product 5 & 8 data packages and relevant planning documents to assess the risk of flooding from tidal, fluvial, surface water, groundwater, reservoirs and other sources. A review of findings from previous FRAs within the Tees estuary has also been undertaken.

Online flood datasets which have been reviewed include:

- Flood Map For Planning (Flood Zone 2, Flood Zone 3 ,Flood Storage Areas, Flood Defences, Areas Benefiting from Defences);
- Risk of Flooding from Rivers and Sea; and,

- Historic Flood Map.

The Environment Agency data consists of the following elements:

- Product 5: Detailed flood risk assessment data package including maps of flood zones, defences and storage areas, areas benefitting from defences, historic flood event outlines and model extent, reports, including flood modelling and hydrology reports and modelling guidelines;
- Product 8: Flood defence breach hazard map including, maximum flood depth, maximum flood velocity and maximum flood hazard.

20.3.3 Methodology for assessment of potential impacts

The assessment methodology used for determining the potential environmental impacts on flood risk and coastal defence associated with the proposed scheme is provided within **Section 5**.

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.

The findings of the EIA with regard to the hydrodynamic and sedimentary regime (as set out in **Section 6**) are of relevance to this section and reference to this topic is made in this section.

20.3.3.1 Assessment of receptor sensitivity and magnitude

Section 5 provides general definitions, guidelines and examples for determining the sensitivity of receptors and the magnitude of impacts in this EIA Report.

In the context of this section, specific examples of receptor sensitivity and receptor magnitude relevant to flood risk and coastal defence are provided in **Table 20.3** and **Table 20.4**. The examples provided have been selected using professional judgement and knowledge of the relevant policies and guidance.

Table 20.3 Sensitivity of receptor

Sensitivity	Topic specific description
Very High	• Increased risk of flooding to nationally significant infrastructure as a result of the proposed scheme; • Internationally or nationally designated planning policy areas; • Major residential and commercial developments not currently at risk from flooding neighbouring the proposed scheme; or • Risk to life associated with significant flood depth and flow velocity.
High	• Increased risk of flooding to locally significant infrastructure as a result of the proposed scheme; • Residential and commercial developments not currently at risk from flooding neighbouring the proposed scheme; or • Potential risk to life associated with significant flood depth and flow velocity.
Medium	• Local planning policy designated sites; • Residential property situated in existing flood zones; or • Commercially farmed agricultural land.
Low	• Drainage that does not discharge to high sensitivity sites or existing functional floodplain; or • Waterside, amenity land uses specifically sited adjacent to channel or watercourse
Very Low	• Drainage that does not discharge to sites of any significance or sensitivity to flood risk; or • Water compatible land uses which need to be sited either in or adjacent to channel or watercourse.

Table 20.4 Impact magnitude

Magnitude	Topic specific description
Very High	• Significant number of properties or people at risk of flooding as a result of the proposed scheme during construction and operation; • Causing residential and commercial developments (existing and proposed) to be at permanent risk of flooding as a result of the proposed scheme; or • Increase in surface water runoff from the site having a significant permanent impact on the catchment hydrology in the vicinity.
High	• Localised impact on properties or people at risk of flooding as a result of the proposed scheme during construction; • Causing existing residential and commercial developments to be at permanent risk of flooding as a result of the proposed scheme; or • Increase in surface water runoff from the site having a permanent impact on the catchment hydrology in the vicinity.
Medium	• Small number of properties at flood risk during construction; or • Increase in surface water runoff from the site having a moderate permanent impact on the catchment hydrology in the vicinity.
Low	• Minor temporary increases in flood depths with no new flooding internally in properties expected.
Very Low	• No impact on the long term land use or no material change to land use of any duration has been identified.

20.4 Existing environment

20.4.1 Review of flood risk studies

20.4.1.1 Tees Tidal Flood Risk Management (FRM) Strategy

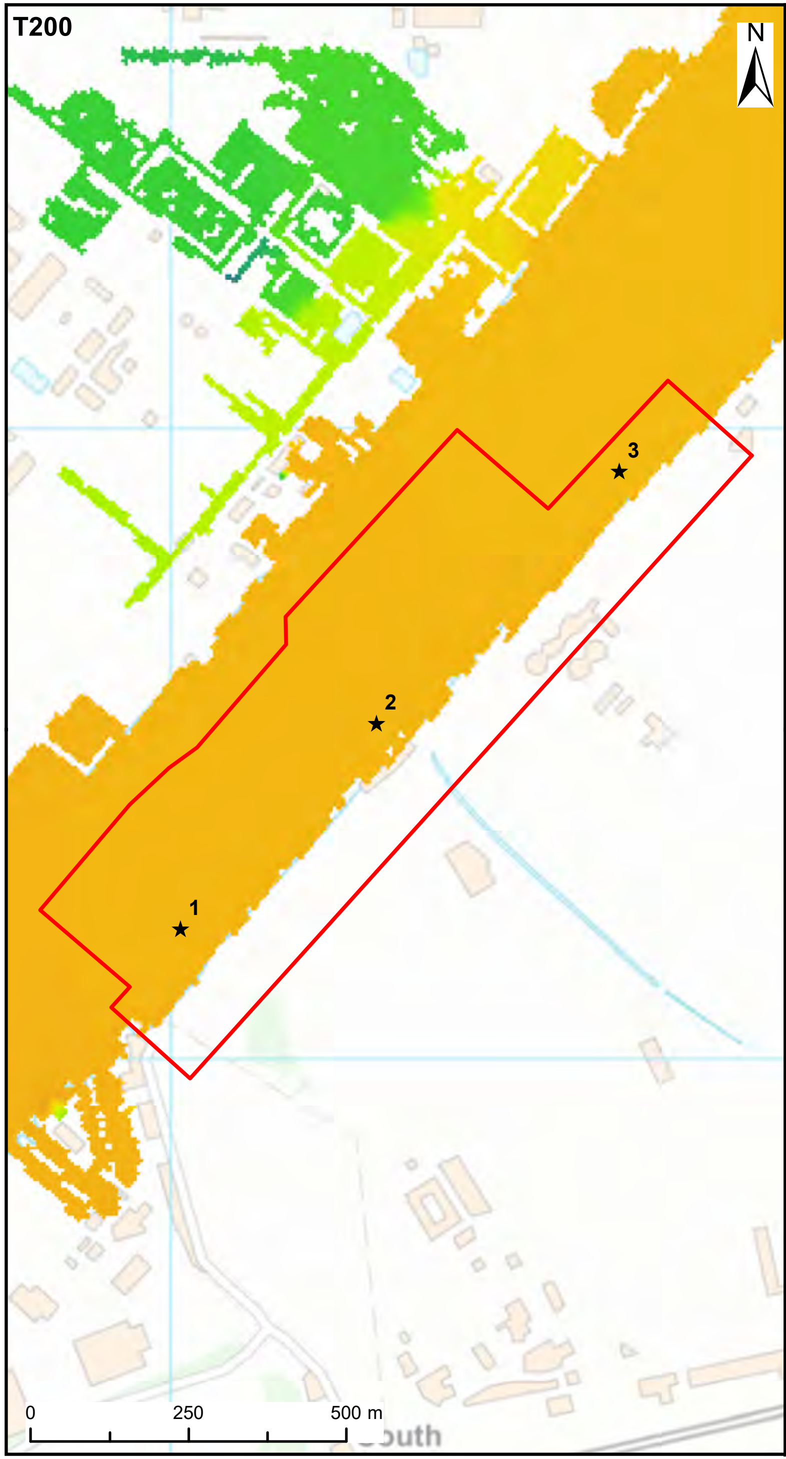
The Tees Tidal Flood Risk Management (FRM) Strategy (Environment Agency, 2009) identified the need for improvements or raising of existing flood defences within the Tees estuary, up to the Tees Barrage. This report also highlighted areas which may be at risk of flooding, either at present or in the future. Areas identified as being at risk are those located where ground levels are less than 5.0m AOD. This level relates to a 0.1% (1 in 1,000) probability of a flood event occurring in any one year. A water level with a 0.5% (1 in 200) probability of occurrence in any one year is classified in the Tees Tidal FRM Strategy as being 4.19m AOD (Environment Agency, 2009). The highest recorded flood event along the Tees occurred in 1953 and reached a level of 4.0m AOD.

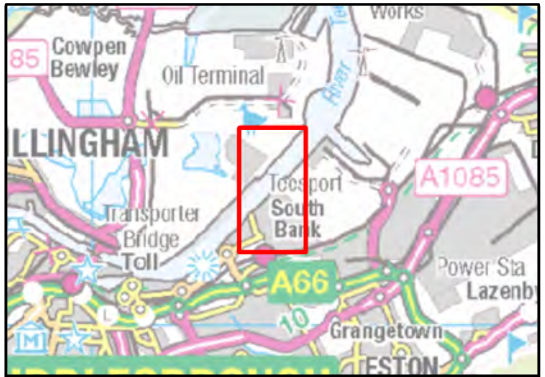
20.4.1.2 Tidal Tees Integrated Flood Risk Modelling Study

The Tidal Tees Integrated Flood Risk Modelling Study (Environment Agency, 2011) expanded upon the Tees Tidal FRM Strategy through development and application of an ESTRY-TUFLOW model that covers the Tees estuary from Teesmouth at the coast to its upstream extent at the Tees Barrage.

The report concludes that some of the area shown as being within the footprint of the proposed scheme, namely the proposed dredge footprint, is in Flood Zone 3, associated with the 1 in 200-year return period event as a result of tidal flooding.

Table 20.5 presents the level in m AOD for a 1 in 200-year and 1 in 1,000-year return period event, taken from the 2011 Tidal Tees Integrated Flood Risk Modelling Study. The data was taken from three points spaced across the entire quay frontage as outlined on **Figure 20.1**. The proposed quay would be constructed at a level of 5.84m AOD, providing suitable protection against the 0.5% (1 in 200) and 0.1% (1 in 1,000) annual exceedance probability event for the present day.





Legend:

Redline Boundary*

★ Modelled Location Points

Water Levels from Tidal Tees Integrated Flood Risk Modelling Study (Environment Agency, 2011)

4.4
4.3
4.2
4.1
4.0
3.9
3.8
3.7
3.6
3.5
3.4
3.3

* The proposed dredge footprint at the Tees Dock turning circle has been omitted from the figure as the modelled water levels are relevant to the assessment of flood risk at the quay wall and the land adjacent to the quay rather than the proposed in-channel works

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

Present Day Modelled Water Levels

Figure: 20.1	Drawing No:

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	06/10/2020	FC	HW	A4	1:12,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
WATER
BURNS HOUSE
HARLANDS ROAD
HAYWARDS HEATH
RH16 1PG
+44 (0)14 4445 8551
www.royalhaskoningdhv.com

Table 20.5 Data taken from the 2011 Tidal Tees Integrated Flood Risk Modelling Study

Study node point name	Return period (years)	Modelled Water Level (m AOD)
Point ID 1	200	4.133
	1,000	4.392
Point ID 2	200	4.128
	1,000	4.390
Point ID 3	200	4.125
	1,000	4.386

For the purposes of this assessment, it is assumed that the baseline water levels for the whole site should be rounded to two decimal places, which for the 1 in 200-year and 1 in 1,000-year return periods are 4.13m AOD and 4.39m AOD respectively.

20.4.1.3 South Industrial Zone Environmental Statement

STDC submitted an ES (July 2020) for general industry and storage or distribution uses within the part of the South Industrial Zone that lies immediately south of the proposed scheme footprint.

The proposed scheme which is the subject of this report is required to support STDC's landside proposals and as such, the water management and flooding report and associated FRA submitted for that application was reviewed in order to understand the interactions between the two sites. A summary of relevant information is presented below.

The SIZ FRA outlines that the site of the proposed landside development adjacent to the proposed scheme footprint is at very low risk from fluvial flooding. There is a moderate risk of tidal / coastal flooding. However, the ground level for the SIZ application is to be set above the 1 in 200-year tidal flood level, including climate change adjustment until 2100. Additionally, the surface water flood risk ranges from low to high, resulting in an overall moderate risk. However, the higher risk areas are predominantly due to localised depressions, and mostly surface flows are shallow and do not follow any clear overland flow paths.

The Sustainable Drainage Strategy for the site aims to reduce the surface water flood risk at the site. The report states that low permeability concrete surfaces are proposed for the majority of the ground across the site, where run off will be collected and passed through appropriate Sustainable Drainage System (SuDS) treatment.

20.4.2 FRA undertaken specifically for the proposed scheme

To inform this section of the EIA Report a separate FRA has been undertaken specific to the proposed scheme footprint and is included as **Appendix 15**. Key information from the FRA related to flood risk from all sources to the proposed scheme footprint is set out in the following sections.

20.4.2.1 Flooding from the sea (tidal/coastal)

The Environment Agency Flood Map for Planning (Rivers and Sea) identifies that the proposed scheme footprint is partially located in Flood Zones 1, 2 and 3.

The majority of the site falls within Flood Zones 2 and 3, which are contained within the banks of the River Tees. Flood Zone 2 is defined as "*Land having between a 1 in 200 and a 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%)*", whereas Flood Zone 3 is defined as "*Land having a 1 in 200 or greater annual probability of sea flooding (≥0.5%)*".

The small section of land required for the proposed scheme is wholly located within Flood Zone 1 and therefore at low risk of flooding. Flood Zone 1 is defined as *"Land having less than a 1 in 1,000 annual probability of sea flooding (<0.1%)".*

Due to the proposed scheme being partially located within the banks of the tidally influenced River Tees, the risk of tidal and coastal flooding is assessed to be high. However, it is noted that as a new port facility, the proposed scheme is considered 'Water Compatible' under the NPPF.

20.4.2.2 Flooding from groundwater

Borehole records indicate that groundwater levels could be linked to tidal levels in the River Tees. This is considered highly likely as the proposed scheme footprint is adjacent to the watercourse and there is likely to be percolation of water through the existing banks into adjacent ground.

The occurrence of groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises. However, groundwater flooding can cause significant damage to property and can pose further risks to the environment and ground stability. There are several mechanisms that increase the risk of groundwater flooding including prolonged rainfall and high in-bank river levels.

No mapping of Areas Susceptible to Groundwater Flooding were available in the Redcar SFRA. Given the distance from the River Tees and potential connectivity between tidal and groundwater levels, it is considered that there is a medium risk of groundwater flooding; however, as this is likely to be inherently linked to tidal flooding it would comprise a limited flood risk to the site when compared with tidal flood risk.

20.4.2.3 Flooding from surface water

The Environment Agency Surface Water Flood Risk map[10] highlights that the proposed scheme footprint is predominantly in areas at 'Very Low' risk of surface water flooding (*i.e. less than 1 in 1,000 years*).

There are two areas on the proposed scheme footprint that have an increased risk of surface water flooding:

- The southernmost corner of the proposed scheme footprint includes areas at 'low' (*i.e. between 1 in 1,000 and 1 in 100 years*) and 'medium' risk (*i.e. between 1 in 100 and 1 in 30 years*); and,
- The area of the proposed scheme footprint associated with the oil depots, boiler house and offices (to be removed prior to the proposed scheme) contains areas at 'low', 'medium' and 'high' (*i.e. greater than 1 in 30 years*) risk.

The pockets of low, medium and high surface water risk are likely to be as a result of localised low points within the current topography. It is understood that prior to construction of the proposed scheme, any residual features associated with the prior use of the site will be removed and the site levelled to remove any potential localised areas of ponding.

As a result, the surface water falling onto the heavy lift areas, which is proposed to be surfaced with concrete, would be captured through a series of gullies and discharged into the Tees estuary through the Quay wall, via an interceptor. Therefore, the site is assessed to be at Very Low risk of surface water flooding.

20.4.3 Summary of flood risk

Table 20.6 summarises the risk of flooding from all sources to the proposed scheme footprint. The overall risk of flooding to the proposed scheme footprint is considered to be low, given that all aspects of the

[10] *Environment Agency, Long term flood risk information. Available at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map (Accessed 23/01/2019)*

proposed scheme will be 'water compatible' and therefore less affected by flooding. However, there remains a residual risk of flooding in the event of a defence failure or overtopping.

Table 20.6 Summary of flood risk

Source of flood risk	Probability of flooding	Description
Fluvial	Low	The proposed scheme is partially located within the River Tees and is therefore situated in either Flood Zone 2 or 3. However, at this location the River Tees is tidally influenced. The remaining elements of the proposed scheme i.e. quay and cranes are located in Flood Zone 1. Therefore, the risk of flooding from fluvial sources is assessed to be low.
Tidal / Coastal	High	The proposed scheme is partially located within the River Tees and is therefore situated in either Flood Zone 2 or 3. However, the proposed scheme will be 'Water Compatible' and therefore less affected by tidal flooding. The remaining elements of the proposed scheme i.e. quay and cranes are located in Flood Zone 1.
Groundwater	Medium	Borehole records have been reviewed for the proposed scheme footprint, which reported groundwater was encountered at 2.05m AOD. These findings indicate that groundwater level could be linked to tidal levels in the River Tees, especially due to its proximity, i.e. adjacent, to the watercourse itself. Given the distance from the River Tees and potential connectivity between tidal and groundwater levels, it is considered that there is a medium risk of groundwater flooding.
Surface water	Low	The Environment Agency's Surface water flood risk map shows that the proposed scheme footprint is primarily at low surface water flood risk, except a few isolated low-lying pockets. Water falling on the proposed scheme footprint is discharged directly into the River Tees.
Sewers	Very Low	There are currently no sewers present within the proposed scheme footprint. During construction there will be no requirement for a connection to the wider sewer system. Additionally, welfare facilities are not proposed on the quay as part of the proposed scheme during the operational phase. Therefore, there is no risk of flooding from sewers and this risk is classified as very low.
Reservoirs and other sources	Low	The proposed scheme footprint has been identified as within the maximum flood extent for reservoirs. However, this area of risk is confined to within the banks of the River Tees and does not cover the small section of land within the proposed scheme footprint. There are no additional canals or artificial sources in the local area. Therefore, the risk of flooding from reservoirs, canals and other sources is considered to be low.

20.4.4 Flood vulnerability

In terms of flood risk and vulnerability, Table 2 of the PPG for Flood Risk and Coastal Change classifies the proposed scheme as 'water compatible'. Table 3 of the PPG for Flood Risk and Coastal Change indicates that developments of this classification are considered appropriate in all Flood Zones.

As set out above, the NPS for Ports states that all applications for port development of 1 hectare or greater in Flood Zone 1, as well as all proposals for projects in Flood Zone 2 and 3, should be accompanied by an FRA. Given the location of the proposed scheme within Flood Zone 2 and Flood Zone 3, an FRA has been undertaken for the proposed scheme (**Appendix 15**).

20.4.5 Hydrodynamic modelling

Hydrodynamic modelling studies assessed the effects of fluvial flows on water levels within the Tees estuary as a result of the proposed scheme (see **Section 6**).

Water levels during a 1 in 100 year fluvial input scenario through the Tees Barrage were modelled, as this was considered the most severe case in terms of flood risk.

Three 'monitoring' points were chosen which ranged from approximately 2.6km upstream and 3.5km downstream of the proposed scheme, as well as adjacent to the proposed scheme footprint. A time-series over a duration of two weeks was plotted showing the baseline water levels and predicted water levels as a result of the proposed scheme at each of the three monitoring locations for the 1 in 100 year fluvial event. The modelled high water levels under each scenario, for each of the monitoring locations were calculated and are shown in **Table 20.7.**

Table 20.7 Modelled high water levels for a 1 in 100 year fluvial event through the Tees Barrage

Scenario	Upstream (m AOD)	At Site (m AOD)	Downstream (m AOD)
Baseline	2.92	2.91	2.83
With proposed scheme	2.92	2.91	2.83

The results show that there is no change in the high water levels at the monitoring locations as a result of the proposed scheme. This also suggests that the fluvial elements of flow in the estuary are minimal when compared with the influence of the tidal proportion of the flow, even during an extreme (1 in 100 year) fluvial event.

20.4.6 Climate change guidance

UK guidance on climate change has been updated through the publication of the Environment Agency's online advice note 'Flood Risk Assessments: Climate Change Allowances' (Environment Agency, 2020).

The principal climate change which could affect flood risk at, or adjacent to, the proposed scheme footprint relates to changes in rainfall and sea level rise. Fluvial flows are less critical because of the location of the proposed scheme within the estuary where tidal and coastal processes are still dominant.

20.4.6.1 Changes in rainfall

Table 20.8 shows the Environment Agency's anticipated changes in extreme rainfall intensity in small and urban catchments which is relevant to the surface water flood risk. The proposed scheme is anticipated to have a 50-year lifespan (i.e. until 2073), as such a 20% (central) and 40% (upper end) allowance for peak rainfall intensity is considered appropriate.

Table 20.8 Peak rainfall intensity allowance in small and urban catchments (use 1961-90 baseline) (Source: Table 2, Environment Agency Climate Change Allowances 29/09/20)

Applies across all of England	Total Potential Change Anticipated for the '2020s' (2015-2039)	Total Potential Change Anticipated for the '2050s' (2040-2069)	Total Potential Change Anticipated for the '2080s' (2070-2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

20.4.6.2 Sea Level Rise

Table 20.9 presents the projections of sea level rise during the proposed scheme's 50-year operational phase (i.e. 2023 – 2073). The baseline (2011) still water levels for the 1 in 200 year and 1 in 1,000 year events were obtained from the 2011 ISIS-TUFLOW model which forms part of the Tidal Tees Integrated Flood Risk Modelling Study (Environment Agency, 2011).

Using the latest higher central and upper end sea level climate change allowances for the Northumbria river basin district (Environment Agency, 2020), the uplift during each epoch was calculated and is presented in **Table 20.9**.

Table 20.9 Change in still water level across the operation phase of the proposed scheme

Extreme Water Level Analysis Results (m AOD)				
	Higher Central		Upper End	
	1 in 200 year	1 in 1,000 year	1 in 200 year	1 in 1,000 year
Still water level (m AOD) (2011)	4.13	4.39	4.13	4.39
Still water level (m AOD) (2023)	4.19	4.45	4.20	4.46
Still water level (m AOD) (2073)	4.55	4.81	4.68	4.94

The proposed quay would be constructed at a level 5.84m AOD, providing suitable protection against the 0.5% (1 in 200) and 0.1% (1 in 1,000) annual exceedance probability event for both the higher central and upper end scenarios throughout the 50-year lifetime of the proposed scheme (i.e. 2023 – 2073).

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

As detailed above, predicted sea level rise is likely to result in a greater degree of flood risk to the site in the future, independently of any potential impact of the proposed scheme. There is, therefore, the potential for more regular flood events of the land within the footprint of the proposed scheme.

20.5 Potential impacts during the construction phase

20.5.1 Potential for effect on risk of flooding at and adjacent to the proposed scheme

The proposed scheme has the potential to alter the risk of flooding during construction as a result of temporary works within either the channel or on the floodplain, both to the proposed scheme footprint and to other areas within the Tees estuary which are determined to be low sensitivity receptors.

Section 20.4 and the FRA (**Appendix 15**) identified that tidal flooding and groundwater flooding represents the predominant sources of flood risk in the vicinity of the proposed scheme. However, It is considered that the flood risk during construction will be not be exacerbated beyond the existing flood risk as identified in the FRA. The proposed scheme will have a very limited change to the defence line taking into account the defences that already exist in this location and the design of the proposed scheme. As such, the potential effect on flood risk is determined to have a very low magnitude of effect. Therefore, **no impact** is predicted.

Mitigation measures and residual impact
As part of the proposed scheme the quay wall will comprise the maintenance of the existing defence line which will then incorporate a revised defence line, set at a level of 5.84m AOD. During the construction phase, a continuous defence line will need to be retained, using the existing, revised or a combined defence line (i.e. quay) such that a continued standard of protection will be provided throughout construction that is comparable with the existing. No further mitigation measures are required. There would be **no residual impact**.

20.5.2 Vulnerability to flooding of those using the site

The location of the proposed scheme within and immediately adjacent to the Tees estuary inherently presents risks to construction workers and other construction related site users associated with drowning or accidents during flood, storm or tidal surge events within the estuary.

As the level of severity of any flood events / storms in the estuary is a controlling factor in predicting the significance of potential impacts to construction workers, a worst case scenario is assumed. In this case, the site users are designated as very high sensitivity receptors and the magnitude of impact to these site users is high magnitude. Therefore, without the implementation of mitigation measures the impact is of **major adverse** significance.

Mitigation measures and residual impact
The risk of a flood event occurring and its impact on human health can be controlled through the implementation of the following mitigation measures:

- Development of a construction phase Flood Risk Emergency Plan (FREP).
- Prior to works commencing, all construction workers will undergo site induction training prior to being allowed access to the proposed scheme site. This will include actions required in the event of a flood risk emergency incident, such as those included in the FREP including obtaining flood warnings /alerts, responding to warning sirens and following escape routes in the event of a site evacuation.
- No workers would be allowed on site unless they have undergone a site induction.
- Arrangements will be identified and made for safe access to and from the site.
- In the event of tidal surge and / or significant storm events, prior warning will be given to the site users in order to cease construction works and evacuate site workers to higher ground.

These measures will minimise the potential risk to human health as far as possible and significantly reduce the magnitude of the effect. On this basis, the residual risk to site users is determined to be of **minor adverse** significance.

20.6 Potential impacts during the operational phase

20.6.1 Potential for effect on risk of tidal flooding at and immediately adjacent to the proposed scheme

The principal issue in relation to flood risk and coastal defence is whether the risk of flooding could be altered by the proposed scheme, both to the proposed scheme footprint and the surrounding areas.

The FRA (**Appendix 15**) has identified that the proposed scheme footprint is at risk from sea (tidal/coastal) flooding, and this represents the predominant source of flood risk to the proposed scheme. The majority of the proposed scheme footprint lies within the River Tees, which falls within Flood Zones 2 and 3. The small section of the proposed scheme footprint on land, comprising the quay and cranes, is wholly located within Flood Zone 1 and therefore at low risk of flooding.

The proposed quay would be built at a level 5.84m AOD, which is above the 5.0m AOD threshold which the Tees Tidal Flood Risk Management (FRM) Strategy identified as being at risk during a 1 in 1,000 year event.

In accordance with the NPS for Ports (Department for Transport, 2012) and NPPF (Ministry of Housing, Communities and Local Government, 2019), the proposed scheme is classified as 'water compatible'. To ensure the operation of the proposed scheme, once constructed the quay structure would comprise the revised river bank of the Tees estuary, as such it will provide the revised defence line and would not affect the flood risk in the vicinity. As a result, the receptor sensitivity is very low. The tidal flood risk to the site has the potential to have a low magnitude effect. Therefore, the impacts from tidal/coastal flooding has **negligible** significance.

Mitigation measures and residual impact

As part of the proposed scheme the quay wall will comprise the incorporation of a revised defence line, set at a level of 5.84m AOD, and therefore providing a standard of protection that is comparable with the existing once operational. No further mitigation measures are required. There would be **no residual impact** with regard to tidal/coastal flooding.

20.6.2 Potential for effect on risk of tidal flooding elsewhere in the estuary system

The predicted effect of the proposed scheme on flows and water levels has been assessed as part of the hydraulic modelling studies (reported in **Section 6**) and outlined in **Section 20.4.4**. For the purposes of this assessment, the impact of fluvial flows in raising water levels in the estuary is considered. An increase in high water levels could have the potential to increase the tidal flood risk, should they occur coincidentally.

The estuary is determined to represent a medium sensitivity receptor. The results of the hydrodynamic modelling for the 1 in 100 year fluvial event through the Tees Barrage show there is no effect on the high water levels between the baseline scenario and the scenario with the proposed scheme in place.

As a result, it can be concluded that there is **no impact** predicted on the tidal flood risk throughout the estuary as a result of the proposed scheme.

Mitigation measures and residual impact

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

20.6.3 Surface water runoff and foul sewage

The risk of surface water flooding has been considered as part of this assessment. However, it is understood that the landside parts of the proposed scheme footprint would be levelled prior to construction in order to remove any localised areas of ponding. Therefore, the surface water flood risk to the site is not assessed further here. Instead, the main flood risk relates to the performance of surface water drainage systems and foul sewage, which is assessed below.

It is understood that the current surface water runoff and drainage from the land is likely to be directly into the Tees estuary. It is anticipated that as part of the proposed scheme the quay would be surfaced with crushed stone and surface water would drain into the underlying material without the need for a formal drainage system. A drainage system collecting surface runoff through gullies would be required on the heavy lift areas, as such areas are proposed to be surfaced with concrete. The collected water will be discharged into the Tees estuary through the quay wall, via an interceptor.

Welfare facilities are not proposed on the quay itself in order to maximise the available space to support operations; therefore there would be no foul sewage generated as a result of the proposed scheme.

It has been determined that there is likely to be a very low magnitude of effect, on a low sensitivity receptor. As a result, it is concluded that there would be a **negligible impact** as a result of the proposed scheme.

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

20.6.4 Potential effect on frequency of overtopping

The potential for increased overtopping frequency has been informed by the studies into the effects of the proposed scheme on wave climate throughout the estuary system (**Section 6**). The modelling outlines the baseline conditions on both swell waves and local generated waves under extreme wind.

The baseline swell waves do not extend up the Tees estuary to the proposed scheme footprint, indicating that the site is well sheltered from the North Sea waves.

The swell waves that reach the area downstream of Tees Dock and the Tees Turning Area reach at magnitude of approximately 0.05m to 0.15m. The swell waves of any significance (>1.5-2.0m) only reach the estuary mouth. Therefore, a low magnitude effect is predicted, on a low sensitivity receptor, resulting in a potential impact of **negligible** significance.

The wave model results show that locally generated waves under extreme wind are of more significance at the proposed scheme footprint. Due to the proposed scheme being set-back into the riverbank and in addition to the raised quay level compared with the present day, local bathymetric differences to the model immediately surrounding the quay are expected. However, the changes are unlikely to be significant and will be extremely localised. The modelling results indicate that the local generated wind waves can reach a height of 0.3m to 0.4m for a 1 in 1 year return period and 0.5m to 0.7m for a 1 in 100 year return period at the proposed scheme footprint.

The amplitude of these waves is equivalent to the increase in water levels that would occur at the proposed scheme during a locally generated extreme wave event. For the purpose of this assessment, the upper limits were used in order to represent the worst-case scenario (**Table 20.10**).

Table 20.10 Worst-case scenario locally generated wind waves

Return period	Wave height (m)	Amplitude (m)
1 in 1 year	0.40	0.20
1 in 100 year	0.70	0.35

If a locally generated extreme wind event, as predicted above, was to occur at the same time as an extreme tidal event, it would have the effect of raising the water level beyond that expected based on tidal still water levels alone, in turn increasing the flood risk to the proposed scheme.

Table 20.11 quantifies this water level increase under baseline conditions, as well as taking sea level rise due to climate change into account. The size of the waves predicted for the most extreme locally generated wind wave is unlikely to change significantly due to climate change, and therefore the calculated increase in water level is appropriate for use through the lifetime of the proposed scheme.

Table 20.11 Cumulative water levels under an extreme tidal event and extreme locally generated wind wave event

Extreme tidal event for Upper End return period (years)	Modelled Water Level (m AOD)	Increase in water level due to extreme 1 in 100 year wind event (m)	Cumulative Water level (m AOD)
2011 (Baseline)			
200	4.13	0.35	4.48
1,000	4.39	0.35	4.74
2023			
200	4.20	0.35	4.55
1,000	4.46	0.35	4.81
2073			
200	4.68	0.35	5.03
1,000	4.94	0.35	5.29

The proposed quay would be constructed at a level of 5.84m AOD, providing suitable protection against the worst-case scenario for wind waves and still water levels, including climate change.

As a result, the effects of the locally generated wind waves are determined to have a medium magnitude effect on a low sensitivity receptor. Overall, a **negligible** impact is predicted.

Mitigation measures and residual impact

No mitigation measures are required in regard to the impact of swell waves or locally generated waves. The residual impact would be of **negligible** significance.

21 SOCIO-ECONOMICS

21.1 Policy and consultation

21.1.1 Policy

The following paragraphs provide a summary of key planning and economic strategy documents of relevance to the proposed scheme at a national, regional and local level. It should be noted that only those policies and objectives relating to socio-economic matters are considered.

21.1.1.1 National policy

The Government published the revised NPPF in February 2019 (MHCLG, 2019).

Paragraph 7 of the NPPF outlines that: *"the purpose of the planning system is to contribute to the achievement of sustainable development."*

Achieving sustainable development means that the planning system has three objectives – economic, social and environmental. The economic objective involves helping to build a strong, responsive and competitive economy by ensuring that sufficient land of the right types is available in the right places. The social objective involves supporting strong, vibrant and healthy communities with accessible services that reflect current and future needs and support communities' health, social and cultural well-being.

Chapter 6 of the NPPF concerns building a strong, competitive economy. Paragraph 80 sets out that: *"planning policies and decisions should help create the conditions in which businesses can invest, expand and adapt."* It places significant weight on the need to: *"support economic growth and productivity, taking into account both local business needs and wider opportunities for development."*

Paragraph 82 states that: *"planning policies and decisions should recognise and address the specific locational requirements of different sectors. This includes making provision for clusters or networks of knowledge and data-driven, creative or high technology industries; and for storage and distribution operations at a variety of scales and in suitably accessible locations"* (Lichfields emphasis).

The Government published its Industrial Strategy in November 2017 (BEIS, 2017). The Strategy outlines the aspiration to create an economy that boosts productivity and earning power throughout the UK. The Strategy identifies four Grand Challenges (developments in technology set to transform industries and societies) in which the UK can play a leading role. The first of these Challenges is to put the UK at the forefront of the artificial intelligence (AI) and data revolution. In order to support rapid adoption of AI technologies at scale, the Office for AI will work initially with six priority business sectors: cybersecurity; life sciences; construction; manufacturing; energy; and agricultural technology. The Strategy identifies that manufacturing is crucial to the economy, providing 10% of the UK's GVA (Gross Value Added), generating around 50% of exports and accounting for 70% of business-led research and development.

The Strategy recognises that every region in the UK has a role to play in boosting the national economy and states that the Government will continue to build the Northern Powerhouse to help create prosperous communities throughout the UK. The Government aims to do this, in part, by agreeing Local Industrial Strategies that build on local strengths and deliver economic opportunities.

The Strategy identifies that strong local economies around the world tend to have key attributes which include having a good supply of skilled labour; being well connected; and having land available for offices and factories.

21.1.1.2 Regional policy

The Tees Valley Strategic Economic Plan (SEP) (TVCA, 2016) sets out the growth ambitions and priorities for Tees Valley over a 10-year period. The SEP has been refreshed to create a strategy which includes priorities to improve, diversify and accelerate growth in the local economy to benefit businesses and residents.

As the overarching economic plan for the Tees Valley, the refreshed SEP provides a framework for economic development to deliver six growth generating themes. These themes have been devised to help deliver the SEP's target of creating 25,000 new jobs and generating £2.8 billion of additional GVA between 2016 and 2026.

The SEP notes that the Tees Valley has world class expertise in a number of key sectors which are vital to the health of the northern and wider UK economies. Taking account of the current composition of the Tees Valley economy, including existing employment specialisms and the potential for growth, seven priority sectors have been identified:

- Advanced Manufacturing;
- Process, Chemicals and Energy;
- Logistics;
- Health and Biologics;
- Digital and Creative;
- Culture and Leisure; and
- Business and Professional Services.

The SEP confirms that developing these sectors is considered critical to boosting competitiveness and diversification, improving economy resilience and providing the range of jobs needed to ensure that growth across Tees Valley is both widespread and inclusive. In terms of the sectors of greatest relevance to the proposed development site, these are most likely to be advanced manufacturing, process, chemicals and energy and logistics.

The draft Tees Valley Local Industrial Strategy (LIS) (TVCA, 2019) sets out an ambitious plan to transform the economic performance of the area and drive an increase in productivity. It builds on the distinctiveness of the local economy and responds to the opportunities and challenges that subsequently arise.

The LIS focuses on delivering productivity growth centred on clean energy, low carbon and hydrogen, by improving performances and helping more local people into good jobs with long-term prospects.
The LIS identifies the following overarching ambition: *"Tees Valley will be a global leader in clean energy, low carbon and hydrogen. The area will achieve a net zero carbon industrial cluster by 2040, providing good jobs with long-term prospects that local people can access."*

The LIS confirms that the Tees Valley business base is diverse and comprises of a range of sectors characterised by different levels of maturity, productivity and labour intensity. These sectors can be broadly characterised according to the following three categories:

- **Globally Competitive Sectors**: well-established sector strengths where the Tees Valley is widely regard as benefitting from world class expertise and a business base comprised largely of globally-significant firms. Collectively, these sectors account for 14% of Tees Valley's GVA. Local concentrations of employment and economic output are typically high in these sectors, reflecting the presence of high volumes of activity. Sectors include Chemicals and Process Industries; and Advanced Manufacturing.

- **Regional Sector Strengths with Growth Potential**: sectors where the Tees Valley is not currently recognised as being globally competitive, but where the conditions are in place locally – or could be established – to drive growth moving forwards. This includes areas such as clean energy, low carbon and hydrogen where Tees Valley can drive growth nationally by exploiting its unique industrial cluster, research and innovation assets, and by maximising synergies between existing sector specialisms. Sectors include Clean Energy, Low Carbon and Hydrogen; Bioscience; and Digital.
- **Enabling Sectors**: job rich sectors that account for high volumes of employment – as well as 34% of Tees Valley's GVA – and which play an important role in supporting the effective functioning of the wider economy through the goods or services that they provide. The logistics sector, for example, supports the efficient movement of raw materials and finished products, which is beneficial to all parts of the economy. Sectors include Professional and Business Services; Logistics; and Construction.

The LIS also acknowledges the importance of the STDC area which is "*one of the UK's greatest development opportunities*". Once fully developed, the LIS states that the 4,500 acre site – the single biggest development opportunity in the UK and run by the only Mayoral Development Corporation outside of London – has the potential to create 20,000 jobs and generate an additional £1 billion per annum to the local economy.

Furthermore, maximising the potential of the STDC site is identified as being central to the LIS's ambition to attract investment and establish a global reputation in clean energy, low carbon and hydrogen.

21.1.1.3 Local policy

The Redcar and Cleveland Local Plan was adopted in May 2018 (RCBC, 2018a). Policy LS 4 (South Tees Spatial Strategy) states that the South Tees Spatial Strategy encompasses the following areas:

- Wilton International;
- STDC area (including current and former steelworks at South Tees and Redcar);
- Teesport; and,
- South Tees Industrial Estates and Business Parks.

In relation to the economy, Policy LS4 states that the Council and its partners will aim to deliver the following objectives (*inter alia*):

- deliver significant economic growth and job opportunities through the STDC and Tees Valley Enterprise Zone at Wilton International and South Bank Wharf;
- support the regeneration of the STDC area through implementing the South Tees Area Supplementary Planning Document;
- investigate opportunities to create a new energy hub to support the offshore wind and sub-sea engineering sectors;
- support the expansion and protection of the port and logistics sector;
- improve existing employment areas and provide a range of modern commercial premises that meet contemporary business requirements including the target sectors of the South Tees Area Supplementary Planning Document (SPD);
- give the area an identity and make it attractive to inward investment; and,
- enhance the quality and range of services and facilities that serve the needs of those working in the South Tees employment area.

The South Tees Area SPD (RCBC, 2018b) was adopted in May 2018. It supports the economic and physical regeneration of the South Tees Area, setting out the vision and core objectives for the area.

The SPD sets out the following vision for the area:

"The Vision for the South Tees regeneration programme is to see the area transformed into a hotbed of new industry and enterprise for the Tees Valley that makes a substantial contribution to the sustained economic growth and prosperity of the region and the communities it serves.

The Vision sees the creation of up to 20,000 new jobs. The focus is on higher skilled sectors and occupations, centred on manufacturing innovation and advanced technologies and those industries best able to deliver sustained economic prosperity for the Tees Valley and its people, while realising a jobs spectrum that offers opportunities for all. The Vision is underpinned by the aspiration for new development to make best use of existing infrastructure and available land and to deliver a high value, low carbon, diverse and inclusive circular economy for the Tees Valley.

The Vision sees an aspirational, modern industrial park, combining industrial, environmental, heritage and community assets in a well designed development that is safe for all users and supported by a safe and efficient transport network, which delivers enhanced connectivity to the wider Tees Valley and beyond.

It extends to realising a telling, positive change in the external perceptions of the South Tees Area and wider Tees Valley to potential inward investors, to achieving the remediation of land contamination and to safeguarding biodiversity and promoting and encouraging environmental improvement. In overall terms, the realised Vision for the South Tees Area will deliver an exemplar, world class industrial business park that is renowned as a destination for manufacturing excellence."

The SPD includes a number of Strategic Development Principles intended to guide planning applications associated with the redevelopment of the STDC area. Development Principle STDC 1 provides a series of priorities for the South Tees area in line with the SPD's Vision and Objectives. These include a strong alignment with the Government's Industrial Strategy, a co-ordinated world class offer, promotion and support for the expansion of existing port facilities, support for uses associated with advanced manufacturing, the low carbon and circular economy and for the creation of high-skilled employment and to support development which makes the best use of available land and existing infrastructure.

The South Tees Regeneration Masterplan was published in November 2019 (STDC, 2019). This document presents the vision, strategy and Masterplan for the regeneration of the area. The Masterplan does not form part of the statutory development plan though it has closely informed the preparation of, and is aligned with, that statutory policy framework.

The Masterplan identifies the site as being part of the SIZ and sets out a development overview for the area. It identifies the following target industries:

- Port-related uses, including port-based fabrication;
- Offshore energy industries, including manufacturing;
- Materials processing and manufacturing;
- Contract fabrication;
- Potential for rig and large equipment decommissioning; and,
- Energy generation.

The Masterplan identifies the site's river boundary as offering the opportunity for a significant increase in port-capacity on the river. This opportunity enhances the potential for attracting major industries that rely on imports and exports by sea, and that serve offshore industries.

The Masterplan makes reference to the site's potential market appeal with respect to the offshore wind industry. It states:

"…the UK offshore wind industry has committed to work with UK Government on a transformative sector deal, which, by 2030, will deliver thousands of additional skilled jobs and billions of pounds worth of export opportunities. Through this deal, the industry aims to generate one third of the UK's electricity from offshore wind by 2030.

In response to this emerging step change in the UK offshore wind industry, STDC has received numerous proposals from investors, including the manufacture of: gravity foundations; monopiles and transition pieces; top sides; blades; nacelles; and gearing systems. Interest has also been shown in establishing an onshore engineering base to serve Dogger Bank.

Presently, STDC is engaged in advanced dialogue with developers wishing to establish a new offshore wind base, inclusive of extensive port facilities, for the manufacture of all aspects of wind turbine substructures and superstructure tower assemblies. If realised, this would also offer the opportunity for significant offshore oil and gas rig decommissioning, which could produce a major feedstock for metals production projects."

The Masterplan also refers to the site's suitability for materials processing and manufacturing, stating:

"*To reflect the growth in metals recycling both in the UK and globally, along with an ever-improving sophistication in the metals recycling process, the Master Plan for the SIZ accommodates a sizeable materials processing zone that can capitalise on the proposed new port facilities to cater for imports of recyclable materials by ship. This could extend to handling metals from rig decommissioning operations carried out elsewhere on the river.*

The large industrial shed spaces in the SIZ offer the potential for re-use, and one such use could be metals manufacturing (such as steel or aluminium) using recycled metals, subject to market conditions and project viability being conducive. However, before making any decisions in this regard, the various shed facilities will need to be carefully evaluated to determine the viability of them being re-used. The proposed materials processing zone could extend to handling and recycling composites – another growing market – along with other recyclable materials. A key aspect of the vision for South Tees is the creation of a truly circular economy, and it is therefore appropriate that the plans make provision for uses aligned with recycling and re-use of materials on a large-scale basis."

21.1.2 Consultation

As outlined in **Section 5**, the scope of the EIA for the proposed scheme was agreed in August 2020 based upon Scoping Opinions previously issued by MMO and RCBC for a similar scheme in 2019.

Whilst the principle of scoping in the topic of socio-economics was secured, the precise elements of what should constitute the assessment were not defined. In attempting to address this, consultation has been undertaken with the relevant RCBC officers (in Business Skills and Investment) to outline a proposed scope of assessment. The proposed scope was formulated in accordance with the approach employed as part of the EIA application for STDC's landside proposals. To date, no comments have been received on the proposed scope of assessment and from this it has been assumed that the approach is considered acceptable.

21.2 Methodology

21.2.1 Assessment methodology

The paragraphs below describe the methods used to assess the likely effects; the existing conditions that exist in the surrounding area; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been adopted.

The assessment establishes the existing environment in terms of population, economic, employment and labour market conditions, before examining the potential effects of the proposed scheme and their significance. Opportunities for the mitigation of any adverse effects and the enhancement of positive effects are then considered, before the residual effects are assessed.

The assessment draws upon a combination of data sources, including nationally published data from the Office for National Statistics (ONS), as well as local authority statistics, Experian datasets, data from the 2011 Census and other publicly available national statistics.

21.2.2 Study area

As detailed within **Section 1**, the study area for the EIA covers the marine elements of the proposed scheme as well as its landside elements (namely the construction of a quay within the riverbank). For the purposes of this assessment, the landside element is located within the STDC area and is part of the area known as South Bank/SIZ. It is located between Tees Dock No.1 Quay and the Teesport Commerce Park and is within the Redcar and Cleveland 003 Middle Super Output Area (MSOA).

The effects of the proposed scheme are expected to be felt across the Area of Impact (AOI). For the purposes of this assessment, the study area is the Area of Impact (AOI), which comprises the area from which the majority of the workforce will be drawn. The current criteria for defining travel to work areas are that:

- at least 75% of an area's resident workforce must work in the area;
- at least 75% of the people who work in the area must live in the area; and,
- the area must have a working population of at least 3,500.

Applying this methodology to data from the 2011 Census relating to commuting patterns, it is possible to define the AOI as comprising Redcar and Cleveland, Middlesbrough and Stockton-on-Tees.

Analysis of these data (as shown in **Figure 21.1**), reveals that, in 2011, there were approximately 8,665 people working within the Redcar and Cleveland 003 MSOA identified above. Of these workers, 54% were resident in Redcar and Cleveland, 17% in Middlesbrough and 15% in Stockton-on-Tees. Collectively, this corresponds to 86% of people working in the area (greater than the 75% methodological threshold). Similarly, of the combined resident population across the MSOA (approximately 1,775), 60% work in Redcar and Cleveland, 20% in Middlesbrough and 10% in Stockton-on-Tees (in combination accounting for 90% of the area’s residents).

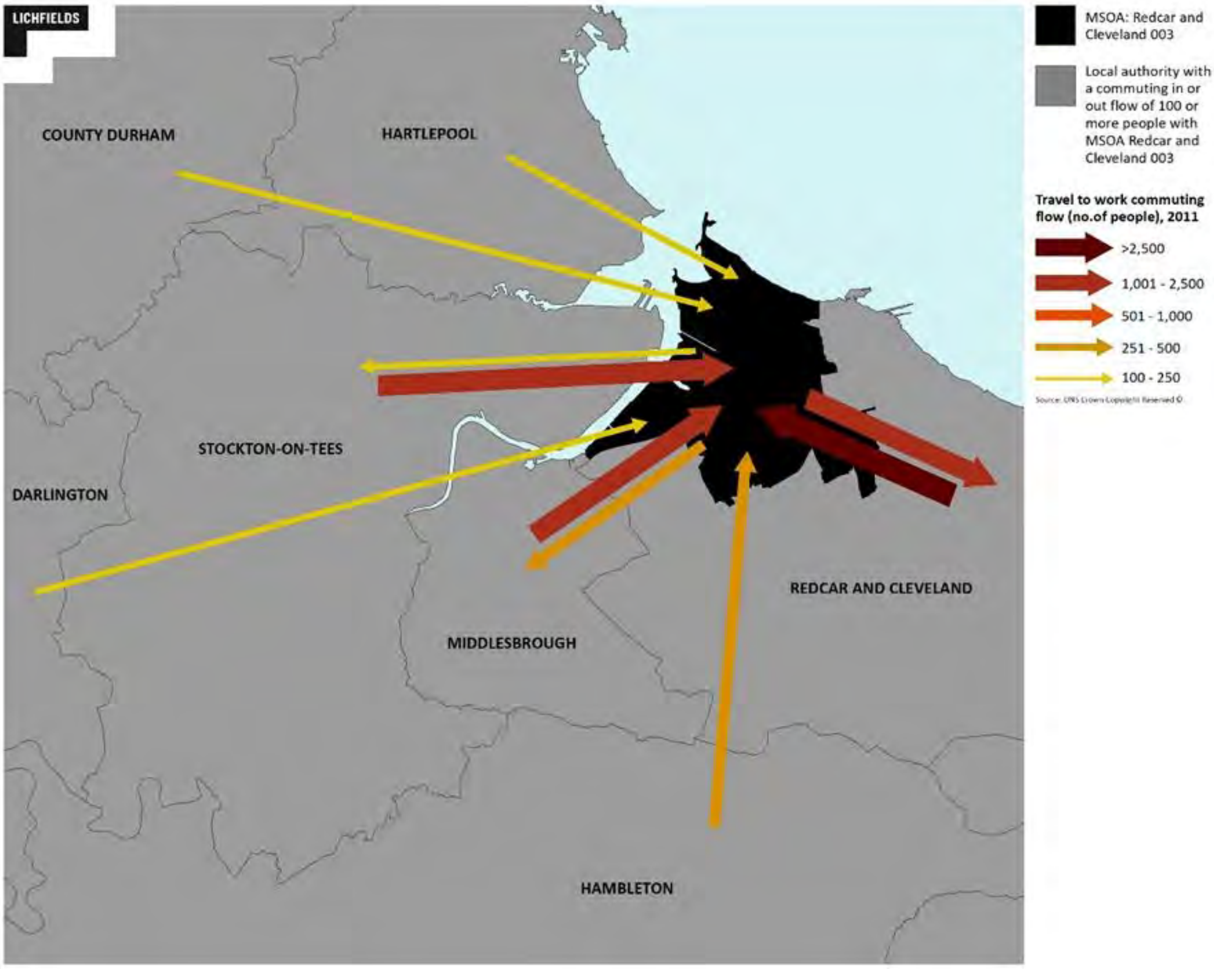


Figure 21.1 Travel to work flows from MSOA Redcar and Cleveland 003

Taking the above into account, the AOI considered in relation to the various effects of the proposed development are set out in **Table 21.1**.

Table 21.1 Impact areas considered

Factor	Area of Impact
Construction employment	Redcar and Cleveland, Middlesbrough and Stockton-on-Tees
Construction economic output	Redcar and Cleveland, Middlesbrough and Stockton-on-Tees
Operational employment	Redcar and Cleveland, Middlesbrough and Stockton-on-Tees
Operational economic output	Redcar and Cleveland, Middlesbrough and Stockton-on-Tees

21.2.3 Significance criteria

Since there are no generally accepted criteria for assessing the significance of socio-economic impacts, they have been assessed based on the scale of the increase over the baseline position, as well as the nature and context of their impacts. Where relevant, the location of the impact and its likely duration has been taken into account. In some cases, this cannot be quantified or measured, so the nature and context of the impacts are considered more generally, taking account of qualitative factors.

The socio-economic impacts of the proposed scheme are identified as 'beneficial', 'negligible' or 'adverse' (**Table 21.2**).

Table 21.2 Definition of impacts

Effect	Definition
Beneficial	A positive and/or advantageous effect to a Minor, Moderate or Substantial magnitude.
Negligible	No obvious significant effect to a receptor or environment.
Adverse	A negative and/or disadvantageous effect to Minor, Moderate or Substantial magnitude.

The terms presented in **Table 21.3** are used to define the significance of the impacts identified.

Table 21.3 Definition of the significance of impacts

Significance	Definition
Substantial	Where the proposed scheme could be expected to have considerable effects (by extent, duration or magnitude) or of a more than local significance on the existing population, levels/types of employment and economic characteristics of the area.
Moderate	Where the proposed scheme could be expected to have a noticeable effect which may be considered significant on the existing population, level/types of employment and economic characteristics of the area.
Minor	Where the proposed scheme could be expected to result in a small, very short or highly localised effect on the existing population, level/types of employment and economic characteristics of the area.
Negligible	Where no discernible effect is expected as a result of the proposed scheme on the existing population, level/types of employment and economic characteristics of the area.

The duration of the socio-economic impacts is considered in the context of whether it is temporary or permanent. Due to their nature, all operational impacts are considered to be permanent unless otherwise stated. In terms of temporary impacts, the duration can be determined to be short term (less than 5 years), medium term (5-10 years), or long term (more than 10 years).

The sensitivity of receptors is also considered. Sensitivity varies between receptors and in, some instances, qualified judgement is required to establish where receptors place on a scale from low sensitivity (easily adapt to change) to high sensitivity (do not easily adapt to change). In identifying sensitivity, factors including capacity to accept or respond to change and the local position, local needs and priority groups are taken into account.

A matrix identifying the significance of the potential effects is set out in **Table 21.4**. Any impacts assessed as being either moderate or substantial (as per **Table 21.4**) are classified as 'significant' in EIA terms.

Table 21.4 Matrix for determining the significance of impacts

Magnitude of change/impact	Sensitivity of receptor/environment to change or impact			
	High	**Medium**	**Low**	**Negligible**
High	Substantial	Moderate to Substantial	Minor to Moderate	Negligible
Medium	Moderate to Substantial	Moderate	Minor	Negligible

Magnitude of change/impact	Sensitivity of receptor/environment to change or impact			
Low	Minor to Moderate	Minor	Negligible to Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

21.2.4 Assumptions and limitations

The limitations of the assessment are identified, where applicable. In particular, the data used from publicly available sources has not been verified. Furthermore, whilst the latest available data has been used, it should be noted that many data sources are frequently updated and could be subject to change since the time of drafting or during the course of the planning application and marine licence application process.

Assumptions are also identified, where relevant, within the remaining sections. In summary, however, due to the specialised nature of the proposed scheme the assessment of the employment effects associated with the proposed scheme has drawn on experience from similar types of development and the technical specification of the proposed scheme. In particular, the scale and nature of the construction work required has been compared with similar schemes in close proximity to the proposed scheme (including the Anglo American Harbour facility) and the workforce requirements adjusted commensurately to reflect any key differences between the proposed scheme and the comparators with respect to:

- the dimensions of the proposed quay;
- the phasing of delivery; and,
- the technical specification of the proposed scheme (including the extent of excavation and mechanical/electrical engineering works assumed).

Similarly, given the specialised nature of employment likely to be generated on site during operation, the use of estimates based on experience from other similar developments around the UK is considered the most appropriate approach.

21.3 Existing environment

This section sets out the existing environment of the local area (as it relates to the proposed scheme) from a socio-economic perspective. This includes a summary of the current local economic conditions and labour market conditions within the AOI (defined as Redcar and Cleveland, Middlesbrough and Stockton-on-Tees local authorities). Where appropriate and where the availability of data permits, this is benchmarked against regional and national averages.

21.3.1 Population

According to the most recent population estimates (ONS, 2019a) the resident population of the AOI was 475,478 in 2019. Over the period 2009-2019 the resident population grew by 2.7% across the AOI. This was a lower rate of growth in comparison to the North East region (3.7%) and nationally (7.8%).

21.3.2 Local economic conditions

Employment growth

An analysis of ONS Job Density data (ONS, 2018a) indicates that the total number of jobs in the AOI stood at 204,000 in 2018 (latest data available). **Table 21.5** illustrates that jobs growth across the AOI during the period 2008-2018 was at 2.5% lower than the equivalent rate experienced regionally (4.3%) and nationally (13.6%).

Table 21.5 2018 employment and jobs density across the AOI

Area	Total jobs	Jobs density	% Change 2008-2018
AOI	204,000	0.70	2.5%
North East	1,206,000	0.73	4.3%
Great Britain	34,850,000	0.86	13.6%

The data also provide a measure of the ratio of total jobs to working age residents in a given area. It shows that the AOI has a job density ratio of 0.70, indicating that it has 70 jobs for every 100 residents of working age (aged 16-64). This is lower than the regional average (0.73) and significantly lower than the national average (0.86), highlighting the potential to deliver employment growth in the local area.

Sectoral structure

An analysis of Business Register and Employment Survey (BRES) data (ONS, 2018b) identifies that, as a proportion of total employment, the largest sectors in the AOI in 2018 were health (17.3%), retail (10.3%), education (9.5%), manufacturing (9.2%) and business administration & support services (7.6%). Collectively, these five sectors constituted 53.8% of total employment.

Location quotient (LQ) analysis establishes how concentrated a particular employment sector is in an area compared to the national average. **Figure 21.2** shows that, in comparison with the structure of the national economy, the following sectors are over-represented in the AOI:

- health (LQ 1.3, 17.3% employment);
- public administration & defence (LQ 1.3, 5.5% employment);
- manufacturing (LQ 1.2, 9.2% employment);
- construction (LQ 1.2, 5.9% employment);
- mining, quarrying & utilities (LQ 1.2, 1.6% employment);
- retail (LQ 1.1, 10.3% employment);
- education (LQ 1.1, 9.5% employment);
- transport & storage (including postal) (LQ 1.1, 5.4% employment);
- property (LQ 1.1, 2.1% employment); and,
- motor trades (LQ 1.1, 2.1% employment).

The following sectors are under-represented locally:

- agriculture, forestry & fishing (LQ 0.3, 0.4% employment);
- professional, scientific & technical (LQ 0.6, 5.4% employment);
- information & communication (LQ 0.6, 2.4% employment);
- financial & insurance (LQ 0.6, 2.1% employment);
- accommodation & food services (LQ 0.8, 5.9% employment);
- wholesale (LQ 0.8, 3.0% employment); and,
- business administration & support services (LQ 0.9, 7.6% employment).

Figure 21.2 Employment representation by sector (location quotient analysis)

Table 21.6 provides a summary of employment change within the AOI by sector over the period 2009-2018. This is shown in proportionate terms, in order to facilitate a comparison with the regional and national performance. From this it can be seen that:

- Information & communication, arts, entertainment, recreation & other services, wholesale, agriculture, forestry and fishing and financial and insurance all experienced stronger proportionate levels of growth in the AOI compared to regional and national averages; whilst conversely,
- health, accommodation and food services, transport & storage (including postal), motor trades, education, manufacturing, retail, mining, quarrying and utilities, construction and professional, scientific & technical experienced lower levels of growth (or higher proportionate levels of decline) in comparison with the regional and national averages.

In terms of those sectors likely to be of greatest relevance to the proposed scheme, the following can be observed from **Table 21.6**:

- Manufacturing: employment in the AOI declined substantially (-8.1%) despite remaining relatively static at the regional and national level; and
- Transport and logistics (including postal): employment in the AOI increased (5.3%) albeit at a rate below the regional and national level.

Table 21.6 Employment change in proportionate terms (2009-2018)

Industry	AOI	North East	GB
Information & communication	55.2%	18.5%	22.8%
Business administration & support services	43.6%	49.2%	29.7%
Arts, entertainment, recreation & other services	32.0%	14.6%	9.8%
Wholesale	24.7%	3.7%	7.8%
Agriculture, forestry & fishing	15.4%	-8.3%	1.2%
Health	12.3%	15.4%	13.3%
Property	9.9%	5.6%	22.2%
Accommodation & food services	7.3%	13.0%	23.6%
Transport & storage (including postal)	5.3%	13.6%	14.6%
Motor trades	4.1%	5.6%	17.4%
Financial & insurance	3.2%	-3.7%	-2.6%
Education	-5.4%	1.0%	4.9%
Manufacturing	-8.1%	0.0%	0.3%
Retail	-9.5%	-2.7%	-1.5%
Mining, quarrying & utilities	-14.5%	13.3%	25.7%
Construction	-21.4%	-15.2%	2.0%
Public administration & defence	-22.6%	-27.5%	-14.0%
Professional, scientific & technical	-24.5%	-20.6%	30.9%
All sector average (total employment)	-7.7%	3.2%	10.6%

Business growth

ONS UK Business Count data (ONS, 2019b) show that the number of active enterprises in the AOI increased from 8,900 to 11,950 over the period 2010-2019. This represents a growth rate of 34.3%. This is higher than the percentage increase observed regionally (26.1%) and nationally (30.1%).

The AOI's rate of business growth has been underpinned by strong growth in Micro firms (38.2%) – exceeding the regional (28.3%) and national (31.3%) growth rates. Similarly, growth in Large firms (22.2%) exceeded the regional (16.9%) and national (21.5%) growth rates. The AOI experienced growth in both Small (10.6%) and Medium-sized (9.8%) firms but at rates below the regional and national equivalents (**Table 21.7**).

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Table 21.7 Business growth rate in the AOI 2010-2019

Employment sizeband	AOI	North East	Great Britain
Micro (0 to 9)	38.2%	28.3%	31.3%
Small (10 to 49)	10.6%	12.7%	20.1%
Medium-sized (50 to 249)	9.8%	15.2%	25.2%
Large (250+)	22.2%	16.9%	21.5%
Total	**34.3%**	**26.1%**	**30.1%**

21.3.3 Labour market conditions

Economic activity

Annual Population Survey data from the most recent full year (2019) (ONS, 2019c) indicates that the economic activity rate (i.e. the share of working-age residents either in or seeking employment) across the AOI is 72.2%. This is lower than the regional (75.0%) and national (78.9%) economic activity rates.

In 2019, the model-based unemployment rate (share of working-age residents out of employment) in the AOI was 6.3% - higher than both the regional (5.9%) and national (4.0%) averages. This is also reflected in unemployment data for August 2020 which shows that there were 24,170 residents in the AOI claiming out-of-work benefits. This equates to a claimant rate of 8.3%. This rate is higher than that of the region (7.5%) and nationally (6.6%). By comparison, in January 2020 (and prior to the labour market effects of Covid-19) the AOI claimant rate (4.9%) was also higher than both regional (4.4%) and national (2.9%) averages. Taken together these data suggest that there is greater scope locally to accommodate employment growth.

Skills and qualifications

Figure 21.3 indicates that the skills base of the AOI's resident workforce (age 16-64) is characterised by:

- A lower proportion of working-age residents with graduate level (NVQ level 4+) qualifications (29.6%) than that of the North East region (31.9%) and nationally (40.3%);
- A lower proportion of working-age residents at all other NVQ levels (NVQ1 – 3) in comparison to the regional and national averages; and
- A higher proportion of working-age residents with no qualifications (12.0%) than that of the wider region (9.4%) and nationally (7.7%).

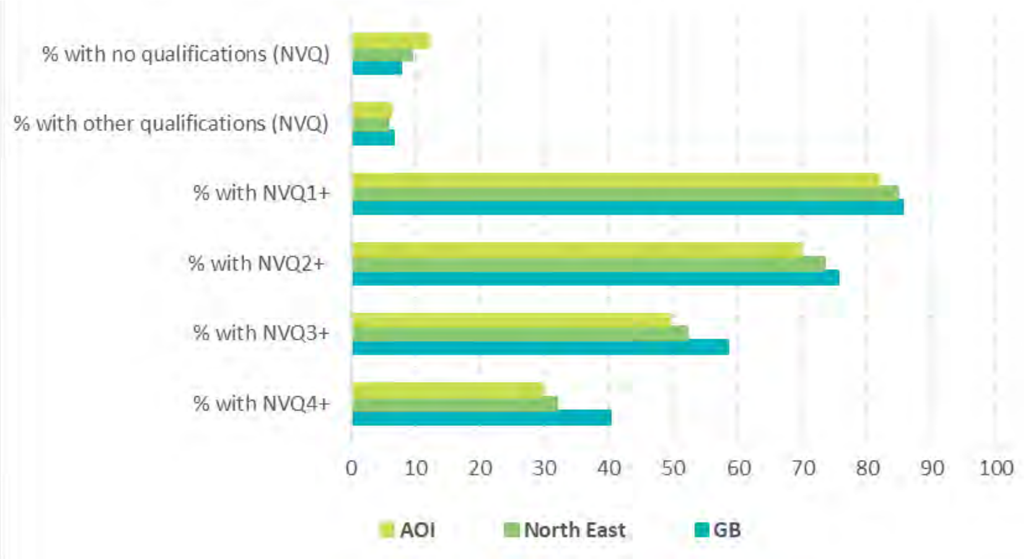

Figure 21.3 AOI resident skills base (% 16-64 population)

An analysis of the existing occupational profile of the resident workforce (**Figure 21.4**) also shows that:

- The proportion of AOI residents working in Standard Occupational Codes (SOC) 1-3 (managers, directors and senior officials; professional occupations; and associate professional & technical occupations) is low - at 34.4% - in comparison to the North East region (40.8%) and nationally (47.4%); and
- The proportion of AOI residents working in Standard Occupational Codes (SOC) 7-9 (sales and customer service occupations; process, plant and machine operatives; and elementary occupations) is high - at 28.9% - in comparison to the North East region (27.8%) and nationally (23.7%).

Earnings

Latest (2019) data from ONS Annual Survey of Hours and Earnings (ASHE) (ONS, 2019d) indicate that median weekly resident wages (gross) across the AOI (£536) were higher than the regional average (£531) but lower than the national average (£587).

Similarly, the median weekly workplace-based earnings (gross) were higher for the AOI (£542) in comparison with the North East (£533) but lower than the national average (£587).

Figure 21.4 ***Occupational profiles by Standard Occupational Code (SOC)***

Deprivation

Deprivation at the local level is measured by the Index of Multiple Deprivation (IMD), which uses a series of datasets to rank areas across seven domains that range from income to health. These categories in combination produce a multiple deprivation score for each local area.

The latest English Indices of Deprivation (2019) (MHCLG, 2019b) provides a composite measure of deprivation at a local level. **Figure 21.5** indicates that there are significant pockets of deprivation across the AOI, with the most significant pockets located in Middlesbrough but also along the banks of the River Tees in both Stockton-on-Tees and Redcar and Cleveland, including the proposed scheme footprint.

Within the local authorities that constitute the AOI there are:

- 23.9% of LSOAs (lower super output areas) in Redcar and Cleveland that score in the 10% most deprived nationally;
- 48.8% of LSOAs in Middlesbrough that score in the 10% most deprived nationally; and
- 20.8% of LSOAs in Stockton-on-Tees that score in the 10% most deprived nationally.

By this metric, Middlesbrough is ranked as the most deprived local authority in England. The LSOA within which the proposed scheme is located (Redcar and Cleveland 00D) is categorised as being within the 10% most deprived nationally.

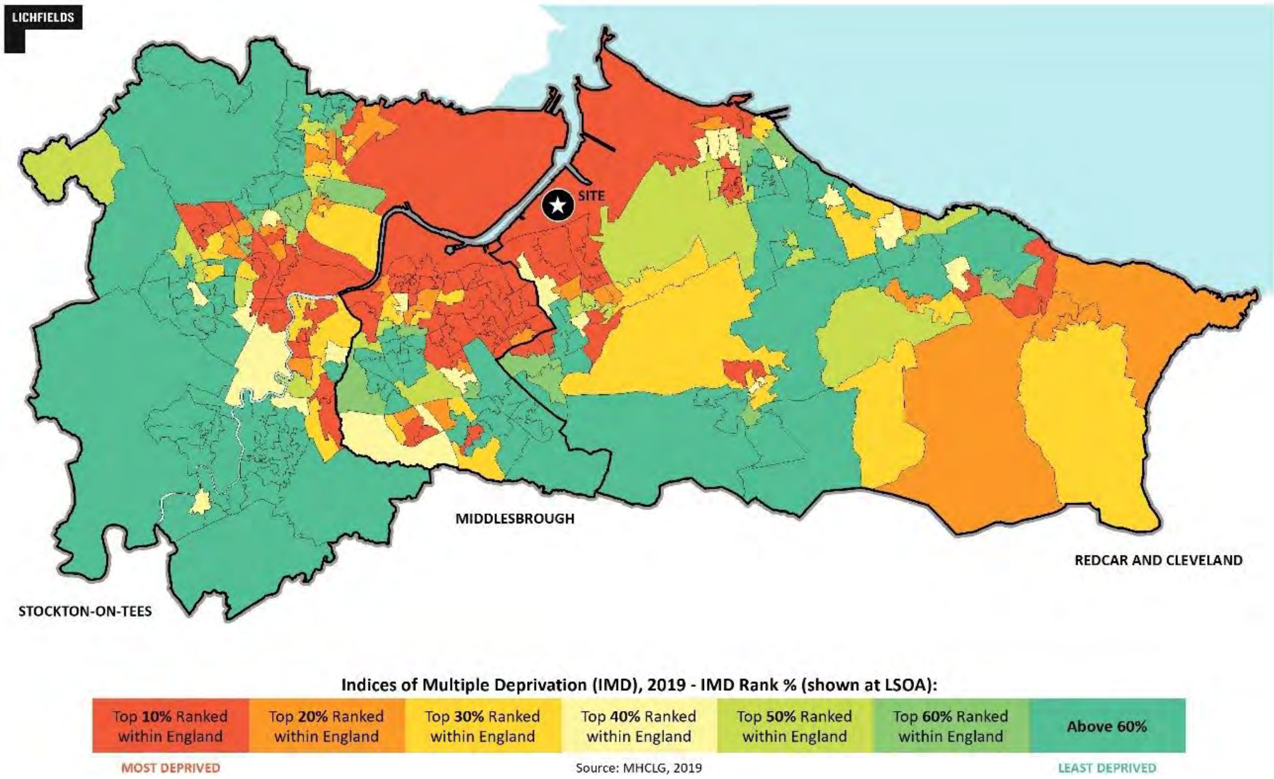

Figure 21.5 ***Deprivation map of the AOI***

Economic output

Data from ONS provide estimates of balanced gross value added (GVA – a measure of economic output) at a local authority level (ONS, 2019e). When considered in conjunction with the total number of jobs (ONS, 2018a) within the same timeframe, this can provide an indication of the level of productivity – or GVA per job – for a given local authority area across all sectors of the economy. **Table 21.8** indicates that in 2018 GVA per job was marginally higher within the AOI (£46,578) compared to the North East (£45,300). It was, however, lower than the national figure (£54,766).

Table 21.8 ***Balanced gross value added and GVA per job, 2018***

	Wider AOI	North East	UK
Total GVA (2018) (million)	£9,502	£54,632	£1,908,608
Total GVA per job (2018)	£46,578	£45,300	£54,766

21.3.4 Summary of existing environment

As demonstrated within the preceding paragraphs, the AOI has:

- Lower jobs growth performance relative to the regional and national levels.
- A lower jobs density ratio compared to both regional and national averages.
- Higher business growth relative to regional and national averages, with particularly strong growth in Micro (0-9 employees) firms.
- An economic activity rate that is lower than the regional and national averages. Both the model-based unemployment rate for the AOI and the proportion of economically active population claiming out-of-work benefits are higher than the regional and national averages.

- Worse performance compared to regional and national averages in terms of skills and occupational profile of the resident workforce. The AOI has a lower proportion of residents with higher skills (NVQ Level 4+) and a lower proportion of the workforce in higher skilled occupations (SOCs 1-3). In addition, it has a higher proportion of residents with no qualifications and a greater proportion of the workforce in lower skilled occupations (SOCs 7-9).
- On average lower resident-based earnings compared to workplace-based earnings but in both cases sitting above the regional average but below the national average.
- Significantly higher levels of deprivation within the context of all English local authorities.
- Productivity (as measured by GVA per job) is marginally higher than the regional average but lower than the national average.

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

Demographic profile
According to the 2018-based projections (ONS, 2020b), the population of the AOI is forecast to increase to 480,913 residents by 2032 (an increase of 1.1% from 2019 levels). This is lower than the rate of growth projected at the regional (2.6%) and national (5.8%) level.

The AOI's working age population, however, is projected to decline by 3.4% across the same period. This rate of decline is greater than that expected across the region (-2.1%) and in contrast to a projected increase in the working age population of 2.6% nationally.

Local economic and labour market conditions
The Employment Land Review (NLP, 2016) that forms part of the evidence base for the adopted Redcar and Cleveland Local Plan sets out a range of future employment forecasts for the Borough. The baseline econometric forecast modelled a contraction in the workforce over the course of the plan period, albeit some B class uses (either fully or in part) were forecast to grow over the same period including professional services, administrative and support services and land transport, storage and post. Similarly, the labour supply scenario forecasts only a negligible increase in employment during the plan period.

The Employment Land Review also had regard to a 'policy on' scenario which noted the Tees Valley SEP ambition to deliver 25,000 new jobs across the sub-region over the period 2015-2025. Based upon analysis undertaken by the Tees Valley Combined Authority, the apportionment of this growth within Redcar and Cleveland was estimated to be in the order of 215 new jobs per annum – equating to 2,150 new jobs over the course of the period 2015-2025.

Site specific future baseline
For the proposed scheme specifically, the absence of development (i.e. a no development scenario) would result in a future baseline with no additional on-site job creation – i.e. the proposed scheme would not be developed unless alternative proposals came forward.

21.4 Potential impacts during the construction phase

21.4.1 Creation of direct and indirect employment

Creation of direct employment
The typical approach in assessing levels of construction employment involves the application of an appropriate labour coefficient to an estimated construction cost. However, the specialist nature of the proposed scheme and the construction work required makes it more difficult to accurately estimate the construction employment effects using a labour coefficient approach. For instance, it is estimated that the cost of constructing the proposed scheme (£160 million) allows for considerable costs associated with

dredging activity which are likely to translate to very small direct employment effects. As such, adopting the traditional approach which uses construction cost as a key determinant of construction employment is considered likely to significantly over-state the direct employment effects associated with the proposed scheme during construction.

Cognisant of the above, direct employment effects have been estimated based on experience of other similar types of development and their related construction workforce requirements. In particular, the assessment has reflected the construction workforce requirements associated with the consented Anglo American Harbour facility located downstream of the proposed scheme footprint (RHDHV, 2015).

The scale and nature of the construction work required has been compared with similar schemes and the workforce requirements adjusted commensurately to reflect any key differences between the proposed scheme and the comparators with respect to:

- the dimensions of the proposed quay;
- the phasing of delivery; and,
- the technical specification of works (including the extent of excavation and mechanical/electrical engineering works assumed).

It has been estimated, allowing for the adjustments summarised above, that the proposed scheme could support a maximum of 110 direct FTE construction jobs during the peak requirement, which is expected to occur during demolition, quay construction, excavation and dredging phases. Assuming a gradual ramping up and down from the peak, it is estimated that the works could support approximately 2,600 person-months of employment. Over the course of approximately three year construction phase , this could support an average of 79 direct FTE jobs.

The extent to which construction opportunities created by the proposed scheme will be taken up locally cannot be estimated with any certainty until contracts have been let. Based upon experience, however, it would be reasonable to expect that at least a proportion of the construction jobs would be taken up by residents of the AOI. For instance, whilst national and regional construction firms often use their own labour on schemes, it is typical for a share of the workforce to be drawn from the local area. Indeed, the ES submitted in relation to the Anglo American Harbour facility located downstream of the proposed scheme footprint stated that: *"It is expected that the vast majority of construction employees would be home based and would travel from within the three districts (Royal HaskoningDHV, 2015)."*

Furthermore, it is understood that STDC is committed to maximising the number of Tees Valley firms that are able to access and succeed in tendering for opportunities. Within this context, it is noted that the construction industry is particularly strong within the AOI, with a location quotient of 1.2 (ONS, 2018b).

Creation of indirect and induced employment
Construction typically involves purchases from a range of suppliers, who in turn purchase from their own suppliers further down the supply chain. The relationship between the initial direct and total economic effects is referred to as the 'multiplier effect'. It demonstrates that an initial investment can have much greater 'spin-off' effects as it works through the economy. The construction sector is recognised as being a part of the UK economy where there is a particularly large domestic effect in the supply chain.

In this context, it is anticipated that businesses in the AOI would benefit from supply chain linkages and trade connections established during the construction phase. This would create additional indirect jobs in suppliers of construction materials and equipment.

In addition, local businesses would be expected to benefit from a temporary increase in demand as a result of expenditure by direct and indirect workers during construction. This could be expected to include wage spending of workers in shops, bars, restaurants and other services and facilities and helps to create additional induced jobs.

ONS Detailed Input-Output Tables (ONS, 2019f) indicate that the construction industry has an indirect employment multiplier of 2.17. Applying this to the 79 direct FTE jobs predicted to be supported per annum indicates that the proposed scheme could be expected to support 93 additional indirect FTE jobs per annum over the duration of the build period at the national level (in addition to the direct jobs derived above).

It should be noted that the above analysis is based upon the application of a Type I multiplier and therefore makes no allowance for any induced employment effects associated with the proposed scheme; that is, jobs generated within the local, regional or national economy as a result of expenditure by those in direct or indirect employment associated with the scheme. On this basis, the total employment effect is considered to represent a conservative estimate.

In total, therefore, the proposed scheme could be expected to support 172 direct and indirect FTE jobs per annum over the course of the construction period. In comparison to the total construction industry employment within the AOI (ONS, 2018b) this constitutes growth of 1.6%. The level of employment to be supported by the proposed scheme is considered to correspond with a low magnitude of change. Within the construction industry locally, the latest available data (ONS, 2020c) indicate that comparatively few jobseekers (c.35) are currently seeking employment within the skilled construction and building trades across the AOI. Notwithstanding, model-based unemployment within the AOI is higher than both the regional and national averages (ONS, 2019c) and the proportion of the working age population in the AOI that are claimants currently is also higher than both regional and national averages (ONS, 2020a). The job density of the AOI is also lower than the regional and national averages (ONS, 2018a) and, as indicated above, the sector is overrepresented locally. Taken together, it is assessed that the receptor has medium sensitivity to change.

Taking the above into account, the employment impacts of the proposed scheme during the construction phase are considered to be temporary (short term), **minor beneficial.**

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

21.4.2 Demand for temporary accommodation by construction employees

It is expected that the vast majority of construction employees would be home based and would travel from within the three districts. As such, the magnitude of change is expected to be low. Even if a proportion of construction workers were to require temporary accommodation, there are 67,500 private rented bedrooms in the three districts, of which nearly 18,000 are in Redcar and Cleveland. In addition, there would be hotel and B&B bed spaces. Overall therefore, the receptor sensitivity is also expected to be low.

In this context, the impact of construction workers on temporary accommodation would be temporary (short term) and **negligible.**

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

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21.4.3 Economic output

The construction phase of the proposed scheme will also contribute towards increased economic output, as measured by GVA. GVA is a commonly used measure of productivity and economic performance. It represents the difference between what is produced as output (goods and services) and the inputs required to support the production of those outputs (e.g. raw materials, semi-finished products etc.). In measuring economic growth, economists typically assess the quarterly (or annual) change in GVA for a given area.

Based on recent data, the construction sector in the North East region is estimated to generate an average GVA per FTE worker of £63,040 per annum (Experian, 2020). Applying this to the direct employment effects of the proposed scheme it is estimated that this could generate £5.0 million of direct GVA for each year of the construction phase. Applying an indirect GVA multiplier for the construction sector of 2.04 (ONS, 2019f) to the direct GVA above, it is estimated that the proposed scheme could generate £10.2 million of direct and indirect GVA for each year of the construction phase.

The preceding analysis is based upon the application of a Type I multiplier and therefore makes no allowance for any induced economic output effects associated with the proposed scheme. On this basis, the total economic output effect derived above is considered to represent a conservative estimate.

In relation to the combined total GVA within the construction industry across the AOI (c.£0.66 billion) (ONS, 2019e) this represents a 1.5% uplift in GVA. The level of additional economic output to be supported by the proposed scheme is considered to correspond to a low magnitude of change. The receptor is considered to be of medium sensitivity by virtue of the fact that productivity (all sectors) in the AOI is marginally higher than regional productivity but lower than the national productivity (ONS, 2019e).

Taking the above into account the economic output impacts of the proposed scheme during construction are considered to be temporary (short term), **minor beneficial**.

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

21.5 Potential impacts during the operational phase

21.5.1 Creation of direct and indirect employment

Creation of direct employment
It should be recognised that the assessment of operational phase employment for the purposes of this assessment is independent of the wider employment effects that are likely to be generated by the STDC ‘landside’ development (for manufacturing and warehousing/distribution floorspace). This reflects the fact that the two schemes are progressing through the planning system as two separate planning applications and, as a consequence, the employment effect (and associated economic output) to be generated by the landside proposals are considered within the assessment of cumulative effects only.

Notwithstanding the above, it is understood that the delivery of the proposed scheme is critical to the operational flexibility and prospects of success of the landside scheme.

It has been estimated that the proposed scheme would create approximately 10 gross direct FTE jobs, once completed and operational.

In estimating the net additionality of the proposed scheme, it is important to make allowances for displacement effects. This refers to the extent to which the proposed scheme could reduce demand for other businesses (factor market displacement) – or create shortages of labour in competitor firms (labour market displacement) – in the AOI. It is possible to apply high level displacement allowances by having regard to the Homes and Communities Agency Additionality Guidance (HCA, 2014) supplemented by an analysis of the local context.

The South Tees Regeneration Masterplan (STDC, 2019) establishes the guiding principles for the delivery of the STDC site (which includes the proposed scheme footprint). This states that: *"STDC will not seek to compete with other local sites and will, instead, adopt a collaborative approach to redevelopment with neighbouring landowners and operators so that end users' needs and preferences and wider Tees Valley economic objectives are the prime drivers in determining the best location for a potential developer. The South Tees regeneration programme will therefore deliver a development proposition built from uses that are not in conflict with neighbouring industrial centres' traditional market sectors. The focus will therefore be on those development uses that are clearly better suited to the STDC area, taking cognisance of its setting and attributes; uses that can benefit most optimally from the site's USPS, such as proximity to water and excellent port facilities."*

The document states that the development opportunities at the STDC site are distinct from the general stock of available land across Tees Valley and that this differentiation will be maintained to minimise any competition with other employment locations in the area. This would suggest that factor market displacement is expected to be low, as the proposed scheme competes for investment opportunities that the AOI would not otherwise be able to attract: *"While opportunity areas often share common attributes, there are, equally, often key differentiators that set one opportunity area apart from others; this is certainly the case with the STDC area. The unique attributes of very large vacant land areas and the development flexibility this feature brings, proximity to the North Sea and international standard port facilities, and excellent, existing road and rail connections serve to make the STDC Area significantly more attractive to inward investment.*

"Of particular note, is the elevated premium attached to waterside land. When considering areas such as that of STDC compared to general industrial land, this is akin to the differences in value between prime high street retail and tertiary "off-pitch" streets that can be close to impossible to let and yet are within just a few hundred metres of the high street.

"…The implementation of this Master Plan will build upon the existing attributes and advance the "unique selling point" of the STDC Area, differentiating it from other available industrial land available in Teesside, the region and the UK, thus enabling it to fully compete for businesses and investment on an international stage."

Labour market displacement occurs where new development increases demand for labour, making it more difficult for existing businesses in the AOI to retain or recruit staff. It should, however, be recognised that generally labour market displacement is difficult to quantify and is shaped largely by an assessment of factor market displacement (as above) (HCA, 2014). The scale of employment growth associated with the proposed scheme is small and is unlikely to impact upon the availability of labour within the AOI, particularly given the high levels of local unemployment relative to national and regional averages.

In the context of the above, it is assumed that – if delivered and promoted in accordance with the guiding principles of the South Tees Regeneration Masterplan – the displacement effects of the proposed scheme will be low. In accordance with the Homes and Communities Agency Additionality Guide (HCA, 2014), a 25% displacement allowance has therefore been applied.

As a result, it is estimated that the net additional on-site employment generated by the proposed scheme is likely to be in the order of 8 direct FTE jobs. The potential significance of this impact is confirmed below.

Indirect and induced employment

In addition to the direct jobs considered above, some indirect employment would also be created by the spending on goods and services by those businesses based at the proposed scheme. The wage expenditure of workers employed directly at the proposed scheme, as well as those employed in the supply chain, would also support induced jobs in shops, services and other businesses in the local economy.

Estimates of 'spin-off' employment can be derived having regard to the HCA additionality guidance (HCA, 2014) which indicates a range of type II multipliers at the local (1.29) and regional (1.44) level that can be applied to the proposed operational use. In this context, it is estimated that the net additional on-site employment generated by the proposed scheme could support the creation of a further 2 additional 'spin off' FTE in the supply chain as well as shops, services and other business in the local economy (defined as the AOI). At the regional (North East) level, a total of 4 'spin off' FTE jobs is anticipated (including the 2 to be captured locally).

Overall, the level of direct, indirect and induced employment to be supported by the proposed scheme totals 12 FTEs at the regional level (10 FTEs at the local level). This represents less than 0.01% of the total employment with the AOI and is therefore considered to correspond to a negligible magnitude of change. Model-based unemployment within the AOI is higher than both the regional and national averages (ONS, 2019c) and the proportion of the working age population in the AOI that are claimants currently is also higher than both regional and national averages (ONS, 2020a). The job density of the AOI is also lower than the regional and national averages (ONS, 2018a). Taken together, it is assessed that the receptor has medium sensitivity to change.

As such, the operational employment to be supported by the proposed scheme is considered to represent a permanent and **negligible** impact.

Mitigation measures and residual impact

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

21.5.2 Economic output

The employment opportunities generated by the proposed scheme could be expected to contribute towards the creation of additional economic output (measured as Gross Value Added (GVA)). The precise level of GVA to be generated by the proposed scheme will depend upon the precise nature of the end users attracted to the site. For the purposes of generating an initial estimate, however, it has been assumed that the direct employment to be created during the operational phase is likely to fall broadly within the marine transport and logistics sector.

On the basis of the above, it is estimated that the additional direct employment could generate in the order of £750,000 of additional GVA per annum. This has been estimated having regard to:

- the level of direct FTE (net) employment to be supported by the development; and,
- the average GVA per FTE worker (at the regional level) for the 'Air and Water Transport sector' as defined by Experian (Experian, 2020).

Based upon the latest available data (ONS, 2019e), this would represent an uplift equivalent to 0.3% of the total GVA of the 'Land, Water and Air Transport' of the AOI in 2018. This is considered to correspond to a negligible magnitude of change. The receptor is considered to be of medium sensitivity by virtue of the fact that productivity (all sectors) in the AOI is marginally higher than regional productivity but lower than the national productivity (ONS, 2019e).

The operational economic output associated with the proposed scheme is therefore considered to represent a permanent and **negligible** impact.

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

22 CLIMATE CHANGE

22.1 Introduction

This section of the EIA Report describes the existing environment in relation to climate change and details the assessment of the potential impacts during the construction and operational phases of the proposed scheme.

The climate change assessment comprises a calculation of greenhouse gas (GHG) emissions likely to arise from construction and operational activities associated with the proposed scheme.

22.2 Policy and consultation

22.2.1 Legislation

United Nations Framework Convention on Climate Change

The United National Framework Convention on Climate Change (UNFCCC) is an intergovernmental environmental treaty and entered into force on 21 March 1994. The main objective is the *"stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."*

A regular series of international meetings of the UNFCCC have taken place since 1997 resulting in several important and binding agreements: the Copenhagen Accord (2009); the Doha Amendment (2012); and the Paris Agreement (2015). At the 22nd Climate Change Conference of the Parties (COP22) in November 2016, the UK ratified the Paris Agreement to enable the UK to *"help to accelerate global action on climate change and deliver on our commitments to create a safer, more prosperous future"* (BEIS, 2016).

The Doha Amendment included a commitment by parties to reduce greenhouse gas emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020. The UK Climate Change Act 2008 has an interim 34% reduction target for 2020, which if achieved will allow the UK to meet and exceed its Kyoto agreement target. This interim target for the UK is likely to be met in 2020.

During the United Nations Climate Change Conference in Paris in 2015 (known as 'COP21') the following were key areas of agreement (UNFCCC, 2016):

- limit global temperature increase to below 2ºC, while pursuing efforts to limit the increase to 1.5ºC above the pre-industrial average temperature;
- parties aim to reach global peaking of GHG emissions as soon as possible to achieve the temperature goal;
- commitments by all Parties to prepare, communicate and maintain a Nationally Determined Contribution;
- contribute to the mitigation of GHG emissions and support sustainable development;
- enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change;
- transparent reporting of information on mitigation, adaptation and support which undergoes international review; and,
- in 2023 and every five years thereafter, a global stocktake will assess collective progress toward meeting the purpose of the Agreement.

The UK ratified the Paris Agreement in November 2016. At the recent COP24, held in Katowice, Poland in December 2018, a set of rules for the Paris climate process were agreed.

Kyoto Protocol

The Kyoto Protocol is an international agreement adopted in 1997 and was enacted in 2005. The Protocol is linked to the UNFCCC objective to reduce atmospheric concentrations of GHG to reduce the rate and extent of global warming. The Protocol applies to the reduction of six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

The Protocol acknowledges that the economic development of a country is an important factor in the country's ability to combat climate change. Therefore, countries have an obligation to reduce their current emissions, as they are historically responsible for the current concentrations of atmospheric GHGs.

The Climate Change Act 2008

The UK Climate Change Act 2008 provides a framework for the UK to meet its long-term goals of reducing GHG emissions by 34%, relative to a 1990 baseline by 2020 and by 80% in 2050 ("climate mitigation"). The Climate Change Act was enacted as part of the UK's responsibility and obligations as a signatory of the Kyoto Protocol 1997 (which did not become binding until 2005). The UK target covers the six main GHGs referenced in the Kyoto Protocol.

The UK Climate Change Act requires the government to set legally-binding 'carbon budgets' to provide a constraint of GHG emissions in a given time period. Carbon budgets are caps on the quantity of GHG emissions emitted in the UK over a five-year period. The first five carbon budgets have been placed into legislation and will run up to 2032.

In June 2019, the Government announced an amendment to the Climate Change Act 2008 (Climate Change Act 2008 (2050 Target) Amendment Order 2019) to change the reduction target from at least 80% to be 'net zero'.

The Climate Change Act requires the UK Government to produce a Climate Change Risk Assessment (CCRA) every five years. The CCRA assesses current and future risks to, and opportunities for, the UK from climate change (to inform "climate adaptation" actions). In response to the CCRA, the UK Climate Change Act also requires Government to produce a National Adaptation Programme (NAP) (both discussed further below).

UK Climate Change Risk Assessment 2017

The Government produced its latest CCRA in 2017, the second assessment to be produced for the UK following the first release in 2012. The report concludes that among the most urgent risks for the UK are flooding and coastal change risks to communities, businesses and infrastructure. It identifies suggestions for reducing these risks, including the consideration of climate change in developing new infrastructure.

National Adaptation Programme

The National Adaptation Programme (NAP) sets the actions that the UK government will undertake to adapt to the challenges of climate change in the UK as identified in the CCRA. The NAP details the range of climate risks which may affect the natural environment, infrastructure, communities, buildings and services. Key actions are set out in the NAP which aim to address the identified high-risk areas, which include:

- flooding and coastal change risks to communities, businesses and infrastructure;
- risks to health, well-being and productivity from high temperatures;
- risks in shortages in the public water supply for agriculture, energy generation and industry;
- risks to natural capital; and,
- risks to domestic and international food production and trade.

22.2.2 National Planning Policy

National Planning Policy Framework
The revised NPPF (Ministry of Housing, Communities and Local Government, 2019) was adopted in February 2019, which advises that the planning system should support the transition to a low carbon future. With respect to planning for climate change, the NPPF states:

"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures"

The NPPF also states:

"New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and,

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards."

22.2.3 Local planning policy

RCBC declared a climate emergency in 2018 and has committed the borough to become carbon neutral by 2030. This declaration will be reflected in an Environmental Strategy, as well as wider environmental priorities for the Borough.

Redcar and Cleveland Local Plan
The Redcar and Cleveland Local Plan was adopted on 24th May 2018 by RCBC. The following policies are of relevance to climate change.

2. Sustainability and design

"Policy SD4: General Development Principles
In assessing the suitability of a site or location, development will be permitted where it:

[…]

> e. avoids locations that would put the environment, or human health or safety, at unacceptable risk;
> All development must be designed to a high standard. Development proposals will be expected to:

[…]

> l. be sustainable in design and construction, incorporating best practice in resource management, energy efficiency and climate change adaptation.
> "2.34 Applicants for major developments will be required to submit a Design and Access Statement to demonstrate how good design has been taken into account in drawing up the development proposal, including adaptation to climate change, reducing carbon emissions and water consumption, and setting out how waste will be managed"

“Policy SD7: Flood and water management

Flood risk will be taken into account at all stages in the planning process to avoid inappropriate development in areas at current or future risk. Development in areas at risk of flooding, as identified by the Environment Agency flood risk maps, will only be granted where all of the following criteria are met:

a. the proposal meets the sequential and exception tests (where required) in relation to the National Planning Policy Framework;
b. a site specific flood risk assessment demonstrates that the development will be safe, including the access and egress, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall; and
c. new site drainage systems are well designed, taking account of events that exceed the normal design standard (e.g. consideration of flood flow routing and utilising temporary storage areas).

All development proposals will be expected to be designed to mitigate and adapt to climate change, taking account of flood risk by:

d. ensuring opportunities to contribute to the mitigation of flooding elsewhere are taken;
e. prioritising the use of sustainable drainage systems (SuDs);
f. ensuring the full separation of foul and surface water flows; and
g. ensuring development is in accordance with the Redcar and Cleveland Strategic Flood Risk Assessment.

2.56 The NPPF states that planning should proactively help the mitigation of, and adaption to, climate change including the management of water and flood risk. It is important that inappropriate development is avoided in areas currently at risk from flooding, or likely to be at risk as a result of climate change, or in areas where development is likely to increase flooding elsewhere. Any risk must be assessed by using the Environment Agency flood maps and the Council's Strategic Flood Risk Assessment…”.

7. Natural environment

“Policy N4: Biodiversity and Geological Conservation

Protect and enhance the geodiversity and biodiversity of the Tees Valley ensuring the conservation, restoration and creation of key landscapes and habitats, including mitigating and adapting to the impacts of climate change.

7.38 The Tees Valley Nature Partnership have identified five broad landscape types within the Tees Valley, four of which are present in Redcar and Cleveland…
[…]
7.39 TVNP priorities are to:

1. *Protect and enhance the geodiversity and biodiversity of the Tees Valley ensuring the conservation, restoration and creation of key landscapes and habitats, including mitigating and adapting to the impacts of climate change.”*

9. Transport and accessibility

"9.5. The interface between transport and planning is of great importance…The Redcar & Cleveland Local Transport Plan 2011 – 2021 (LTP3) prepared by the Council sets out strategies to address a number of regeneration and transport priorities. These are:

to promote the reduction of transport's emissions of carbon dioxide and other greenhouse gases, with the desired outcome of tackling climate change;
[…]

9.7 The key objectives for the transport strategy component of the Local Plan are to:

minimise the impact of the movement of people and goods on the environment and climate change;"

22.3 Methodology

The climate change assessment comprised an assessment of GHG emissions arising from construction and operational phase activities associated with the proposed scheme.

22.3.1 Guidance

The assessment was carried out in accordance with the approach detailed in the GHG Protocol (World Resources Institute and World Business Council on Sustainable Development 2015), and Institute for Environmental Management and Assessment (IEMA, 2017). The IEMA guidance provides guidelines for, and requirements of, an assessment of GHG emissions within an EIA, as well as considerations for significance criteria.

22.3.2 Study area

GHG emissions arising from the construction and operational phase of the proposed scheme were predicted within a defined 'project boundary', in accordance with the GHG Protocol (World Resources Institute and World Business Council on Sustainable Development 2015). The 'project boundary' was defined as the proposed scheme footprint, and the routes that marine vessels and road vehicles travel to and from the proposed scheme footprint.

22.3.3 Data sources

The assessment was undertaken with reference to several sources, as detailed in **Table 22.1.**

Table 22.1 Key information sources

Data source	Reference
Greenhouse Gas Reporting, Conversion Factors 2020	BEIS, 2020a
Emissions of Carbon Dioxide for Local Authority Areas	BEIS, 2020b
ICE Database, 2019	ICE, 2019
GloMEEP	GloMEEP, 2018, Port Emissions Toolkit, Guide Number 01, Assessment of Port Emissions

22.3.4 Consultation

The methodology for the climate change assessment was provided to RCBC. This included details of the GHG emissions sources considered in the assessment, emission factors and significance criteria. No response was received from RCBC to our proposed methodology and therefore we have assumed that the method was acceptable.

22.3.5 Impact assessment methodology

The GHG assessment was undertaken in accordance with the methodology defined in the GHG Protocol, developed by the World Resources Institute and World Business Council on Sustainable Development (2015).

The term 'GHG' in this assessment encompasses three gases, namely CO_2, CH_4 and N_2O. Emissions of other 'Kyoto' gases are not considered significant in the context of the proposed scheme and they are excluded from consideration. Where practicable, the results in this assessment are expressed in carbon dioxide equivalent (CO_2eq) which recognises that different gases have notably different global warming potential[11].

22.3.5.1 Construction phase

The construction phase GHG assessment quantified GHG emissions, considered to be net contributions to the global system, from the following sources:

- embedded carbon in materials used on site;
- fuel consumption from marine vessels, dredgers and road traffic; and,
- fuel consumption by plant and equipment.

As most of the construction plant and equipment are likely to be diesel powered, GHG emissions associated with the consumption of electricity during the construction phase are anticipated to be minimal and were not be considered in the assessment.

The approach to determine GHG emissions from each of the sources considered in the assessment is provided below.

Embodied emissions in materials
Embodied GHGs are the total emissions generated to produce a built asset. "Cradle to (factory) gate" GHG emissions, which encompass the extraction, manufacture and production of materials to the point at which they leave the factory gate of the final processing location, were calculated for main construction materials associated with the proposed scheme. GHG emissions were derived from quantities or volumes of known materials that will be used in construction.

The quantities of each type of construction material to be used on site have been estimated and the relevant emission factors sourced from the Inventory of Carbon and Energy (ICE) database (ICE, 2019). The emission factors from the ICE database are 'cradle-to-factory' and, therefore, do not include the transportation of materials to site. Volumes of new materials to be used on site that were considered in the assessment are provided in **Table 22.2**.

[11] Global Warming Potential of a GHG is a measure of how much heat is trapped by a certain amount of gas in the atmosphere relative to carbon dioxide.

Table 22.2 Construction materials to be used for the proposed scheme

Infrastructure	Construction material in the ICE database	Volume of construction materials (m^3 unless otherwise stated)			Emission factor (kg CO_2e / kg)
		Phase 1	Phase 2	Total	
Piles	Concrete (1:1:2 Cement: Sand: Aggregate)	11,866	11,014	22,880	0.209
Imported fill	General Aggregates and Sand	111,006	102,960	213,966	0.005
Surfacing (crushed stone)	General Stone	7,848	7,848	15,696	0.079
Rock blanket	General Stone	81,000	105,300	186,300	0.079
Concrete	General Concrete	12,963	12,034	24,997	0.103
Platform pile	Concrete (1:1:2 Cement: Sand: Aggregate)	5,974	5,974	11,948	0.209
Platform deck	General Concrete	4,500	4,500	9,000	0.103
Receiving platform piles	Concrete (1:1:2 Cement: Sand: Aggregate)	7,037	6,225	13,262	0.209
Receiving platform deck	General Concrete	11,700	10,350	22,050	0.103

Emissions associated with the movement of materials to the site were quantified from the road vehicle source group, detailed in **Table 22.3**. These vehicle movements also include the removal of unusable materials from site for disposal at an appropriately licensed facility. It is envisaged that concrete arisings from demolition works would be crushed on site and reused as fill as part of the proposed scheme. It is also assumed that excavated soils could be re-used on-site or the adjacent SIZ development without requiring disposal into landfill.

Road transport movements

Road transport movements during the construction phase will be associated with workers travelling to the site via car and HGV movements. An average trip length of 50km (each way) for HGV movements, and 10 km (each way) for cars has been assumed, which are considered to be the likely average travel distances for workers and supplies. Emission factors were obtained from the Department for Business, Energy and Industrial Strategy (BEIS) (BEIS, 2020a).

The construction phase traffic movements used to calculate GHG emissions are provided in **Table 22.3**.

Table 22.3 Construction phase traffic movements

Vehicle	Average daily trips	Annual trips	Average trip length, each way (km)	Annual distance (km)
Cars	200	52,000	10	1,008,000
HGVs	41	10,660	50	1,033,200
*Assumed 5 day working week, with no bank holiday or public working holiday (8 days).				

Emission factors for each vehicle type considered in the assessment were obtained from BEIS, in kg CO_2e per km travelled. The forecast change in the fleet composition of diesel, petrol and electric cars was obtained from the Department for Transport (DfT 2019) WebTAG data. In the absence of suitable empirical data, it has been assumed that the fleet composition of HGVs would not change over the temporal scope of the assessment to provide a precautionary approach.

On-Site plant and equipment

Emissions associated with fuel consumption from on-site plant and equipment during construction have been calculated from those known at the time of assessment, as listed in **Table 22.4**. The engine power for each vehicle and equipment has been obtained from manufacturer specifications.

The engines for each of the plant and equipment were assumed to operate at 80% load for the full duration of the working day (24 hours a day) during the whole construction phase. This is likely to be conservative, as it is unlikely that a number of plant and equipment would be used for the full duration of the construction phase. It was assumed that all construction plant would be diesel powered. Emission factors for the assessment were obtained from BEIS (2020a).

Table 22.4 Site vehicles to be used during the construction phase (indicative of market equipment)

Vehicle	Plant and equipment operation (weeks)	Assumed engine power (kW)
Jack up with crawler crane (Marlin or similar)	50	230
Slave barge (400t)	50	294
Safety/workboat	50	588
Concrete crusher	50	149
Piling rig	200	390
Excavator	327	70
Dump truck	247	34.8
Crane	180	260
Roller	80	137
JCB	64	93

Capital dredging

Capital dredging will be carried out within part of the Tees Dock turning circle, within parts of the existing navigation channel and within areas not currently subject to maintenance dredging to create a berth pocket. This would include dredging of marine sediments and excavation of soils / landside material within the river bank to create the berth pocket.

The total dredged volume for marine sediments is predicted to be approximately 1,800,000m^3. Dredging will be undertaken using a combination of a TSHD and a backhoe dredger. Different backhoe dredgers will be used for soft and hard materials. It is envisaged that up to three barges will be required to support with the transport of sediment dredged using the backhoe dredger to the offshore disposal site.

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Information for the calculation of GHG emissions from dredging are provided in **Table 22.5.**

Table 22.5 Specifications of dredgers and barges to be used during the construction phase

Parameter	TSHD	BHD- soft material	BHD – hard material
Service time (hr/week)	168	168	168
Operational time (hr/week)	140	120	120
Number of dredgers	1	1	1
Number of barges	0	2	2
Installed power dredger (kW)	8,313	1,600	1,600
Installed power barge (kW)	0	1,800	1,800
Total installed power (kw) (including dredger and barge)	8,313	5,200	5,200
Power load factor estimate – dredger	50%	75%	80%
Power load factor estimate – barge	0%	45%	27%
Weekly fuel consumption (m^3)	158	92	74
Duration of deployment (weeks)	4	8	8
Total fuel consumption (l)	586	686	637

Construction vessel deliveries

In addition to the workboats associated with demolition listed in **Table 22.4**, and dredgers and barges listed in **Table 22.5**, there will be emissions associated with delivery of materials such as piles and rock for use in the proposed berth pocket to create the rock blanket.

The calculation of GHG emissions from construction vessels was carried out in accordance with the Port Emissions Toolkit, published by the GloMEEP Project Coordination Unit (GloMEEP, 2018). Emissions were calculated from vessels cruising to the site using propulsion and auxiliary engines, where in the absence of available information regarding the origin of delivered material, an average trip length of 300km per delivery was assumed. In addition, emissions were also calculated from vessels using auxiliary engines whilst at the berth offloading or loading material.

It was assumed that the rock blanket material would be delivered to the proposed berth pocket on the Stema Barge II or similar, and all other deliveries would be from General Cargo vessels of less than 5,000 dead weight tonne (DWT). Load factors, engine sizes for general cargo vessels and GHG emission factors were obtained from the Port Emissions Toolkits (GloMEEP, 2018).

Parameters to calculate GHG emissions from construction vessel deliveries are provided in **Table 22.6**.

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Table 22.6 Parameters to calculate emissions from construction vessel deliveries

Vessel	Number of deliveries	Total distance travelled (km)	Propulsion engine capacity (kW)	Auxiliary engine capacity (kW)	Emission factors (g / kWh)			
					CO_2 (propulsion engines)	CO_2 (auxiliary engines)	N_2O	CH_4
Stema Barge II (or similar)	13	3,900	3,840	845	683	722	0.03	0.01
General Cargo	16	4,800	1,008	222	683	722	0.03	0.01

22.3.5.2 Operational phase

GHG emissions were calculated from marine vessels predicted to be using the proposed scheme during operation. Assuming a worst-case scenario from a vessel size perspective (whereby the scheme is utilised for the offshore wind industry), the proposed scheme has been designed to accommodate a vessel with an overall length of up to 169m, breadth of up to 60m and laden draft of 11m. In addition to the vessels used to support with the manufacturing and staging of wind farm components, it is envisaged that other, smaller installation vessels would also utilise the quay including general cargo vessels.

It has been estimated that up to 390 offshore wind vessel calls would take place at the facility on an annual basis. This includes approximately 300 vessel calls per year associated with offshore wind staging and 90 vessel calls per year associated with offshore wind manufacturing activities.

For the purposes of the assessment, parameters from the North Sea Atlantic, an offshore support vessel which operates in the North Sea, were used in the assessment. It was assumed that each vessel would be cruising for a period of 24 hours, and hotelling at the berth for 24 hours per vessel call.

GHG emissions from operational phase vessels were calculated in accordance with the Port Emissions Toolkits (GloMEEP, 2018), as detailed for construction phase vessel movements. Parameters used to calculate emissions from vessels in the operational phase are detailed in **Table 22.7.**

Table 22.7 Parameters to calculate emissions from vessels in the operational phase

Vessel	Number of movements	Propulsion engine capacity (kW)	Auxiliary engine capacity (kW)	Emission Factors (g / kWh)			
				CO_2 (propulsion engines)	CO_2 (auxiliary engines)	N_2O	CH_4
North Sea Atlantic (or similar)	390	9,000	1,200	683	722	0.03	0.01

In addition, four mobile cranes are anticipated to be used during the operational phase of the proposed scheme, which will be responsible for loading and unloading of materials on vessels situated at the berth. It has been assumed that the cranes would operate at 80% load for 14 hours per day, and would be diesel powered. Parameters to calculate emissions from cranes during the operational phase are provided in **Table 22.8**. Emission factors for the consumption of diesel by cranes were obtained from BEIS (2020a).

Table 22.8 Parameters to calculate emissions from cranes in the operational phase

Vessel	Engine Size (kW)	Operational Hours	Gas Oil Emission Factor (kg CO2 / kWh)
Crawler Crane	750	5,110	0.257
Mobile Harbour Crane	400	5,110	0.257

Due to uncertainties in the uptake of cold ironing within the shipping sector, indirect (Scope 2) GHG emissions from the consumption of electricity by vessels at the berth were not considered in the assessment. As detailed in **Table 22.7**, it was assumed that vessels would use auxiliary engines whilst situated at the berth, which is likely to release more GHG emissions than cold ironing. Therefore, the assessment approach is considered to be conservative.

22.3.6 Significance criteria

There is no single preferred method to evaluate the significance of GHG emissions arising from a 'project'. IEMA guidance advises that all releases of GHGs might be considered to be significant, but professional judgement should be used to contextualise a project's GHG budget (IEMA, 2017).

GHG emissions arising from the project were therefore compared to existing regional GHG emissions, and the national UK carbon budgets.

22.4 Existing environment

22.4.1 Regional GHG emissions

The Department for Business, Energy and Industrial Strategy's (BEIS) *Emissions of carbon dioxide for Local Authority areas* online database discloses the UK's CO_2 net emissions in 2018 were estimated at 373,235 kt CO_2 (BEIS, 2019b). **Table 22.9** presents annual CO_2 emissions in the Redcar and Cleveland region from 2005 to 2018.

Table 22.9 Redcar and Cleveland Region CO_2 Emission Estimates 2005-2018 (kt CO_2) (BEIS, 2020a).

Year	Industry and commercial	Domestic	Transport	Total
		Annual kt CO_2		
2005	9,992.2	333.5	220.5	10,543.1
2006	9,609.1	330.3	218.7	10,154.5
2007	9,809.5	315.8	221.3	10,342.6
2008	9,005.3	311.5	214.0	9,526.5
2009	7,999.9	282.2	204.4	8,482.2
2010	3,756.2	301.3	201.8	4,254.6
2011	3,292.0	261.6	198.2	3,746.9
2012	7,725.6	284.8	193.7	8,198.9
2013	9,309.4	277.3	191.2	9,772.3
2014	8,559.7	232.0	193.7	8,979.7
2015	6,614.7	224.9	191.9	7,025.5

Year	Industry and commercial	Domestic	Transport	Total
		Annual kt CO_2		
2016	2,347.4	215.3	194.3	2,751.2
2017	2,307.7	202.8	196.3	2,700.5
2018	2,213.1	198.0	197.9	2,602.5

Industry and Commercial was the largest contributing sector to GHG emissions within the Redcar and Cleveland region between 2005 and 2018. During 2018 the Industry and Commercial sector released 2,213.1 kt CO_2 whilst Domestic and Transport sectors contributed 198.0 kt and 197.9 kt respectively.

The data in **Table 22.9** shows that annual CO_2 emissions within the Redcar and Cleveland region have decreased by 75% from 2005 to 2018, with reductions in Industry and Commercial the largest driver of this change. This is a larger reduction than the wider UK average, which had a reduction of 35% over the same time period (BEIS, 2020b).

22.5 Potential impacts during the construction phase

Construction phase GHG emissions from the activities considered in the assessment are provided in **Table 22.10.**

Table 22.10 Predicted GHG emissions during construction

Source	CO_2e emissions (tonnes)
Construction dredger	6
Construction vessels	453
Construction plant estimate	2,474
Construction vehicles	1,063
Construction materials	58,536
Total	**62,532**

It is anticipated that the proposed scheme would generate approximately 62,500 tonnes of CO_2e during the construction phase.. The largest source of emissions is from embodied emissions within materials used during construction works, comprising approximately 94% of total emissions.

Construction of the proposed scheme is anticipated to take place over an approximately three-year period. Therefore, assuming an even distribution of emissions over the three-year period, construction of the proposed scheme would contribute less than 1% of emissions within the RCBC region, based upon the most recent figures for 2018. It is acknowledged that some emissions sources considered in the assessment will take place outside of the RCBC administrative region, possibly even the UK, particularly embodied emissions within construction materials and construction vessel movements.

At a national scale, the fourth carbon budget for the UK for emissions between 2023 to 2027 is an average of 390 Mt CO_2e per year. Therefore, over the three-year construction period, emissions from the proposed scheme would comprise 0.006% of the national carbon budget. It is acknowledged that the UK carbon budgets are due to be updated in late 2020 following the adoption of the net zero target (2019 amendment to the 2008 Climate Change Act). However, the construction of the proposed scheme is not anticipated to compromise the ability of the UK to meet its targets in the fourth carbon budget. GHG emissions arising from the construction phase of the project are therefore not considered to be significant in terms of regional or national carbon budgets.

Mitigation measures and residual impact

At the time of preparing the GHG assessment, full construction phase logistics and strategies were not fully developed. However, potential mitigation measures to reduce GHG emissions from construction phase activities are provided below:

- reduce quantities of materials required during construction through efficient design, and use materials with a lower embodied GHG intensity where possible;
- ensure preference for materials that are locally sourced to minimise transport distances;
- implement a Construction Traffic Management Plan to minimise the number of journeys required during construction; and
- use electrical powered construction plant over fossil fuelled construction plant.

Furthermore, some of the mitigation measures to minimise air pollutant emissions during construction, listed in **Section 18**, will also reduce GHG emissions during construction. These include:

- Implement a Travel Plan that supports and encourages sustainable travel for contractor operatives and staff (public transport, cycling, walking, and car-sharing).
- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Implementation of energy conservation measures with respect to the use of NRMM and plant, including:
    - instructions to throttle down or switch off idle construction equipment;
    - switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded; and
    - ensure equipment is properly maintained to ensure efficient energy consumption.

The measures listed above have the potential to reduce GHG emissions arising from construction activities associated with the proposed scheme. However, some emission sources, such as embodied GHGs within construction materials, are unavoidable and there will be some residual construction-related emissions. It is however not considered likely that these emissions will results in a significant increase in regional GHG emissions, or compromise the ability of the UK to meet its targets as part of the fourth carbon budget.

22.6 Potential impacts during the operational phase

GHG emissions from the proposed operational phase of the proposed scheme which have been considered in the assessment are provided in **Table 22.11.**

Table 22.11 Predicted GHG emissions during operation of the proposed scheme

Source	CO_2e emissions (tonnes)
Emissions from vessels cruising	48,415
Emissions from vessels hotelling at the berth	1,397
Emissions from cranes	1,207
Total	**51,018**

Operational phase GHG emissions associated with vessels moving to and from the proposed scheme are anticipated to be 51,018 tonnes per year. The primary use of the proposed scheme is likely to be supporting the construction of offshore wind farms, which would be subject to a separate planning application and EIA. Without the implementation of the proposed scheme, construction vessels for the offshore wind farms would use alternative facilities on the east coast of England. Therefore, it is considered that the provision of the proposed scheme only displaces emissions that would be released as part of construction of other projects. Furthermore, the proposed scheme would be supporting the construction of offshore wind farms, which in itself would help to reduce the UK's carbon intensity of electrical generation. Therefore, impact of operational GHG emissions from the proposed scheme is considered to be not significant.

Mitigation measures and residual impact

The proposed scheme would provide shoreside power (termed 'cold ironing') and therefore vessels would not need to operate main or auxiliary engines whilst berthed. Whilst it is acknowledged that some vessels may not have the capability to utilise this technology, it is likely to lead to a significant reduction in emissions from berthed vessels. As shown in **Table 22.9**, emissions from vessels hotelling at the berth could be responsible for 1,397 tonnes per year. Therefore, a 50% reduction in auxiliary engine use could result in a saving of up to 698 tonnes per year, depending on the carbon intensity of the UK electricity network.

Reductions in emissions from shipping vessels will be largely driven by wider sector legislation changes, or the uptake or technological improvements within the industry. Until the shipping sector can be completely decarbonised, there will be emissions arising from the movement of vessels to the proposed scheme.

However, as the proposed scheme will only result in a displacement of emissions from elsewhere, and it will be supporting projects which will decarbonise the UK electricity network, it is not considered that emissions from operational activities will affect the ability of RCBC or the UK to meet their carbon reduction targets.

23 USE OF NATURAL RESOURCES

Schedule 3 of The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2017 states that EIA Reports produced under these Regulations should include a description of the likely significant effects of the development on the environment resulting from (amongst others): *"the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources."* Very similar wording is contained within Schedule 4 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

Although there will be a requirement for the use of natural resources during construction and operation (i.e. water for drinking/WC use), this is not considered to be significant / unusual for a project of this nature (and no significant natural resource demands are anticipated). Further assessment regarding the use of natural resources is therefore not required. Reference should be made to **Appendix 1** which considers opportunities for the management of waste anticipated to be generated from the site.

24 DISASTER RISK

As noted in the scoping note (Royal HaskoningDHV, 2020), it is considered that disaster risks (e.g. earthquakes) are not applicable to the proposed scheme.

It is recognised that there is a series of pipe tunnels that cross under the Tees estuary in the vicinity of the proposed scheme. However, the proposed scheme has been designed to ensure that works are not required above the pipe tunnels and therefore no disaster risk associated with the pipe tunnels is envisaged. In addition, an electricity pylon is located upstream of the proposed scheme footprint, with electricity cables passing over the river channel. Potential impacts to such infrastructure which could lead to disaster risks from a health and safety perspective, have been designed out of the scheme by locating the proposed quay downstream of such infrastructure.

Given the estuarine setting of the proposed scheme footprint, the main disaster risk associated with the scheme would likely be linked to coastal flooding. The assessment reported in **Section 20** appropriately addresses such potential impacts, and therefore no further assessment of disaster risk is proposed.

25 HEALTH RISK ASSESSMENT

25.1 Policy, methodology and consultation

The Marine Works (Environmental Impact Assessment) (Amendments) Regulations 2017 and the Town and Country Planning (Environmental Impact Assessment) 2017 brought in a requirement to consider the potential impact of a proposed scheme on human health. This section of the EIA Report has therefore been produced to ensure compliance with this requirement.

In the consultation stages of the aforementioned EIA regulations, the general interpretation was that effects of a development on local community health would particularly apply in the combustion, waste and chemicals sectors, and the proposed scheme does not involve such activities. As proposed in the scoping document (**Appendix 2**), this health impact assessment is therefore a concise assessment which relies on the findings of the assessments undertaken for other sections of the EIA, notably air quality and noise and vibration. The assessment has also taken into account the findings of the land quality assessment presented in **Section 8**. Given the scale of the proposed scheme, it was not considered necessary to undertake a full human health impact assessment.

Consultation with the MMO and RCBC confirmed that this approach was acceptable, and therefore the assessment has been undertaken in accordance with the approach presented in the scoping document.

25.2 Potential impacts during the construction phase

25.2.1 Potential reduction in human health

The aspects of the proposed scheme which may give rise to human health impacts are identified as construction related noise and construction phase air quality reductions. A summary of these potential impacts is provided below, using information from **Section 17** and **18** respectively.

Section 17 considers the potential impacts of the proposed scheme on local commercial receptors, as a result of construction related noise disturbance. Impacts to residential receptors were scoped out of the assessment through agreement with RCBC's Environmental Health Officer. The assessment concludes that there would be impacts of **negligible** significance to the only NSR scoped into the assessment.

Section 18 of this EIA Report refers to the Government's health-based ambient air quality objectives, and considers potential impacts on the nearest human receptor locations to the footprint of the proposed scheme. The objectives are established for individual air pollutants at levels which include consideration of the exposure of sensitive or vulnerable members of the public, (e.g. the young, elderly and those with pre-existing lung or coronary conditions). The assessment of potential emissions from construction works concludes that no air quality objective would be breached during the construction phase, and that the proposed scheme would have no significant air quality effects on human receptors (from either construction dust and particulate matter, construction traffic or construction phase vessel exhaust emissions).

Section 8 of this EIA Report considers the potential impacts of the proposed scheme on human health of construction workers as well as human receptors off site. Given the historic uses of the site, there is a risk that any contamination present within the on-site soils or structures to be demolished could be mobilised resulting in risks to human health via a range of pathways including ingestion, inhalation and direct dermal contact. The assessment concludes that with the adoption of embedded mitigation (i.e. implementation of a CEMP, adherence to best practice and guidance and use of appropriate PPE), impacts to human health would be negligible to minor adverse significance.

Taking the above into account, it is considered that the combined impact to human health as a result of noise and air quality disturbance would be **negligible**.

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

25.3 Potential impacts during the operational phase

25.3.1 Potential reduction in human health

The aspects of the proposed scheme which may give rise to human health impacts during operation are identified as operational phase related noise and air quality reductions, as well as any impacts associated with land quality. A summary of these potential impacts is provided below, using information from **Section 17, 18** and **8** respectively.

As detailed in **Section 17** and **18**, operational phase noise and air quality disturbance is predicted to be of negligible significance and not significant respectively. In addition, operational phase impacts to human health as reported in **Section 8** with regard to land quality are considered to be of negligible significance. It therefore follows that the combined impact to human health as a result of noise and air quality disturbance and land quality would be **negligible**.

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

26 OFFSHORE DISPOSAL OF DREDGED MATERIAL

26.1 Introduction

The proposed scheme is predicted to generate up to approximately 1,800,000m^3 of dredged sediment from the Tees estuary. As detailed in **Section 3**, alternatives to offshore disposal have been investigated, however, none are considered to be feasible at this stage. The assessment presented below has therefore been undertaken on a worst-case basis whereby all dredged sediment from the Tees estuary would be disposed offshore.

This section of the report has been informed by undertaking a review of relevant publicly available data regarding the Tees Bay C offshore disposal site. This includes the findings of a targeted benthic ecological survey undertaken during 2019 as part of the NGCT project and data recovered by Cefas during monitoring in 2010 (under the SLAB5 project).

26.2 Modelling the dispersion and deposition of capital dredged material and effect on water quality

To inform the assessment of environmental impacts from predicted offshore disposal of dredged material, a hydrodynamic modelling exercise has been undertaken. The results from the modelling exercise are presented in **Section 6** and are summarised below.

As the offshore disposal commences, a plume of sediment would be generated with the greatest concentrations predicted at the end of the discharge period. The sediment plume is predicted to increase in spatial extent shortly after cessation of discharge due to advection by tidal currents, but then very rapidly reduces in concentration progressively over subsequent timesteps as some material falls relatively quickly to the seabed whilst the material remaining in suspension starts to further disperse in spatial extent.

At 30 minutes after cessation of discharge, the plume is less than 250mg/l at its localised centre, reducing to less than 10mg/l at its peripheries and this trend of dispersion continues throughout the ebbing phase of the tide such that 1 hour after cessation of discharge (Plot G), the plume has a maximum SSC of less than 120mg/l at its centre reducing to less than 10mg/l towards its edges. By the time the next disposal activity commences and starts to form its own sediment plume, the initial plume has moved sufficiently far from its point of release that it does not coalesce with the new plume and, by this time, is less than 40mg/l in SSC at its centre and mostly less than 20mg/l a short distance from the centre and thus is not visible in the plots at the magnitudes presented. The original plume continues to disperse such that after 4 hours and 25 minutes since cessation of discharge, there is absolutely no enhancement due to the initial event (and for a long period prior to this the enhancement is so small in magnitude and spatial extent as to be negligible in such a great depth of water in this deep-water offshore area).

At times when the release is around slack water, the plume tends to reside closer to the point of release for longer, until the subsequent ebb or flood phase of the tide starts to transport it in suspension in the water column in the appropriate direction of dispersion (i.e. to the north-west or south-east, respectively). However, when this occurs the concentration in the plume reduces readily because more material falls to the seabed during the slack currents.

With regard to deposition, **Figure 6.65** to **6.68** illustrate the predicted seabed thickness due to the proposed deposition of sediment. As shown on **Figure 6.66**, deposited sediment from one disposal event is predicted to largely reside within the Tees Bay C disposal site and is of low magnitude (typically a few tens of centimetres).

Royal HaskoningDHV

26.3 Predicted effects

The proposed disposal of dredged material within the Tees Bay C offshore disposal site has the potential to have an influence on the following environmental topics:

- Fish populations and fisheries.
- Benthic ecology.
- Commercial navigation.
- Marine mammals.

The potential impacts on the above environmental topics are discussed below.

26.3.1 Fish populations and fisheries

Impacts on fish due to reductions in water quality and smother of existing habitat

Based on the modelled effects of the sediment plume at the Tees Bay C disposal site described above, it is concluded that there is limited potential for an impact on water quality and, therefore, fisheries interests both within and beyond the boundary of the Tees Bay C site due to disposal of dredged material. Seabed deposition is predicted to be negligible beyond the boundaries of the Tees Bay C disposal site.

Given the long-term history of Tees Bay C as a licensed disposal site, it is considered highly unlikely that the area would be utilised by fish species for feeding, spawning or as a nursery ground. It is also concluded that the site would not represent important fishing grounds for the same reason. It is therefore concluded that there would be **negligible** impact on fish or fisheries due to the proposed deposition of dredged material at Tees Bay C.

Mitigation measures and residual impact

No mitigation measures are required. There would be a residual impact of **negligible** significance**.**

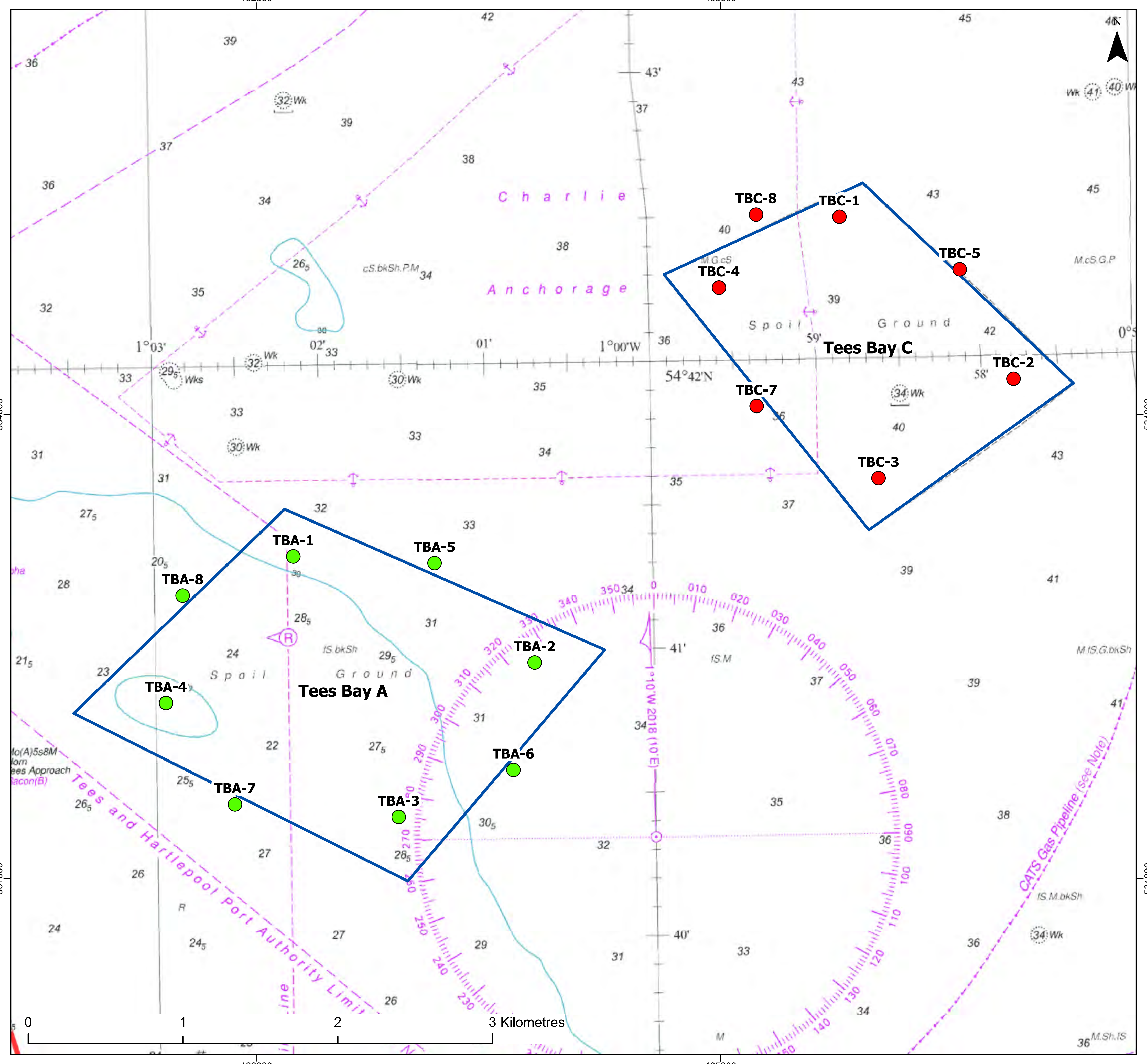
26.3.2 Benthic ecology

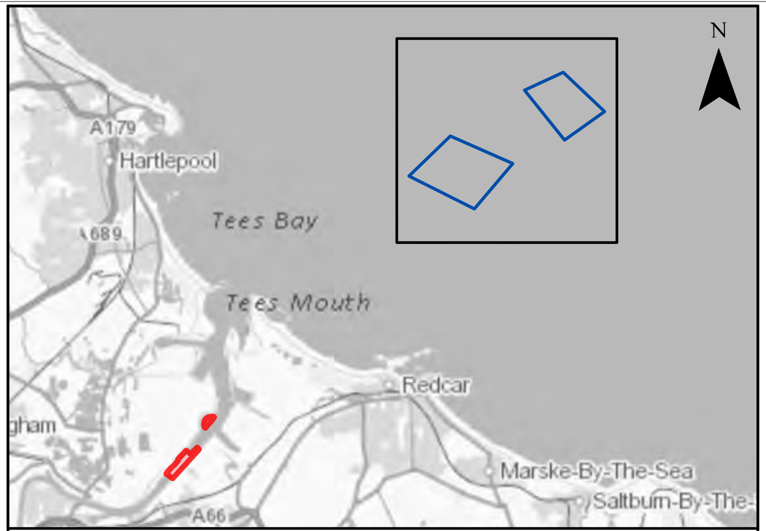
Smothering of existing habitats

In 2010, CEFAS undertook the 'SLAB5' dredged material disposal site sampling survey at a number of disposal grounds around England and Wales, including Tees Bay C and Tees Bay A (Bolam *et al.,* 2011). The study concluded that the macrofaunal communities within the Tees Bay C and Tees Bay A disposal sites appear to be altered (relative to those outside), but that disposal activity has not had significant impacts on either the total number of taxa per grab or the total number of individuals (Bolam *et al*., 2011)

A total of eight Day grab samples (0.1m^2) were collected from within and immediately adjacent to the Tees Bay C offshore disposal during March 2019 as part of the surveys undertaken for the NGCT scheme (**Figure 26.1**). Macrobenthic and PSD analysis was undertaken on these samples. Eight Day grab samples were also recovered from within and immediately adjacent to the Tees Bay A disposal site.

The PSD results show that the sediments within and adjacent to Tees Bay C comprise gravelly muddy sand, muddy sandy gravel and muddy sand. The macrobenthic analysis confirmed that the samples recovered from within and adjacent to Tees Bay C were dominated by Annelida in terms of abundance, biomass and diversity.





Legend

- Site Location
- Offshore Disposal Site

Grab Sample Locations

- Tees Bay A
- Tees Bay C

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Location of grab samples within and adjacent to the Tees Bay offshore disposal sites from 2019

Figure: 26.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/10/2020	TC	SR	A3	1:25,000

Co-ordinate system: British National Grid

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Cluster analysis of square-root transformed macrobenthic abundance data was undertaken to determine the similarity of the epibenthic communities recorded in each sample. The analysis confirmed that all eight samples from within and immediately adjacent to the Tees Bay C site fell within the same faunal group. This faunal group was dominated by the polychaete *Lumbrineris cingulata* which contributed 21% of the within group similarity. Other prevalent species included *S. spinulosa* and Nemertea, which contributed 6% and 5% of the within group similarity respectively.

The Tees Bay C offshore disposal site was found to support populations of two species of conservation interest, namely the Ross worm S*. spinulosa* and the ocean quahog *Arctica islandica*. *A. islandica* is on the OSPAR List of threatened and/or declining species and habitats and is also a FOCI in England and Wales. Dense subtidal aggregations of tubes created by *S. spinulosa* may form biogenic reefs that can stabilise cobble, pebble and gravel habitats and provide a consolidated habitat for epibenthic species (Pearce *et al.* 2011). These reefs form solid, raised structures above the surrounding seabed, thus increasing local habitat complexity and creating a biogenic habitat onto which various other species may become established. *S. spinulosa* is therefore only an Annex I habitat when it is present in reef formation. A summary of the number of individuals recorded at each sample is provided in **Table 26.1**.

Table 26.1 Summary of species of conservation interest in samples recovered from Tees Bay C

Species	Sample ID	Individuals present
S. spinulosa	C1	15
	C2	725
	C3	1
	C5	66
	C6	262
	C7	1
	C8	10
A. islandica	C3	5
	C4	4
	C6	1

As reported above, there were high densities of *S. spinulosa* found locally within Tees Bay C (particularly from site C2). Despite the high density of individuals at this location, the visual inspection of the grab samples indicated that the tube aggregations were representative of a low-lying veneer formation that was not deemed to meet the Annex I reef qualifying criteria as described by Gubbay (2007) (Ocean Ecology, 2019).

As well as species of conservation interest, two individuals of the invasive species *Yoldiella* were reported at one station within Tees Bay C. Following discussions with expert bivalve taxonomists at the National Museum of Wales, they were assigned to *Yoldiella c.f hyperborea*. The genus *Yoldiella* is in need of further taxonomic study with three species recorded on the east coast of the USA, Norway and Iceland as well as two potential subspecies. Molecular systematics would be required to determine which population or species these specimens belong to with certainty.

As shown on **Figure 26.1**, the sampling station which contained the invasive species *Yoldiella* was located on the eastern boundary of the disposal site. None of the other seven sampling stations within and adjacent to the Tees Bay C site contained invasive species. It should also be noted however that individuals were recorded within both the Tees estuary and the Tees Bay A site, indicating a potentially widespread population beyond the boundary of the Tees Bay C site.

Broadscale habitat mapping from the UKSeaMap (2018) illustrates that the Tees Bay C offshore disposal site is occupied predominantly by low and moderate energy deep circalittoral sand (EUNIS code A5.27) (**Figure 26.2**). An area of moderate energy deep circalittoral mud (EUNIS code A5.37) is also reported to be present in the south-west corner of the Tees Bay C offshore disposal site, with localised areas of moderate energy circalittoral fine sand or circalittoral muddy sand in the west of the site (EUNIS code A5.25 and A5.26).

The proposed disposal of dredged material at the Tees Bay C offshore disposal site would be significantly greater than the rate of input of material to this site over recent years. It is therefore concluded that the disposal activity would be expected to result in an impact on the benthic ecology (smothering) at and adjacent to the disposal ground due to the predicted accumulation of material on the seabed.

A review of MarLIN has been undertaken to determine the sensitivity of the key species present within and immediately adjacent to the Tees Bay C offshore disposal site to smothering. This data is provided in **Table 26.2**.

Table 26.2 Sensitivity of key species within the Tees Bay C offshore disposal site to impacts likely to arise from offshore disposal of dredged material

Species	Pressure	Intolerance	Recoverability	Sensitivity	Evidence / confidence
Sabellaria spinulosa	Smothering	Low	Immediate	Not sensitive	Moderate
	Increase in suspended sediment	Low	Immediate	Not sensitive	Moderate
	Introduction of non-native species	No information available			

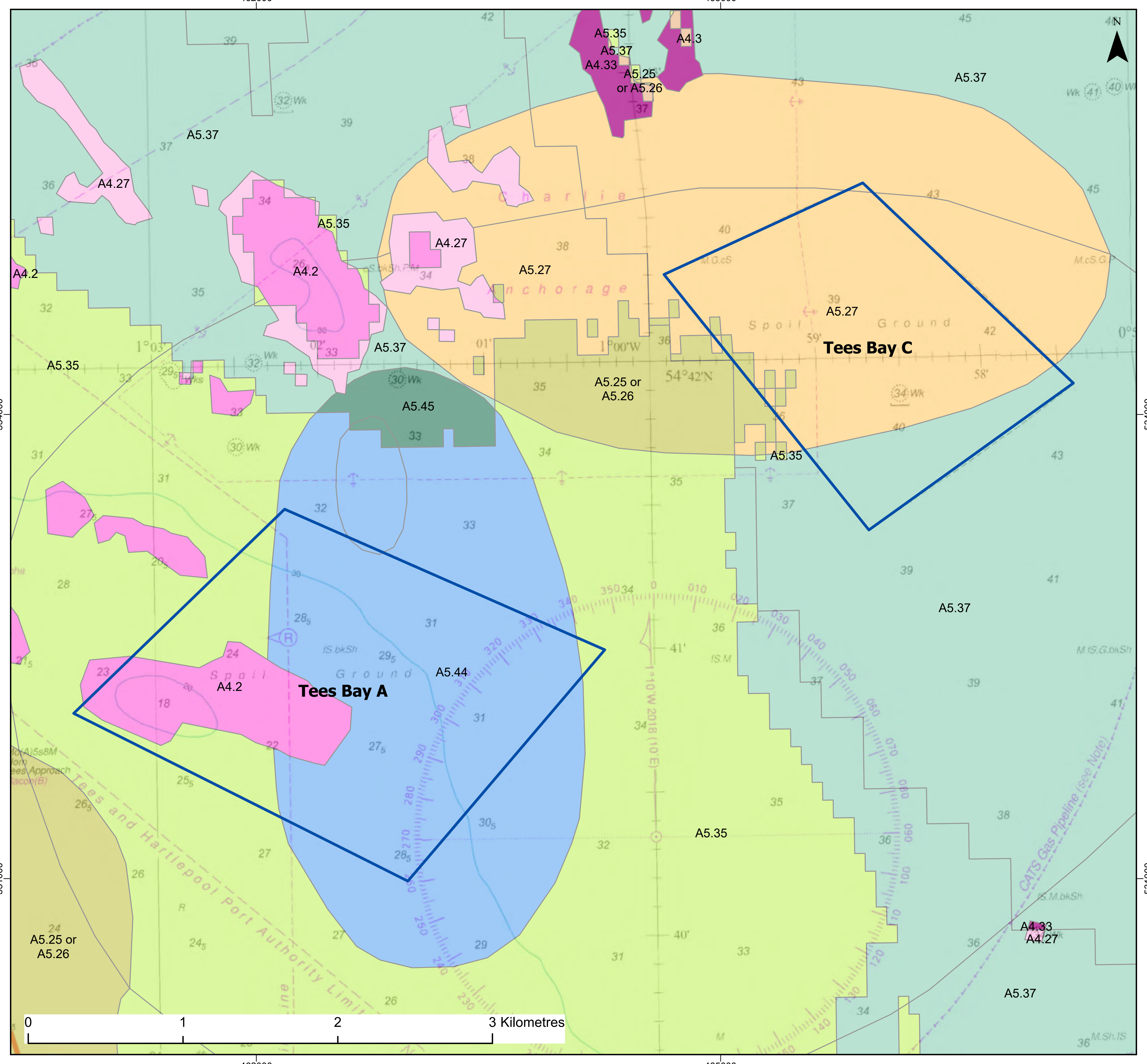
The short-term impact of the disposal activity would be expected to smother the seabed within the footprint of the disposal site. Hydrodynamic and sedimentary modelling has predicted some short-term build-up of sediment at the disposal site, however, this would be dispersed over time.

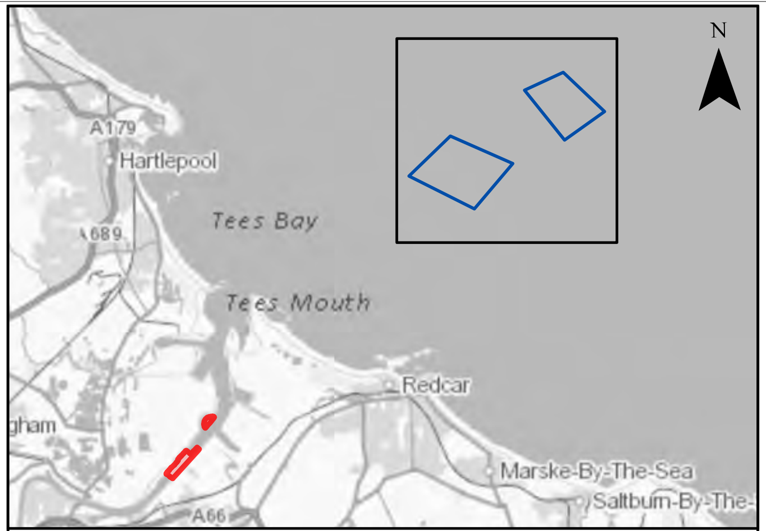
Based on the information available from MarLIN, the species which was by far the most abundant within the samples recovered in and adjacent to the Tees Bay C offshore disposal site (i.e. *Sabellaria spinulosa*) is not sensitive to smothering or increases in suspended sediment.

Overall, it is recognised that there would be an impact on the benthic ecology within and adjacent to the disposal site (an area which is designated specifically for the disposal of dredged material), however the dominant species within the disposal site is not sensitive to the effects of smothering and is reported to have an immediate recoverability following smothering. It is therefore concluded that the impact would be of **negligible** significance.

Mitigation measures and residual impact

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





Legend

- Site Location
- Offshore Disposal Site

Broad-scale Seabed Habitat Map

- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.2: Atlantic and Mediterranean moderate energy circalittoral rock
- A4.33: Faunal communities on deep low energy circalittoral rock
- A4.3: Atlantic and Mediterranean low energy circalittoral rock
- 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

Client: Tees Valley Combined Authority

Project: South Bank Quay

Title: Broad-scale Seabed Habitat Mapping at the Tees Bay Offshore Disposal Sites

Figure: 26.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/10/2020	TC	SR	A3	1:25,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

Spread of invasive species
The benthic survey undertaken in March 2019 for the proposed NGCT project immediately downstream of the proposed scheme footprint confirmed the presence of invasive species within samples from the Tees estuary, as well as within samples from the offshore disposal sites in Tees Bay. Two individuals of the invasive species *Theora lubrica* were found in samples from the Tees estuary, within the NGCT dredge footprint.

Yoldiella c.f hyperborea was found in samples from the Tees estuary, Tees Bay C (two individuals) and Tees Bay A (one individual). The stations within the Tees estuary which contained *Yoldiella c.f hyperborean* are within the areas which are subject to regular maintenance dredging by PDT, however were located outside of the proposed dredge footprint for the proposed South Bank scheme. The proposed dredging and offshore disposal required for the proposed scheme therefore has potential to result in the spread of *Theora lubrica* and possibly *Yoldiella c.f hyperborean*, should these species colonise substrate within the proposed dredge footprint prior to the dredge taking place (if they are not there already).

Given the very small number of individuals encountered during the 2019 survey (the results of which have been used as a proxy to inform this EIA in the absence of data at the time of writing), it is concluded that the species are not present at levels of concern within the Tees estuary. Maintenance dredged material from the Tees (which contains both invasive species) has been disposed of at the offshore disposal sites in Tees Bay for many years and will continue into the future. As a result, the disposal of dredged material within Tees Bay C as a result of the proposed scheme would not introduce a further source of potential impact (beyond that which has already occurred from previous and ongoing maintenance dredge disposal operations). Overall, the potential impact would be of **negligible** significance.

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

26.3.3 Commercial navigation

Conflict between disposal barges and existing vessel movements
To undertake the disposal operation, the TSHD and/or disposal barges would transport dredged material from the proposed dredge footprint to the Tees Bay C offshore disposal site. Consequently, there is potential for conflict with other vessels using the approach channel and the coastal waters of Tees Bay.

The disposal operations are linked to the dredging task and would require regular movements of dredging plant between the dredge site and the disposal site, via the navigation channel and the coastal waters of Tees Bay. In the context of the existing numbers of vessel movements in and out of the Tees estuary (as reported in **Section 14**), the numbers of vessels transiting through the channel at any one time to deposit dredged material offshore would be low (i.e. a TSHD and/or a barge), and **no impact** is predicted.

The proposed disposal of dredged material has the potential to result in shallowing of the water depth above the Tees Bay C disposal site. The Tees Bay C disposal site has an overall area of approximately 294ha (equating to 2,940,000m^2), with water depths ranging between 39m and 42m bCD (as shown on the Admiralty Chart). Given the volume of material to be deposited, which would be evenly spread across the Tees Bay C site, it is considered that shallowing of the seabed would not occur to such an extent that it significantly impacts navigation. It is concluded that the proposed disposal of dredged material into the Tees Bay C site would result in **no impact** on navigation as a result of potential shallowing.

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

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26.3.4 Marine mammals

Underwater noise disturbance to marine mammals from offshore disposal

The underwater noise predicted to arise from the proposed dredging activities have been used as a proxy for the assessment of potential impacts associated with offshore disposal of dredged sediments (see **Sections 10.5.1** and **10.5.2**). This is considered to be a worst-case scenario, as noise levels for the offshore disposal of dredged sediments are likely to be less than those generated during dredging activities. The impact ranges are based on those modelled for the Hartlepool approach channel dredging scheme (see **Section 10.5**) and the impact areas have been calculated for the offshore disposal site (**Table 26.3**).

As outlined in **Section 10.5.1**, there would be no risk of any PTS as a result of the proposed dredge and consequently this conclusion also applies to the proposed offshore disposal of dredged material.

The number of harbour porpoise, minke whale, grey seal and harbour seal that could be at risk of TTS or display a fleeing response, as a result of underwater noise during offshore disposal of dredged sediments (**Table 26.3**) has been assessed based on the number of animals that could be present in the maximum potential impact area (**Table 26.4**).

Table 26.3 Maximum predicted impact ranges (and areas) for any TTS and for fleeing response during offshore disposal of dredged sediments

Potential impact	Receptor	Criteria and threshold (NMFS, 2018 and Southall *et al.*, 2019)	Modelled impact range (km) and area (km^2) for dredging
TTS or fleeing response from cumulative SEL to offshore disposal of dredged sediments	Harbour porpoise	153 dB re 1 µPa HF SEL_{cum}	0.7km 1.54km^2
	Minke whale	179 dB re 1 µPa MF SEL_{cum}	<0.01km 0.003km^2
	Grey and harbour seal	181 dB re 1 µPa PW SEL_{cum}	<0.01km 0.003$km^{2)}$

Table 26.4 Maximum number of individuals (and % of reference population) that could be impacted as a result of underwater noise associated with offshore disposal of dredged sediments

Potential impact	Receptor	Estimated number of individuals in impact area (% of the reference population)	Magnitude
TTS or fleeing response to underwater noise during offshore disposal of dredged sediments	Harbour porpoise	1.4 harbour porpoise (0.0004% NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Minke whale	0.000003 minke whale (0.00000001% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Grey seal	0.00004 grey seal (0.0000006% of the NE England MU) based on density of 0.014/km^2 for offshore disposal area plus 1km buffer.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Harbour seal	0.0000003 harbour seal (0.0000004% of the NE England MU; 0.0000002% of the Seal Sands haul-out site) based on density of 0.00009/km^2 for offshore disposal site plus 1km buffer.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).

The magnitude of the potential impact of TTS and fleeing response as a result of offshore disposal of dredged sediments is negligible / very low for harbour porpoise, minke whale, grey seal and harbour seal, with less than 1% temporary disturbed (TTS and fleeing response) (**Table 26.4**).

The potential risk of any TTS or fleeing response that could result from underwater noise during offshore disposal of dredged sediments would be limited to the immediate vicinity of the vessels while they are disposing of the dredged material. The number of harbour porpoise, minke whale, grey seal and harbour seal that could be impacted are the maximum number of animals that could potentially be at risk of any TTS or fleeing response (**Table 26.4**).

Taking into account the medium receptor sensitivity for TTS and fleeing response and the potential magnitude of the effect, along with the temporary nature of the disturbance, the impact significance for any temporary auditory injury or behavioural impact as a result of underwater noise during offshore disposal of dredged sediments on harbour porpoise, minke whale, grey seal and harbour seal, has been assessed as **negligible** (**Table 26.5**).

Table 26.5 Assessment of impact significance for underwater noise during offshore disposal of dredged sediments on marine mammals

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
TTS or fleeing response to underwater noise during offshore disposal of dredged sediments	Harbour porpoise	Medium	Negligible / very low	Negligible	No mitigation required.	Negligible
	Minke whale		Negligible / very low	Negligible		Negligible
	Grey seal		Negligible / very low	Negligible		Negligible
	Harbour seal		Negligible / very low	Negligible		Negligible

Mitigation measures and residual impact

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

Potential for vessel interactions (collision risk) with marine mammals during disposal of dredged material

There is the potential for an increase in the collision risk to marine mammals during vessel transits to the Tees Bay C offshore disposal site. However, marine mammals present within or near to the offshore disposal site would be habituated to the presence of vessels given the existing levels of marine traffic and would therefore be able to detect and avoid vessels. For this reason, harbour porpoise, minke whale, grey seal and harbour seal are considered to have a low sensitivity to the risk of a vessel strike (see **Section 10.5.3**).

Although the risk of collision is likely to be low, the number of harbour porpoise, minke whale, grey seal and harbour seal that could be at increased risk has been assessed based on a very precautionary worst-case of up to 5% of the number of individuals that could be present in the area (**Table 26.6**). This is a highly precautionary assumption, as it is unlikely that marine mammals present in the area would be at increased collision risk with vessels, considering the minimal number of vessel movements compared to the existing number vessel movements in the area. The footprint of the Tees Bay C offshore disposal site is approximately 3km^2.

Table 26.6 Estimated number of harbour porpoise, minke whale, grey seal and harbour seal that could be present in the offshore disposal site area that could be at potential increased vessel collision risk

Potential impact	Receptor	Maximum number of individuals (% of reference population)	Magnitude
Potential increased collision risk during offshore disposal of dredged sediments (5% of animals in offshore disposal area)	Harbour porpoise	0.13 harbour porpoise (0.00004% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Minke whale	0.0015 minke whale (0.000006% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Grey seal	0.002 grey seal (0.00003% of the NE England MU) based on density of 0.014/km^2 for offshore disposal area plus 1km buffer.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).
	Harbour seal	0.00001 harbour seal (0.00002% of the NE England MU; 0.000007% of the Seal Sands haul-out site) based on density of 0.00009/km^2 for offshore disposal site plus 1km buffer.	**Negligible / very low magnitude** (permanent effect with less than 0.001% of reference population anticipated to be exposed to effect).

Taking into account the receptor sensitivity of low for all species and the potential magnitude of the impact of negligible for harbour porpoise, minke whale, grey seal and harbour seal, the impact significance for any potential increase in collision risk with vessels during offshore disposal of dredged sediments has been assessed as **negligible** (not significant) for harbour porpoise, minke whale, grey seal and harbour seal (**Table 26.7**).

Table 26.7 Assessment of impact significance for increased collision risk from vessels at the offshore disposal site

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
Potential for increased collision risk from vessels during offshore disposal of dredged sediments	Harbour porpoise	Low	Negligible / very low	Negligible	No mitigation required, other than good practice.	Negligible
	Minke whale	Low	Negligible / very low	Negligible		
	Grey seal	Low	Negligible / very low	Negligible		
	Harbour seal	Low	Negligible / very low	Negligible		

Mitigation measures and residual impact

No mitigation measures are required beyond the implementation of good practice. The residual impact would be of **negligible** significance for harbour porpoise, minke whale, grey seal and harbour seal.

Disturbance to marine mammals at seal haul-out sites during offshore disposal activities

The offshore disposal site is located approximately 9.5km from the coastline, and approximately 14km from the known seal haul out site at Seal Sands. It is therefore concluded that there is no potential for any disturbance due to the disposal of dredged sediment into the disposal site to seals at Seal Sands, including harbour seal protected under the Teesmouth and Cleveland Coast SSSI designation.

As outlined in **Section10.5.4**, any vessels passing the seal haul-out sites as they take the dredged material offshore would maintain the same distance from the haul outs as vessels which currently move up and down the estuary. Vessel traffic is a regular occurrence in this area, meaning the seals present at the haul-out sites would be habituated to the presence of vessels. As a result, there would be no significant or additional disturbance of seals hauled out at the site.

The magnitude of the impact of vessel disturbance to seal haul-out sites is defined as negligible / very low due to the intermittent and temporary nature of the vessel disturbance and the already busy nature of vessel movements in the area. Seal species are highly protected and as such have a very high value. However, their sensitivity to the small increase in vessel disturbance and their habituation to the already high vessel use in the area, gives a sensitivity of low. Therefore, the overall sensitivity is considered to be medium. This gives an overall impact significance of **negligible**.

Mitigation measures and residual impact

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

Potential impacts to marine mammals due to changes in water quality during offshore disposal of dredged sediment

The offshore disposal of dredged material would temporarily increase the suspended sediment concentrations in the water column within and adjacent to the offshore disposal site However, as outlined in **Section 10.5.5**, marine mammals often inhabit turbid environments. Cetaceans utilise sonar to sense the environment around them and there is little evidence that turbidity affects cetaceans directly (Todd *et al.,* 2014). Seals are not known to produce sonar for prey detection purposes; however, it is likely that other senses are used instead of, or in combination with, vision. Studies have shown that vision is not essential to seal survival, or ability to forage (Todd *et al*., 2014).

Increased turbidity is unlikely to have a substantial direct impact on marine mammals that often inhabit naturally turbid or dark environments. This is likely because other senses are utilised, and vision is not relied upon solely. Therefore, any increases in suspended sediments will have a **negligible** impact on marine mammals.

Mitigation measures and residual impact

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

Changes to marine mammals prey resource during offshore disposal of dredged sediment

Potential impacts on fish species (prey for marine mammals) can result from the physical disturbance and temporary loss of seabed habitat, increased suspended sediment concentrations and sediment re-deposition, smothering and underwater noise.

As outlined in **Section 10.4**, harbour porpoise, minke whale, grey seal and harbour seal feed on a range of prey species and their diet can vary geographically and seasonally depending on available prey resources. Therefore, there sensitivity to any changes in prey availability is considered to be low. However, as a very precautionary worst-case scenario, the potential changes to prey availability has been based on the offshore disposal site area of approximately 3km^2 and the maximum number of harbour porpoise, minke whale, grey seal and harbour seal, that could be in the area and temporary impacted (**Table 26.8**).

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Table 26.8 Estimated number of harbour porpoise, minke whale, grey seal and harbour seal that could be present in the offshore disposal site area that could be impacted by any changes to prey availability

Potential impact	Receptor	Maximum number of individuals (% of reference population)	Magnitude
Changes to prey resources in offshore disposal area	Harbour porpoise	2.7 harbour porpoise (0.0008% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Minke whale	0.03 minke whale (0.0001% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Grey seal	0.04 grey seal (0.00065% of the NE England MU) based on density of 0.014/km^2 for offshore disposal area plus 1km buffer.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Harbour seal	0.0003 harbour seal (0.0004% of the NE England MU; 0.0002% of the Seal Sands haul-out site) based on density of 0.00009/km^2 for offshore disposal site plus 1km buffer.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).

Taking into account the low receptor sensitivity, the negligible potential magnitude of the impact and the temporary nature of any changes to prey resources, the impact significance has been assessed as **negligible** for harbour porpoise, minke whale, grey seal and harbour seal (**Table 26.9**).

Table 26.9 Assessment of impact significance for any changes in prey resources for marine mammals

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
Changes to prey resource in offshore disposal area	Harbour porpoise	Low	Negligible / very low	Negligible	No mitigation required.	Negligible
	Minke whale	Low	Negligible / very low	Negligible		
	Grey seal	Low	Negligible / very low	Negligible		
	Harbour seal	Low	Negligible / very low	Negligible		

Mitigation measures and residual impact

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

27 CUMULATIVE IMPACT ASSESSMENT

27.1 Introduction

In addition to identifying and assessing the potential impacts of the proposed scheme in isolation, the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) and the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 require an assessment of its potential cumulative impacts. A CIA assesses the potential impacts of a project with other past, present (current) and reasonably foreseeable (proposed) projects.

With respect to past projects or existing/completed projects, a useful ground rule in CIA is that the environmental impact of schemes that have been completed should be included within the environmental baseline. As such, these impacts are already taken into account in the EIA process for the proposed scheme. Consequently, completed projects can be excluded from the scope of CIA. However, the environmental impacts of recently completed projects may not be fully manifested and, therefore, care is needed in respect of how the potential impacts of such projects are taken into account.

Projects that are currently being constructed or that are in the planning process (where sufficient information is publicly available), as well as on-going activities that have the potential to influence the same environmental parameters as the proposed scheme are the focus of this CIA. Future plans or projects for which sufficient information is not available on which to base a reliable assessment, which are unlikely to be submitted or receive consent until after the proposed scheme has been completed, cannot reasonably be assessed as part of a CIA. However, the applicants for such projects will be required to take the effect of this proposed scheme into account in their own application.

27.2 Guidance on cumulative impacts and cumulative effects assessment

The IEMA 'Guidelines for Environmental Impact Assessment' (IEMA, 2004) define cumulative impacts as:

"…the impacts on the environment which result from incremental impacts of the action when added to other past, present and reasonably foreseeable future actions…"

Cumulative impacts can be therefore additive or interactive. Typically, additive impacts occur when different project activities have an impact on the same environmental receptor at the same time. Interactive impacts are assessed in relation to a specific receptor but are caused by the interaction of different types of impacts from project activities even if individually these are insignificant (e.g. the interaction of underwater noise disturbance and increased suspended sediments on migratory fish).

To be considered within the CIA, other plans and projects should meet the following criteria. They should:

- generate their own residual impacts of at least minor significance;
- be likely to be constructed or operate over similar time periods to the proposed scheme (or their environmental consequences have the potential to be realised over the same time period);
- be spatially linked to the predicted zone of influence of the proposed scheme (for example, influencing the same area as affected by the sediment plume); and,
- be either consented (but not operational) or the subject of consent applications with the statutory authorities in the study area or part of another statutory procedure.

27.3 Assessment methodology

27.3.1 Definition of temporary boundaries

Temporal boundaries provide the timescales over which a project and, therefore, the assessment are undertaken and they give temporal limits to the CIA. When determining temporal boundaries, it is necessary to consider the longevity of effects, the potential nature of effects over time and the importance of seasonal variations in populations and sensitivities.

The temporal boundary for this assessment includes present plans and projects where the impacts are still occurring, or where mitigation measures are still operating; and reasonably foreseeable future plans and projects with which there could be a temporal or spatial overlap.

STDC's intention is to construct the proposed scheme during 2021 with the proposed scheme planned to be operational by 2023.

27.3.2 Definition of spatial boundaries

Spatial boundaries define the area likely to be affected by the proposed scheme. The study area can therefore be defined by the hydrodynamic model extent which for the marine environment is determined on the basis of the potential extent of the dredging and disposal plumes.

As with the marine parts of the proposed scheme, the study area for the landside parts of the proposed scheme is defined as the area over which potentially significant direct and indirect effects may occur. In this instance, the landside study area is likely to vary by topic (as detailed in the respective technical sections of this report and summarised in **Table 1.1**). Landscape and visual impact assessment has been detailed separately within **Table 1.1** as impacts associated with that topic are predicted to extend the greatest distance from the proposed scheme footprint (up to 5km from the proposed scheme footprint).

27.3.3 Identification of relevant plans and projects

Based upon the temporal and spatial boundaries described above, a comprehensive list of plans and projects relevant or potentially relevant to the CIA has been compiled and is provided in **Section 27.4**. This includes an explanation as to why plans/projects were taken forward for detailed assessment in the CIA or why they were screened out of the need for further assessment. The list of projects to consider has been discussed and agreed with the MMO and RCBC as part of the scoping discussions held in July / August 2020.

27.4 Scope of assessment

27.4.1 Screening

Plans and projects identified within the vicinity of the proposed scheme are outlined in **Table 27.1**. The landside projects detailed in **Table 27.1** have been determined through liaison with RCBC planning department in July 2020. Where data is available, details of project type, construction dates, duration of works and other relevant data are provided, along with the distance from the proposed works.

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Table 27.1 Plans and projects identified in the vicinity of the proposed scheme

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
AV Dawson	Proposed quayside works and dredging at its North Sea supply base and Dawson's Wharf.	Approximately 4.5km upstream	No marine licence application submitted to date.	There is no environmental assessment information available to undertake a cumulative assessment with the proposed scheme. In addition, given the separation distance between the proposed scheme footprint and the AV Dawson scheme, it is considered that there is no pathway for cumulative impacts to occur. **Screened out of the CIA.**
South Industrial Zone	Outline planning application for demolition of existing structures on site and the development of up to 418,000sqm (gross) of general industry (Use Class B2) and storage or distribution facilities (Use Class B8) with office accommodation (Use Class B1), HGV and car parking and associated infrastructure works. All matters reserved other than access.	Immediately adjacent (inland)	Application submitted but awaiting approval.	The South Industrial scheme is located in very close proximity to the proposed scheme footprint and therefore is screened into the CIA. **Screened into the CIA.**
NGCT	The NGCT scheme comprises capital dredging up to 4.8 million m3 of sediment from the riverbed, realignment of the approach channel, disposal of dredged material offshore, construction of a new container terminal facility and construction of various landside elements (buildings, rail terminal, road access, lighting, drainage and a pumping station). PDT is proposing to fully construct the proposed NGCT in advance of the existing Harbour Revision Order expiring on 7th May 2028.	Approximately 1.5km downstream. Dredge footprint overlaps at Tees Dock turning circle.	Planning permission granted and implemented. Marine licence application submitted but awaiting approval.	The NGCT scheme is located in very close proximity to the proposed scheme footprint and therefore is screened into the CIA. **Screened into the CIA.**
Anglo American Harbour Facilities	The Anglo American Harbour Facilities scheme was granted a DCO in 2016. The DCO permits the following activities which are yet to commence: Phase 1 • site compounds; • construction of a 28m wide and 280m long quay including ship loads and ship loader rails; • dredging up to 750,000m^3 of material from the approach channel and berth pocket;	Immediately downstream	Marine licence granted.	The consented Anglo American Harbour Facilities is located in very close proximity to the proposed scheme footprint and therefore is screened into the CIA. **Screened into the CIA.**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
	• lagoon habitat enhancement works; • installation of a surge bin; • installation of a conveyor system and transport towers; • construction of buildings and parking area; • erection of security fencing; • provision of ancillary infrastructure. Phase 2 • extension of the quay to provide a total quay length of 486m including ship loader and ship loader rails; • dredging up to 372,000m3 of material from the approach channel and berth pocket; • installation of a second surge bin; • installation of a second conveyor within the conveyor housing installed during Phase 1; • provision of ancillary infrastructure.			
Hartlepool approach channel	PDT is proposing to undertake a programme of works within and adjacent to the existing approach channel into Victoria Harbour, located to the immediate south of Hartlepool Headland on the north-east coast of England. The current approach channel dimensions are limiting the size of vessels which can gain entry into the harbour. PDT is therefore proposing to deepen, realign, widen and extend the length of the approach channel, to allow Victoria Harbour to accept deeper drafted and larger beam vessels through a wider tidal window. In addition to the proposed dredge (and associated disposal of dredged material), PDT is proposing to construct an underwater retaining wall, immediately adjacent to the Middleton Breakwater, which is located at the mouth of Victoria Harbour. The underwater retaining wall is required to avoid the risk of Middleton Breakwater being undermined following the proposed dredge.	Approximately 6km north	Marine licence granted	Numerical modelling was undertaken in support of the Hartlepool approach channel marine licence application using the MIKE21-FM hydrodynamic model (Royal HaskoningDHV, 2018). The model has shown that under all tidal conditions, there is a clear separation of effect between the proposed scheme at Hartlepool and the planned works in the Tees estuary (i.e. the effects and impacts of the proposed scheme at Hartlepool are not predicted to extend into the Tees estuary), indicating no cumulative effect on hydrodynamics will exist. Consequently, there will in turn be no cumulative effect on sediment transport or morphology between the proposed South Bank scheme and Hartlepool approach channel. No further consideration of the Hartlepool channel scheme is therefore necessary. **Screened out of CIA**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
Ongoing maintenance dredging at Hartlepool and in the Tees estuary	This activity has been ongoing for many years.	0km	Marine licence granted for offshore disposal.	Given the frequency, duration and the ongoing nature of this activity, maintenance dredging and disposal is represented in the baseline conditions for the area. However, maintenance dredging could be undertaken at the same time as the capital dredging activity required for South Bank (albeit within a different part of the estuary). **Screened into the CIA (excluding maintenance dredging at Hartlepool channel as the effects of this would not extend into the Tees).**
Inter Terminals Jetty 1 refurbishment	Inter Terminals has submitted a planning application and a marine licence application to undertake refurbishment works to its existing Jetty 1 on the northern bank of the Tees estuary. The scheme involves minor 'top-side' works to the existing infrastructure at Jetty 1 and Dolphin D, and a dredge of the river bed (with associated disposal of dredged material) to extend the existing berth pocket downstream. The works would result in Dolphin D being used as an operational structure rather than simply a berthing dolphin.	Immediately adjacent to the dredge footprint	Consent in place	The proposed works to Jetty 1 are highly localised and the construction works would be short term. The works are considered to be of a sufficiently small scale that there would be no significant cumulative impacts. **Screened out of the CIA.**
Tees Channel Dredge	The Tees Channel Dredge project involves a proposed deepening of the Tees navigation channel, the turning circle and Tees Dock to a maximum maintained depth of 14m below CD. An Environmental Scoping Report (Royal HaskoningDHV, 2016) was submitted to the MMO alongside a request for a scoping opinion for the project in 2016; however, the environmental assessment proposed within that report has not yet been undertaken.	0km	No application submitted to date	Given that the dredge footprint largely overlaps with that for South Bank (with the exception of dredging in Tees Dock, which, given its location, would have no means of affecting the hydrodynamic and sedimentary regime of the estuary system), the area would be dredged by either the South Bank project or the Tees Channel Dredge project (not both). This removes the potential for cumulative impacts to arise. The Tees Channel Dredge project, therefore, has not been considered further. **Screened out of CIA**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
Tees GasPort	Trafigura is proposing a scheme to import Liquefied Natural Gas (LNG) at Teesport (within the Tees estuary), on the north-east coast of England. The proposed LNG import comprises floating storage regasification unit (FSRU) at an existing, currently unused jetty. Once the FSRU is in place, LNG carriers will berth next to the FRSU in a side-to-side mooring configuration and discharge the LNG into the FSRU before leaving again. In order to enable the LNG import facility to function the following works are required, referred to herein as the 'proposed works': • Concrete and steel work repairs to the existing jetty. • Modifications to the existing mooring dolphins. • Replacement / repair of ancillary items on the existing jetty. • Modifications to onshore mooring blocks. • Dredging of the existing berth and disposal of dredged material.	Approximately 1.5km downstream	Application submitted but no licence granted	The marine licence application has been submitted. The non-statutory environment assessment undertaken in support of the marine licence application concluded that there would be no significant impact on any environmental parameters as a result of the proposed scheme. It is therefore concluded that this project should be screened out of the CIA. **Screened out of the CIA.**
Anglo American Materials Handling Facility at Wilton and Storage Facility at Bran Sands	Anglo American secured planning permission from RCBC for a Materials Handing Facility (MHF) on land at Wilton, Teesside, in 2015 (reference R/2014/0626/FFM). The associated Anglo American Harbour Facilities DCO was also granted under s114 (1)(a) of the Planning Act 2008 (reference SI 2016 No. 772). Together the permission and consent provide for the construction and operation of facilities to process, transfer and handle for export the material emerging from a portal at the Wilton site, which will serve the consented mine and underground materials transfer system. The permissions led to progression of detailed design engineering, from which emerged requirements for an amended conveyor routing, and an additional storage facility (Use Class B8) at Bran Sands, Redcar. The Storage Facility has indicative dimensions of 1300m long x 170m wide x 40m high.	4km and 3.5km respectively	Both schemes are consented by RCBC	No works are required within the estuary itself, with all works being located on land. The potential exists, however, for cumulative impacts to arise, and therefore this project has been screened into the CIA. **Screened into the CIA.**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
Dogger Bank Teesside A and Dogger Bank Teesside B (now Sofia Offshore Wind Farm, referred to throughout as Sofia)	Dogger Bank Teesside was Forewind's second stage of development of the Dogger Bank Zone. Originally planned to be four separate wind farms known collectively as Dogger Bank Teesside, this stage was divided into two separate applications - Dogger Bank Teesside A & Sofia and Dogger Bank Teesside C&D. Only Dogger Bank Teesside A & Sofia was progressed through to application. The A & Sofia application comprised two wind farms, each with a maximum installed capacity of 1.2GW. They will connect to the national grid at the existing Lackenby Substation in Teesside via an export cable to be located within an export cable corridor. The Dogger Bank Teesside A & Sofia schemes both have consent, currently sharing the same DCO. The DCO states that construction should commence by August 2022. It is understood that both Teesside A and Sofia will potentially bid into the next Contracts for Difference (CfD) round in Spring 2019, which would commit the developers to construction timelines.	5km	DCO granted for the scheme which contains a deemed marine licence from the MMO	The consented Dogger Bank Teesside A & Sofia scheme is located within the coastal waters of Tees Bay. Although this scheme has received consent, it is yet to be constructed, and therefore the potential exists for in-combination impacts during cable-laying from underwater noise and water quality on prey species of the qualifying features of the Teesmouth and Cleveland SPA and Ramsar site. As neither of the consents specify timings for the construction works, it is conservatively assumed that the construction programmes could overlap. However, a review of the ES undertaken for the Dogger Bank scheme has confirmed that the zones of influence of both schemes would not interact, and therefore, there is no pathway for cumulative impacts with the NGCT. **Screened out of the CIA.**
Tees channel dredge	PDT is proposing to undertake a dredge of the approach channel to locally deepen from 5.1m bCD to 5.7m bCD. Consultation with the MMO has confirmed that PDT should submit a variation request to its existing maintenance dredge licence in order to dispose of the dredged material (i.e. the MMO sees the proposed dredge as a maintenance dredge activity). PDT's intention is to undertake the dredge during 2020/2021.	Approximately 2km upstream	Application submitted August 2020.	The MMO sees the proposed dredge as a maintenance dredge activity. Given the frequency, duration and the ongoing nature of maintenance dredging, maintenance dredging and disposal is represented in the baseline conditions for the area. However, the proposed dredge could be undertaken at the same time as the capital dredging activity required for South Bank (albeit within a different part of the estuary). **Screened into the CIA (but considered to fall under the 'maintenance dredge' umbrella rather than a separate plan or project).**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
Grangetown Prairie	An Energy Recovery Facility is proposed capable of processing up to 450,000 tonnes of waste per annum. The need for the scheme has arisen from the Tees Valley Joint Waste Strategy, which has been extended from 2020 to 2035. The proposed site is located on the former South Tees Eco Park, Grangetown Prairie, located approximately 4 miles north-east of Middlesbrough town centre.	Approximately 1.4km south-east	Outline planning permission granted in July 2020.	No works are required within the estuary itself, with all works being located on land. Given the proximity of this project to the proposed scheme footprint, the potential exists, however, for cumulative impacts to arise with regard to terrestrial receptors, and therefore this project has been screened into the CIA. **Screened into the CIA.**
Land at Former South Bank Works; Grangetown Prairie; British Steel and Warrenby Area	Demolition of structures and engineering operations associated with ground preparation and temporary storage of soils and its final use in the remediation and preparation of land for regeneration and development.	Approximately 1.4km south-east	Full planning permission granted May 2017	The works which are the subject of this application comprise temporary storage of soils in mounds, for its final use in the remediation and preparation of land for regeneration and development. No environmental assessment was submitted in support of the application, as no significant environmental impacts were envisaged. Given the nature of the proposed works in relation to the footprint of the proposed South Bank scheme, it is concluded that there is no pathway for cumulative impacts. **Screened out of the CIA.**
Land at Low Grange Farm, South Bank	Outline application for residential development (up to 1250 dwellings) (all matters reserved).	Approximately 1.6km south	Outline planning permission granted March 2016.	No works are required within the estuary itself, with all works being located on land. Given the proximity of this project to the proposed scheme footprint, the potential exists for cumulative impacts to arise to terrestrial receptors, and therefore this project has been screened into the CIA. **Screened into the CIA.**
Residential development	Outline planning application for up to 550 residential units with associated access, landscaping and open space.	Approximately 5.5km east	Planning permission granted July 2020	No works are required within the estuary itself, with all works being located on land. The potential

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
	Reserved matters application (appearance, landscaping, layout and scale) following approval of outline planning permission R/2016/0663/OOM for up to 550 residential units with associated access, landscaping and open space.		Planning permission granted October 2019	exists, however, for cumulative impacts to arise, and therefore this project has been screened into the CIA. **Screened into the CIA.**
Teesside Combined Cycle Power Plant	Construction of a 1,700mwe combined-cycle gas turbine power station at Wilton International.	Approximately 4km south-east	Order made April 2019	No works are required within the estuary itself, with all works being located on land. The potential exists, however, for cumulative impacts to arise, and therefore this project has been screened into the CIA. **Screened into the CIA.**
Lianhetech, Seal Sands (Stockton Council)	Proposed new buildings, plant upgrade, swale and associated access and car parking provision	Approximately 1.5km north	Planning permission granted February 2020	No works are required within the estuary itself, with all works being located on land. Given the separation distance between the proposed scheme and this other project, and its location to the north of the river with significant industrial development in-between, it is considered there is no pathway for cumulative impacts. **Screened out of CIA.**
New cinema development	Demolition of existing cinema and replacement with a new cinema including external terraces, landscaping and temporary sea wall	Approximately 7km east	Planning permission granted August 2020	The proposed works for this project are located approximately 7km east at the coastal margin. Given the separation distance between the proposed scheme and this other project, with significant industrial development in-between, it is considered there is no pathway for cumulative impacts. **Screened out of the CIA.**
Engineering operations at Metals Recovery Area	Demolition of existing buildings/structures and engineering operations associated with ground remediation and preparation of land for development.	Approximately 500m east	Application submitted and awaiting decision	No works are required within the estuary itself, with all works being located on land. Although the proposed works are in close proximity to the

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
				proposed scheme, the works are very minor in nature of no cumulative impacts are predicted. **Screened out of CIA.**

27.5 Cumulative assessment of development in and adjacent to the Tees estuary

27.5.1 Introduction

A detailed CIA was undertaken for the Anglo American Harbour Facilities, which considered all relevant plans and projects at the time in and adjacent to the Tees estuary. The findings from that CIA are therefore directly relevant to this CIA. The key issues identified as part of the Anglo American Harbour Facilities CIA are presented below and supplemented with information to take account of other relevant plans and projects which were not considered (as they were not proposed at the time) within the Anglo American Harbour Facilities CIA.

27.5.2 Hydrodynamics and sedimentary regime

The proposed scheme has the potential to result in the following cumulative impacts with the NGCT, Anglo American Harbour Facilities schemes and the ongoing maintenance dredging in the Tees estuary:

- dispersion of suspended sediment during capital dredging and deposition at the offshore disposal site;
- changes to tidal propagation;
- changes to wave conditions;
- changes to tidal currents; and
- changes to the sediment budget.

There is no pathway for cumulative impacts to arise with any other plan or project screened into the assessment as the other projects are either located on land, or far enough away to ensure the zones of influence do not overlap.

The potential for cumulative impacts to arise between the projects that have been scoped into the CIA, an assessment of the significance of such impacts and recommendation of appropriate mitigation measures (where appropriate) are also presented in the subsections below.

Maintenance dredging at Hartlepool and within the Tees estuary has been on-going for many years. Given the frequency, duration and the ongoing nature of this activity, maintenance dredging and disposal is represented in the baseline conditions for the conditions. However, the implications for water quality (increased suspended sediment concentrations) are relevant to the CIA.

Dispersion of suspended sediment and deposition on the seabed during capital dredging
All projects scoped into the CIA involve will involve capital dredging. This activity will create a plume of sediment which will disperse throughout the estuary according to the prevailing currents, prior to settling on the riverbed and seabed.

During the capital dredging works for the proposed scheme, other port facilities on the Tees will remain operational. Maintenance dredging is, therefore, expected to continue throughout the capital dredge period. The capital dredge is also expected to influence the maintenance dredging requirements during and immediately after the period of construction. This is because fine material will be released into suspension, some of which will then settle in the various maintained areas.

The extent of the sediment plume created by capital dredging is heavily dependent on the dredging plant that is adopted, and this is determined by (amongst other factors) the nature of the bed and the dredge volume. The EIAs for the schemes scoped into the CIA have made informed assumptions about the most likely dredge plant that would be adopted and, in some cases, assumed that different types of plant would be used for dredging different sediment types as part of the same project. As noted in **Section 6.5.2**, it is important to note that figures showing the "maximum extent of sediment plume dispersion and deposition" do not represent a plume that would occur at any one point in time (such plumes are shown in the timestep plots). Rather, this type of figure shows the areas of the river channel or offshore area that will become affected by a plume at some point during the dredging or disposal activities (in some areas this will be on a single occasion, in other areas it will be on multiple occasions) and the maximum magnitude of change that will be experienced at that point and are therefore referred to as maximum 'zones of influence'. Consequently, for the purposes of this CIA, the maximum zones of influence of sediment plume dispersion and deposition footprint has been identified from the EIA studies undertaken for each project and the CIA assumes that the construction phases of the projects could be implemented at the same time.

Table 27.2 summarises the conditions that result in the maximum zones of influence and **Figures 27.1** to **27.3** presents a summary of the results of the predictive modelling of suspended sediment concentration and deposition onto the riverbed and seabed.

Table 27.2 Summary of conditions used in the predictive modelling of the maximum zones of influence of sediment plume dispersion and deposition onto the river and/or seabed during capital dredging

Project	Modelled conditions used to inform CIA
South Bank Wharf (proposed scheme)	Combined maximum zone of influence from Stages 1 - 4 inclusive of the dredging activities (BHD and TSHD in the berthing pocket, river channel and tees Dock turning circle)
Anglo American harbour Facilities	TSHD in low river flow, spring tide
NGCT	TSHD dredging sand in the approach channel in low river flow, spring tide

A review of all EIA studies for the above projects highlights that the maximum increase in suspended sediment in the water column was predicted to be in close proximity to the dredger, with plume dispersion resulting in a significantly reduced concentration of suspended sediment beyond the source of the plume.

For the NGCT studies, significant deposition of sediment was also only predicted in close proximity to the dredging (and reclamation for NGCT) over the slack water period. In practice, much of this deposited material will be re-dredged as part of the capital works for each scheme. At the peripheries of each plume, the enhanced SSC values will be barely distinguishable from the background levels. Furthermore, as the deposited material will be unconsolidated, it is expected to disperse as tidal currents increase with no long-term accumulation on the riverbed or seabed at the initial point of deposition.

It should be noted that the potential for cumulative effects only arises should the dredging for the proposed scheme, NGCT scheme and Anglo American Harbour Facilities schemes coincide (which is considered to be highly unlikely). Under such circumstances, the effect would be a greater increase in SSC than predicted for the proposed scheme alone, and a larger predicted zone of influence than the proposed scheme alone. The effect would be additive rather than interactive (i.e. the predicted impacts of each project would not interact to result in an impact that is of greater or lesser magnitude than the sum of the impacts in isolation).

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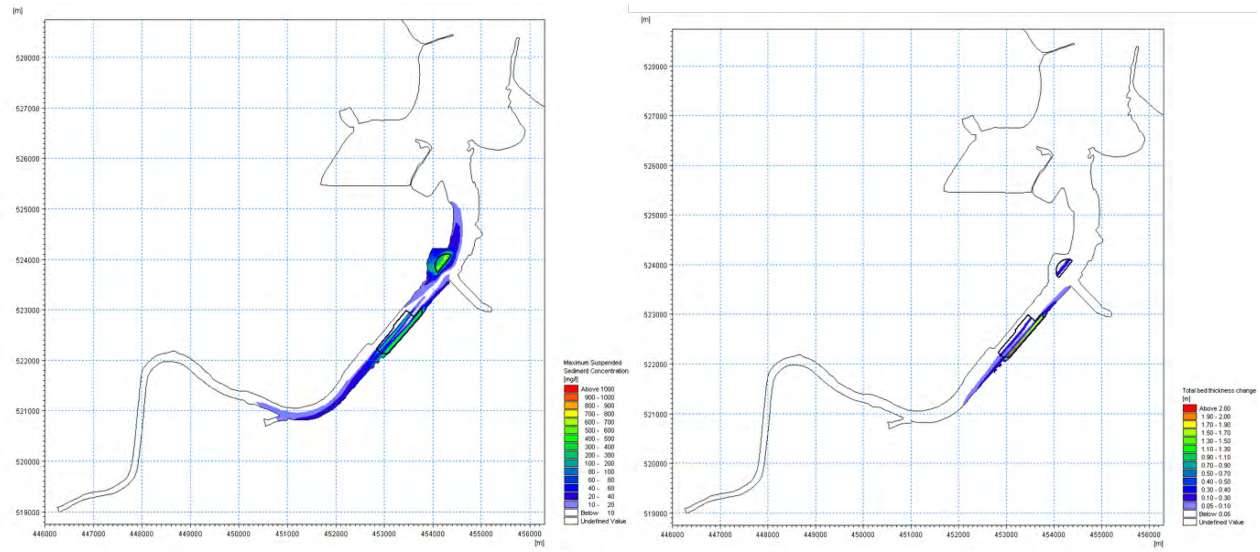


Figure 27.1 Predicted maximum increase in SSC (near-bed layer) (left) and deposition on the riverbed (right) as a result of the proposed scheme [Note: plots show sediment plume impacts arising from dredging activities during Stages 1 - 4 inclusive of the capital dredging programme]

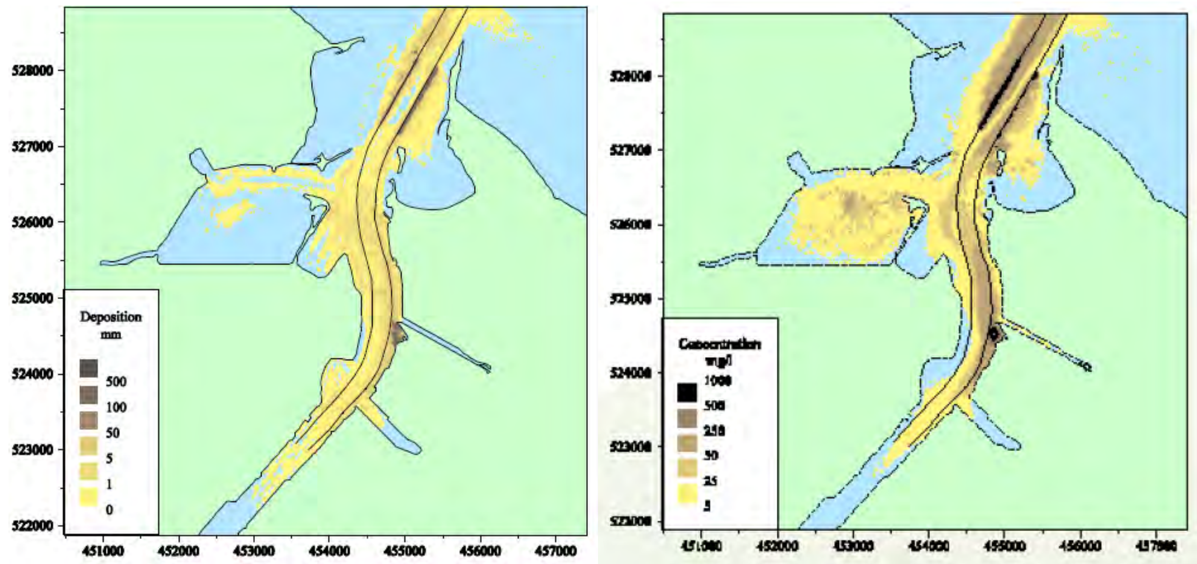


Figure 27.2 Predicted increase in SSC (left) and deposition on the seabed (right) as a result of the NGCT (Royal Haskoning, 2006)

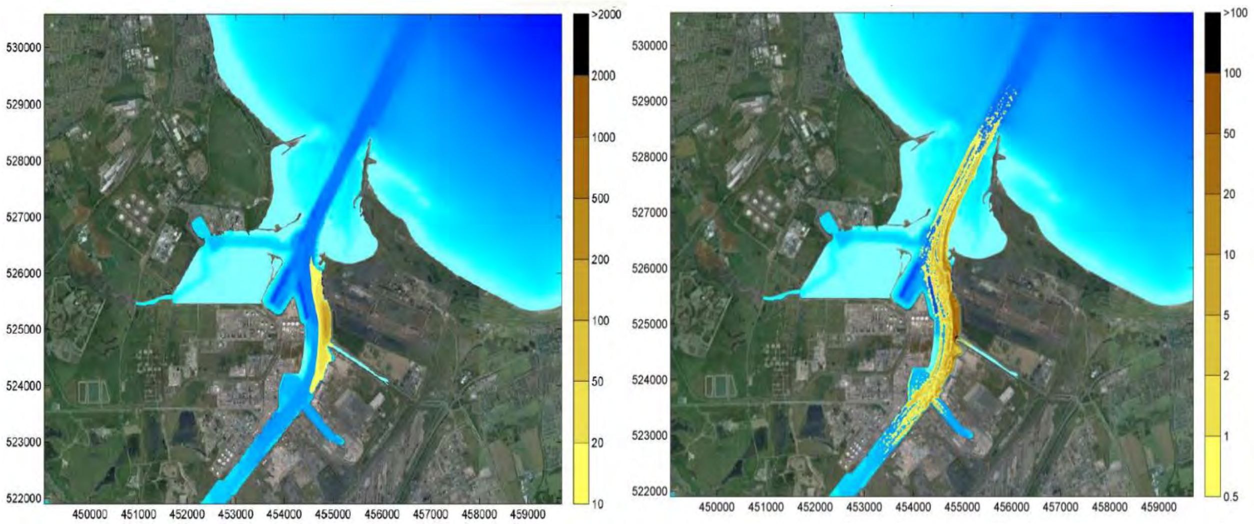


Figure 27.3 Predicted increase in SSC (left) and deposition on the seabed (right) as a result of the Anglo American Harbour Facilities (Royal HaskoningDHV, 2014)

The potential impacts of the maintenance dredging programme in the Tees are considered within the Maintenance Dredging Baseline Document (Royal Haskoning, 2008). This consideration is specifically in the context of the implications of maintenance dredging for the Teesmouth and Cleveland Coast SPA and Ramsar site and comprises assessment of the following:

- potential for impact on the morphology of the SPA and Ramsar site;
- effect of increases in suspended sediments during maintenance dredging on food resources of SPA interest features;
- remobilisation and redistribution of sediments (which may be contaminated); and,
- increased noise levels (disturbance) during maintenance dredging.

The Maintenance Dredging Baseline Document 2008 concluded that maintenance dredging represents a potential supply of fine material to Seal Sands, with the timing of maintenance dredging in relation to the state of the tide being an important control on the supply of fine material to this intertidal area. Overall, however, the Maintenance Dredging Baseline Document concluded that the maintenance dredging activity does not appear to be having (or has historically had) an impact on the designated site that would alter or affect its condition.

The WFD assessment presented in the latest annual update to the Maintenance Dredging Baseline Document (Royal HaskoningDHV, 2019) concluded that, at water body level, maintenance dredging at current permitted levels has no significant impact on estuary morphology, marine ecology and marine water quality.

Mitigation measures to limit the suspension of sediment and subsequent deposition of sediment during capital dredging have been proposed for the Anglo American Harbour facilities and the NGCT. For the former project, mitigation comprises the use of specialist dredging equipment (i.e. an enclosed grab loading into a sealed barge) for dredging of unconsolidated material to minimise resuspension in the water column. This requirement is specified because of the elevated concentration of contaminants within the dredged sediment, and this measure would limit sediment release into the water column as far as practicable. The implications of the potential cumulative effects identified above on other environmental parameters (e.g. sediment and water quality, marine ecology, ornithology, fish and fisheries) is discussed below.

Potential effects on tidal propagation

Design calculations for the proposed scheme showed an increase in the existing tidal prism of the estuary by less than one percent (0.8% to one decimal place), which is not deemed to be a cause of significant estuary-wide change in hydrodynamics. The NGCT is predicted to have a very small effect on water levels (tidal range in the Tees estuary is predicted to be increased by less than 4mm, with the tide arriving up to 2 minutes earlier). The EIA studies undertaken for the Anglo American Harbour Facilities predicted that there will be no impact on tidal propagation or water levels due to the limited area of proposed dredging for this project. Hence, no cumulative impacts are predicted to arise.

Predicted effect on wave conditions

There is no predicted effect on local wind-generated waves at the site of the proposed scheme since the changes in hydrodynamics are so small and localised. Swell waves do not penetrate far into the estuary and, therefore, are not predicted to be affected by the proposed scheme.

Wave modelling for the NGCT considered the wind and swell components separately. It is predicted that wind waves within the estuary will be affected by the reflective properties of the terminal but, it is also predicted that such waves will be unaffected by the increased depth of the channel. Swell waves (long period waves from offshore) do not penetrate far into the estuary and, therefore, are not predicted to be affected by the proposed NGCT. Swell waves, however, will be affected by the increased depth of the channel in the lower estuary that will arise from capital dredging for the NGCT.

The EIA studies undertaken for the Anglo American Harbour Facilities showed that the harbour facility itself does not have the potential to affect swell waves; therefore there is no potential for cumulative effect on wave conditions due to the proposed scheme and this aspect is not assessed further within the CIA.

Predicted effect on tidal currents

Numerical modelling was undertaken for the proposed scheme in its operational phase during both neap and spring tides, with a mean daily river flow through the Tees Barrage (20 cumecs). Modelling showed that the proposed new quay alignment and capital dredge will not significantly affect the existing baseline hydrodynamic conditions. Although there will be flow newly occurring in the area of the new quay, peak flows will be low. Elsewhere, there will be a general small magnitude reduction in baseline flows varying during different phases of the tidal cycle, but these changes always remain within the reach immediately opposite the proposed scheme. In summary, there will be no measurable change to tidal currents at the Tees Dock turning circle and no estuary scale effects on baseline hydrodynamic conditions.

Modelling studies undertaken for the NGCT predict that current speed changes, of low magnitude, will occur in the vicinity of the NGCT development (1.5km downstream of the proposed scheme) and at the mouth of the estuary. A decrease in current speeds of up to 0.10m/s is predicted in the vicinity of the terminal, with increases of a similar order of magnitude closer to the shores of the estuary. This area (adjacent to the proposed reclamation) is predicted to experience the greatest effect on flows. Further downstream at the mouth of the estuary, very little effect on tidal current speeds is predicted (decreases in current speeds of the order of 0.05m/s).

The Anglo American Harbour Facilities EIA predicted that currents will be reduced within the deepened areas. Some current speed increases are predicted on the shoreline adjacent to the works, suggesting that the dredging is predicted to draw some of the flow to the south side of the estuary, although such effects are shown to be relatively localised to the proposed works. Based on the above, no cumulative impact is predicted to occur.

Changes to estuarine sediment budget

The results of the numerical hydrodynamic modelling showed that the proposed scheme will not significantly affect the existing baseline hydrodynamic conditions. There will be general small magnitude reduction in baseline flows varying during different phases of the tidal cycle, but always remaining largely within the reach immediately opposite the new quay. This reduction in baseline flows may lead to a slight increase in deposition of sediment which would be positive in areas adjacent to the north bank opposite the quay, as it will help the existing mudflat be sustained in light of sea level rise. In the main channel the deposition will require periodic dredging to maintain the design depths (a 10% increase in annual maintenance dredging requirement is expected to be sufficient).

The proposed scheme will result in direct effects to the existing inter-tidal and sub-tidal morphology of the Tees estuary. It is estimated that there will be a loss of 25,000m^2 of existing intertidal habitat, a creation of 55,000m^2 of new subtidal habitat and 325,000m^2 of existing subtidal habitat will be impacted (by the proposed dredge).

The NGCT is predicted to have some effect on estuary morphology and the ES described these changes for various zones within the estuary. The ES for the NGCT concluded that the effect of construction on tidal propagation will be minor, with no change in elevation of either high or low water downstream of the site of the proposed scheme. A minor increase in the level of low water of the order of 2mm (at low water on spring tides) was predicted at the site of the NGCT. It was estimated that the effect of this change will be to convert approximately 30 to 40m^2 of intertidal habitat on the North Tees mudflat to very shallow subtidal habitat under these tidal conditions.

The ES for the NGCT described the potential integrated effect of the scheme on physical processes which have the potential to combine to result in an effect on estuarine morphology. For the deepened approach channel, reduced through-depth flows were predicted which, combined with a strengthened near-bed landward flow, were expected to result in the increased import of fine material to the Tees estuary from offshore; with the potential to increase the maintenance dredging requirements by about 10%. No increase in sandy infill was predicted. A small morphological effect is predicted at Seal Sands, with an increase in the supply of fine material to Seal Sands via Seaton Channel. No changes to tidal flow were predicted in this area. No significant effects were predicted at North Gare and Bran Sands as a result of the NGCT.

The Anglo American Harbour Facilities will not make any changes to the outer sections of the approach channel. It can be concluded that there will be no effect on the supply of material into the Tees estuary from offshore as a result. In addition, no changes to sediment transport in the predominantly sandy areas around Teesmouth were anticipated, and so no effect on sand transport was predicted.

The Anglo American Harbour Facilities are predicted to result in a localised redistribution of sediment deposition in response to predicted changes in current speeds due to the works. It was predicted that this very small change in the overall fine sediment regime will not alter the present frequency of, or methodology used for, maintenance dredging, and no effect on sediment supply to intertidal areas throughout the Tees estuary will occur. Consequently, no effect on the morphology of intertidal areas was predicted due to the Harbour Facilities.

The ongoing maintenance dredging programme in the Tees estuary represents a potential supply of fine material to Seal Sands. However, the latest annual update to the Maintenance Dredging Baseline Document (Royal HaskoningDHV, 2019) concludes that no means have been identified by which the current maintenance dredging regime could adversely affect the overall estuary morphology and the ongoing morphological processes at work. Based on the above, it is concluded that there is no potential for cumulative impacts to arise to the estuarine sediment budget as a result of the projects screened into the assessment.

27.5.3 Marine sediment and water quality

In relation to marine sediment and water quality, the proposed scheme has the potential to result in the following cumulative impacts with the NGCT, Anglo American Harbour Facilities schemes and the ongoing maintenance dredging in the Tees estuary as follows:

- dispersion of suspended sediment during marine works, dredging and disposal; and,
- changes to water quality associated with the release of sediment contamination.

The combined effects on SSC is presented in Section 27.5.2 above. To summarise, the potential for cumulative effects only arises should dredging for each scheme coincide. Under such circumstances, the effect would be a greater increase in SSC than predicted for the proposed schemes alone, and a larger predicted zone of influence than the proposed scheme alone. However, overlaying the plots does not indicate these increases are likely to be significantly greater than those reported for the schemes alone. In addition, the predictions made for each project represent sediment plume dispersion under specific tidal conditions (to enable a realistic worse case to be identified and assessed). It is unlikely, therefore, that the timing of the projects and their respective programmes of capital dredging will coincide to result in a scenario where sediment plumes combine at peak concentration (as predicted by the EIA studies for each project) at any location. Additionally, mitigation is outlined for all three schemes which would reduce plume extents across the estuary and navigational safety is unlikely to support dredging on different sides of the estuary at the same time.

In terms of maintenance dredging, there is the possibility that maintenance dredging could occur at the same time as the proposed scheme, however, it is likely to occur in another area of the estuary. Given the relatively localised effects to the dredger produced in the hydrodynamic modelling assessment for the proposed scheme, it is considered unlikely that the plumes would overlap. As a result, there may be a spatial increase in SSC within the estuary but no additive increase in SSC.

In relation to sediment contamination, data collected to inform the EIAs indicates that concentrations are similar throughout the estuary where regular maintenance dredging occurs. As a result, and noting the comments regarding cumulative effects of SSCs above, it is unlikely that concentrations of contaminants would combine to push water quality concentrations closer to EQS than assessed for the schemes alone. Where the EIA reports larger contaminant concentrations, such as for Anglo American Harbour Facilities, additional mitigation measures are identified to reduce any resulting sediment plume as far as possible and therefore remove the risk of releasing contamination into the water column.

All other potential effects such as discharge of surface water, demolition activities or accidental spills and leaks would be managed using best practice measures to remove the risk to the water environment as far as possible and therefore cumulative effects are not predicted.

27.5.4 Land quality and geology

It is recognised that there are a number of other plans and projects in the surrounding area which could result in cumulative impacts with the proposed scheme on land quality, the closest of which is the SIZ application to the immediate south of the proposed scheme footprint. However, due to the nature of the other proposed schemes and the regulatory regime under which they will be constructed, appropriate mitigation measures would be incorporated into the design of each and thus remove the potential for significant cumulative effects to occur. As a result, **no cumulative impacts** on identified receptors with regard to land quality and geology are predicted.

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

27.5.5 Marine ecology

Loss of intertidal habitat
As noted in **Section 9**, the proposed scheme is predicted to result in the loss of 2.5ha of intertidal habitat within the footprint of the proposed scheme, where the intertidal area will be dredged to create the berth pocket. The significance of this impact is reported to be minor adverse due to the low value nature of the intertidal and limited sensitivities of the key species.

The NGCT scheme would also result in the direct loss of intertidal due to reclamation, estimated to be 1.19ha. The other nearby relevant scheme is the consented Anglo American Harbour Facilities scheme, which would also result in the direct loss of intertidal due to reclamation (for the solid quay) and revetment installation (for the open quay). The maximum area of intertidal loss for the Anglo American Harbour Facilities scheme would be associated with the solid quay and was calculated as 3.6ha.

In light of the quality of intertidal habitat present with the footprint of the NGCT scheme and Anglo American Harbour facility scheme, the receptor (benthic habitats) was considered to be of low value; but the magnitude of the effect would be medium for NGCT and high for the Anglo American Harbour Facility scheme.

The impact on intertidal area as a consequence of the proposed schemes referred to above are spatially distinct and the overall impact is therefore additive as opposed to cumulative (i.e. there would not be an interaction between the various project that would result in a net greater effect on intertidal area).

Smothering of benthic invertebrate communities due to deposition of sediment dispersed during capital dredging
Sediment deposition resulting from the dredging for the proposed scheme will largely be within the proposed dredged footprint. Deposition that occurs in other parts of the river is predicted to be 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 6.51**). Sediment deposition at all of these locations were predicted to be immeasurable (**Figure 6.53**).

The predicted footprints of sediment deposition for the NGCT and the Anglo American Harbour Facilities are largely similar; however, the effect of the NGCT dredge is larger, with deposition predicted to extend into Seaton Channel and onto Seal Sands. As the deposition footprint for the Anglo American Harbour Facilities project is predicted to be within that of the NGCT deposition footprint, the direct effect of NGCT will have the overriding impact on the benthic community. However, the predicted deposition as a result of the NGCT and the Anglo American Harbour Facilities is anticipated as being in the order of a few millimetres. This deposition is likely to be temporary due to the unconsolidated nature of the sediment, and the cumulative impact is predicted to be negligible.

Maintenance dredging is targeted at areas that require dredging to maintain navigable depths and, although it would result in some losses of material into the water column, deposition onto the seabed due to maintenance is predicted to be insignificant. Given this, a cumulative impact is not expected.

Effects on benthic invertebrate communities due to effects on the morphology of intertidal and subtidal habitats

The proposed scheme is not predicted to have an effect on sediment supply into the estuary. The very minor changes in the hydrodynamic regime, specifically currents, may lead to a slight increase in sediment deposition on the North Tees mudflat (**Section 6**).

The studies for the NGCT scheme concluded that there would not be a change in the supply of fine sediment to the Tees (specifically Seal Sands, as assessed in the NGCT ES). NGCT was not predicted to affect the sediment budget of the estuary and, therefore, was assessed that there would be no impact on morphology of intertidal areas.

Based on the above, it is concluded that there will be no cumulative effect on the maintenance dredging commitment within the Tees and, therefore, no cumulative impact on the supply of material to intertidal and subtidal areas or effect on morphology of estuarine habitats.

27.5.6 Marine mammals

The potential exists for a cumulative underwater noise impact to arise from the proposed scheme, should it be undertaken at the same time as the NGCT, Hartlepool approach channel and Anglo American Harbour Facilities schemes.

There would be no potential for any PTS cumulative impacts as each project would ensure adequate mitigation is adopted to reduce the risk of any such impact from occurring. However, there could be the potential for cumulative underwater noise impacts to result in the disturbance of marine mammals.

The potential impact ranges for any disturbance from each of these projects are likely to be similar to those modelled for piling and dredging for the Hartlepool approach channel (**Table 27.3**).

Table 27.3 Maximum predicted impact ranges (and areas) for TTS or fleeing response for piling and dredging based on NMFS (2018) criteria for Hartlepool approach channel scheme modelling

Potential impact / receptor	Species / group	Criteria and thresholds (NMFS, 2018; Southall *et al*., 2019)	Maximum predicted impact range (km)
TTS / fleeing response from piling at NGCT, Hartlepool approach channel and Anglo American Harbour Facilities schemes	Harbour porpoise	Unweighted SPL_{peak} 196 dB re 1 µPa	0.43km
	Minke whale	Unweighted SPL_{peak} 213 dB re 1 µPa	0.03km
	Grey seal and harbour seal	Unweighted SPL_{peak}k 212 dB re 1 µPa	0.04km
TTS / fleeing response during dredging South Bank Port Facility, NGCT, Hartlepool approach channel and Anglo American Harbour Facilities schemes	Harbour porpoise	153 dB re 1 µPa HF SEL_{cum}	0.7km
	Minke whale	179 dB re 1 µPa MF SEL_{cum}	<0.01km

	Grey and harbour seal	181 dB re 1 µPa PW SEL_{cum}	<0.01km

As a worst-case scenario, the maximum number of harbour porpoise, minke whale, grey seal and harbour seal that could be disturbed has been estimated based on the maximum impact ranges during piling at the NGCT, Hartlepool approach channel and Anglo American Harbour Facilities schemes and / or during dredging at the proposed South Bank scheme, NGCT, Hartlepool approach channel and Anglo American Harbour Facilities schemes (**Table 27.4**).

Table 27.4 Maximum number of individuals (and % of reference population) that could be at risk of temporary auditory injury (TTS) or a fleeing response from cumulative impacts of piling and dredging at the proposed scheme, NGCT, Hartlepool Approach Channel and Anglo American Harbour Facilities schemes

Potential impact	Receptor	Maximum number of individuals (% of reference population) from cumulative impacts	Magnitude for cumulative impacts
TTS / fleeing response from piling – cumulative impacts from NGCT, Hartlepool approach channel and Anglo American Harbour Facilities	Harbour porpoise	0.9 harbour porpoise (0.0003% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of the reference population anticipated to be exposed to effect).
	Minke whale	0.00009 minke whale (0.000004% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of the reference population anticipated to be exposed to effect).
	Grey seal	0.0015 grey seal (0.00002% of the NE England MU) based on density of 0.10/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of the reference population anticipated to be exposed to effect).
	Harbour seal	0.007 harbour seal (0.008% of the NE England MU; 0.005% of the Seal Sands haul-out site) based on density of 0.46/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of the reference population anticipated to be exposed to effect).
TTS / fleeing response during dredging – cumulative impacts from NGCT, South Bank, Hartlepool approach channel and Anglo American Harbour Facilities	Harbour porpoise	5.6 harbour porpoise (0.002% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Minke whale	0.00001 minke whale (0.00000005% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).

Potential impact	Receptor	Maximum number of individuals (% of reference population) from cumulative impacts	Magnitude for cumulative impacts
	Grey seal	0.0001 grey seal (0.000002% of the NE England MU) based on density of 0.10/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Harbour seal	0.00064 harbour seal (0.0008% of the NE England MU; 0.0005% of the Seal Sands haul-out site) based on density of 0.46/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
TTS / fleeing response during piling and dredging – cumulative impacts from NGCT, South Bank, Hartlepool approach channel and Anglo American Harbour Facilities	Harbour porpoise	6.5 harbour porpoise (0.002% of NS MU) based on the SCANS-III Block O density of 0.888/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Minke whale	0.0001 minke whale (0.0000004% of CGNS MU) based on the SCANS-III Block O density of 0.01/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Grey seal	0.002 grey seal (0.00003% of the NE England MU) based on density of 0.10/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).
	Harbour seal	0.008 harbour seal (0.01% of the NE England MU; 0.006% of the Seal Sands haul-out site) based on density of 0.46/km^2.	**Negligible / very low magnitude** (temporary effect with less than 1% of reference population anticipated to be exposed to effect).

The magnitude of the potential cumulative impacts for TTS and fleeing response as a result of piling and / or dredging noise from the proposed scheme, NGCT, Hartlepool approach channel and Anglo American Harbour Facilities schemes, is negligible / very low for harbour porpoise, minke whale, grey seal and harbour seal, with less than 1% of the references populations likely to be temporary disturbed (**Table 27.4**).

Taking into account the receptor sensitivity of medium for TTS and fleeing response and the potential magnitude of the effect, along with the temporary nature of the disturbance, the impact significance for disturbance as a result of cumulative underwater noise impacts from piling and dredging activities on harbour porpoise, minke whale, grey seal and harbour seal, has been assessed as **negligible** (**Table 27.5**).

Mitigation measures and residual impact

No mitigation measures are required to reduce the potential disturbance of marine mammals from cumulative underwater noise impacts. The residual impact would be of **negligible** significance.

Table 27.5 Assessment of impact significance for cumulative underwater noise impacts from piling and dredging activities on marine mammals

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual impact
TTS or fleeing response from cumulative impacts during piling and dredging at the proposed scheme, NGCT, Hartlepool approach channel and Anglo American Harbour Facilities	Harbour porpoise	Medium	Negligible / very low	Negligible	None required.	Negligible
	Minke whale		Negligible / very low	Negligible		Negligible
	Grey seal		Negligible / very low	Negligible		Negligible
	Harbour seal		Negligible / very low	Negligible		Negligible

27.5.7 Terrestrial ecology

The following projects are considered to be of relevance with regard to this section of the CIA:

- South Industrial Zone.
- NGCT.
- Ongoing maintenance dredging.
- Tees channel dredge.

Given the separation distance between the proposed scheme footprint and the other projects outlined in **Table 27.1**, there is no pathway for cumulative impacts to arise. Other plans and projects are therefore not considered further below.

Disturbance impacts to otter during construction

Of the proposed projects which have been screened into the cumulative impact assessment, all have potential to have an impact on foraging/commuting otters through collision with vessel or disturbance from noise and light pollution. The impacts to otter associated with the proposed scheme are limited due to the lack of suitable habitat within its footprint. The mitigation outlined for the proposed scheme reduces the potential impacts to otter to an acceptable level during the construction and operation phases. Should any of the other developments have potential to cause an adverse impact upon otter, it is assumed they will be subject to similar mitigation measures to minimise any potential effects, including reduced vessel speeds, and use of appropriate lighting regimes. As such, the proposed scheme is not anticipated to cause impacts worse than **minor adverse** in significance when considered cumulatively with the other projects.

Mitigation measures and residual impact

No additional mitigation is proposed and the residual cumulative impact would be of **minor adverse**.

Royal HaskoningDHV

Impacts to terrestrial fauna during construction
The adjacent landside project at the South Industrial Zone is included within the CIA for potential impacts to terrestrial fauna, notably bats, invertebrates, breeding birds, brown hare and hedgehog.

The footprint of the proposed scheme occupies a small strip of land adjacent to the proposed South Industrial Zone development. The proposed scheme footprint is considered to be peripheral habitat, offering limited foraging potential for species utilising the footprint of the adjacent development (276.77 ha) to spill across to. The removal of the additional limited habitat within the proposed scheme footprint would not cause an impact of greater significance to that already assessed within the much larger footprint of the adjacent landside EIA development. In addition, once the larger area of habitat from the landside development is removed, the footprint of the proposed scheme would become fragmented with little to no functional linkage with other habitats in the area and its biodiversity value would be even less than it currently is.

Of relevance to the proposed scheme, ecology surveys for the adjacent landside EIA development recorded:

- Expansive and good quality habitat for invertebrates (dingy skipper, grayling, mainly associated with an abundance of birds foot trefoil on the Open Mosaic Habitat (OMH). Also, although bird's foot trefoil was recorded within the ephemeral/ruderal habitat within the proposed scheme footprint, the OMH was not found to be present.
- Opportunities for breeding ground nesting birds, including BcOCC red -list species within areas of trees, scrub, wetland, grassland and OMH. No red list species were recorded within the proposed scheme footprint which is the subject of this report, although grassland and scrub habitat was found to support nesting green and (one) amber species.
- A significant population of brown hare within grassland, sparsely vegetated land and OMH, which has potential to use the grassland within the footprint of the proposed scheme.
- Foraging habitat for bats (including on the invertebrate assemblage).

As a more sizable development, the landside EIA proposes a number of mitigation measures including off site habitat compensation to achieve Biodiversity Net Gain (BNG) which addresses the impacts of habitat loss on these receptor groups and reduces potential impacts to an acceptable level The South Tees Regeneration Masterplan Environment & Biodiversity Strategy will include for habitats and species within the footprint of the proposed scheme. As such, the proposed scheme is not anticipated to cause impacts worse than **minor adverse** in significance when considered cumulatively with the landside EIA.

Mitigation measures and residual impact
No mitigation measures are required and the residual cumulative impact would be of **minor adverse**.

Light pollution impacts on foraging and commuting otters and bats
There is potential for commuting otters and bats to be disturbed by light pollution from the operation of the proposed scheme along with all other proposed schemes in the area, which may produce light pollution in the area. There will be no habitat potential for either species within the footprint of the proposed scheme itself and the impacts associated with the proposed scheme are limited due to the lack of habitat within its footprint. The mitigation outlined for the proposed scheme reduces the potential impacts to otter to an acceptable level during the operation phase. Should any of the other developments have potential to cause an adverse impact to otter, it is assumed they will be subject to similar mitigation measures to minimise any potential effects, including lighting regimes. As such, the proposed scheme is not anticipated to cause impacts worse than **minor adverse** in significance when considered cumulatively with the other projects.

Mitigation measures and residual impact

No mitigation measures are required and the residual cumulative impact would be of **minor adverse**.

27.5.8 Marine and coastal ornithology

Construction phase impacts on feeding and food resources due to reductions in marine water quality

The potential exists for a cumulative impact to arise from the potential SSC increases during the construction of the proposed scheme, should it be undertaken at the same time as the dredging required for the NGCT, Anglo American Harbour Facilities schemes, the Hartlepool Channel deepening and the maintenance dredging works that exist within the Tees estuary. As stated in **Section 12.5.2**, the main receptor that may be affected by this cumulative effect is breeding common terns that forage within the Tees, since there may be temporary displacement of prey resources or a reduction in foraging ability.

In order for a potential cumulative impact to manifest, the dredging campaign for the proposed scheme would need to coincide with at least one of the other dredging campaigns noted above, and both would need to be undertaken during the common tern breeding season (i.e. May to August). In the unlikely event that this occurs, the zones of influence from dredging would create an additive effect, as demonstrated in **Figures 27.1** to **27.3**. In other words, a larger predicted zone of influence would be predicted than that arising from the proposed scheme alone. In essence, this creates a larger area of habitat potentially 'lost' to foraging activity on a temporary basis. Clearly, the magnitude of the additive effect would be greater with more dredge campaigns ongoing at any one time.

In the absence of suitable mitigation, this could potentially result in an increased risk to subtidal foraging within the Tees. However, the mitigation measure described for the proposed scheme in **Section 12.5.2** (i.e. dredging along the axis of the river rather than across it to ensure that, at any one time, sediment plumes occupy only half of the river cross section) has also been proposed for the NGCT project. For the Anglo American Harbours facilities scheme, specialist dredging equipment (i.e. an enclosed grab loading into a sealed barge) will be used for dredging of unconsolidated material to minimise resuspension in the water column. When assessed separately, all projects considered in the assessment are anticipated to have a minor impact at worst (with the mitigation measures in place). With mitigation measures in place for all schemes, the combined impact will be reduced as far as possible, and the risk of creating total barriers to prey fish movement and stretches of turbid water stretching the width of the river is minimised.

As stated in **Section 12.5.2**, common terns forage only in the top layer of the water column and are likely to be relatively insensitive to increased SSC. Given the 9,400ha foraging range within the SPA (Natural England, 2018a), the area affected even by the combined plumes is likely to be low (for example, should Stage 2 of the proposed capital dredging coincide with the Hartlepool Channel deepening works, the two dredging plumes together will still affect only around 0.5% of the SPA subtidal habitat (Royal HaskoningDHV, 2015)). However, the additive effect of the sediment plumes from separate dredging campaigns cannot be completely avoided if the campaigns are undertaken simultaneously, therefore the cumulative effect is anticipated to be **minor adverse**.

Construction and operation phase noise disturbance

The potential also exists for a cumulative noise disturbance impact to arise from the proposed scheme, should it be undertaken at the same time as the NGCT, Anglo American Harbour Facilities schemes and the SIZ development immediately landward. However, with the mitigation measures outlined in **Section 12.5.4** (i.e. shrouding employed at the piling rigs) in place, there is anticipated to be (at worst) a minor impact on waterbirds at North Tees Mudflat, and negligible impact further downstream (including at Vopak Foreshore). Given that effects (if any) from the proposed scheme are not expected to include significant displacement of birds, and noise from the other schemes is not anticipated to have a significant effect on the North Tees Mudflat (noise levels at the mudflat from the other projects considered are expected to be lower than the disturbance thresholds set out in e.g. Cutts *et al.,* 2009 and 2013) , there is not expected to be any significant cumulative impact.

Loss of supporting habitat

While the proposed scheme, in isolation, will result in a loss of 2.5ha of comparatively low-value habitat (see **Section 12.5.1**) at South Bank, the impact on waterbirds is considered to be minor. By comparison, loss of supporting habitat was considered a negligible impact in the EIAs for both the Anglo American Harbour Facilities scheme and the NGCT scheme, and a CIA undertaken for the latter (which considered both schemes together) did not assess cumulative habitat loss as a significant impact. Given that other projects (even in combination) would have a negligible impact, the cumulative effect with the proposed scheme would not be expected to be any more significant than when considering the proposed scheme in isolation.

The proposed SIZ development immediately landward of the proposed scheme footprint contains an area of intertidal referred to as The Slems. The Supplementary ES (Lichfields, 2020) reports that as The Slems does not contain a suitable foraging resource for wintering bird species, including those species that contribute towards the Teesmouth and Cleveland Coast SPA and Ramsar wintering waterbird assemblage, mitigation relating to the effect of the loss of intertidal mud specifically in relation to these species is not necessary. Based on the above, there is no pathway for the proposed scheme to result in in-combination impacts to occur to over-wintering bird species with the SIZ development.

27.5.9 Fish and fisheries

Changes in marine water quality due to dredging activity

The potential exists for a cumulative impact to arise from the potential SSC increases during the proposed scheme, should it be undertaken at the same time as other plans and projects in the Tees estuary which require dredging, including the NGCT, Anglo American Harbour Facilities and the ongoing maintenance dredging works. The main receptors that may be affected by this cumulative effect are migratory species, such as salmonids and eels, since, as described in **Section 13.5.1**, temporary barrier effects formed by sediment plumes may deter such species from migrating to and from spawning sites.

Should two or more of the dredging campaigns for the proposed scheme, the NGCT scheme, the Anglo American Harbour facilities scheme and the ongoing maintenance dredging be undertaken simultaneously, the respective sediment plumes could result in an additive effect, as demonstrated in **Figures 27.1** to **27.3**. In other words, a larger predicted zone of influence would be predicted than would be the case when considering the proposed scheme in isolation. In essence, this increases the risk of barrier effects forming and preventing migration, should the dredging be undertaken during the peak migration season.

Significantly, the effect of a combined plume is not likely to result in a different behavioural response in fish compared with the effect of the projects in isolation, although the increased plume footprint may increase the risk of such responses being exhibited. However, the mitigation measure described for the proposed scheme in **Section 13.5.1** (i.e. dredging along the axis of the river, rather than across it to ensure that, at any one time, half of the river cross section is relatively unaffected) has also been proposed for the NGCT project, and other mitigation measures have been proposed for the Anglo American Harbour facilities scheme (including seasonal restrictions on proposed works).

With mitigation measures in place for all schemes, the combined impact will be reduced as far as possible, and the risk of creating total barriers to migratory fish movement is minimised. However, the additive effect of the sediment plumes from separate dredging campaigns cannot be completely avoided if the campaigns are undertaken simultaneously, and the cumulative effect is anticipated to be **minor adverse**.

Mitigation measures and residual impact

No further mitigation measures are possible (or necessary). The residual cumulative impact would **be minor adverse**.

Underwater noise
Underwater noise from the proposed scheme is predicted to arise from both dredging and land-based pile driving activities (see **Section 13.5.3** and **13.5.4**). While there is anticipated to be negligible impact from the land-based piling, there may be minor adverse impacts from the dredging noises which could potentially result in temporary localised redistribution of fish within the estuary. It is not expected to significantly affect the upstream and downstream movements of migratory fish.

Should the dredging campaign for the proposed scheme coincide with dredging from one or more of the NGCT scheme, the Anglo American Harbour facilities scheme and the ongoing maintenance dredging, the individual zones of influence may be combined to form a larger area over which there are elevations in noise level above the background with the Tees. This is not likely to result in a different behavioural response in fish, but it may increase the area over which such responses may be expected.

Given the regularity of maintenance dredging within the channel, resident and migratory fish in the estuary are anticipated to be relatively habituated to such noises, plus the mitigation measures in place will help to reduce the magnitude of impacts from individual dredges. It has to be recognised that underwater noises originating from different sources will be detectable across larger areas of the river than when considered in isolation, though it is highly unlikely that there would be more than one or two dredge campaigns ongoing at any one time. As such, the cumulative effect is predicted to be **minor adverse**.

Mitigation measures and residual impact
No further mitigation measures are possible (or necessary). The residual cumulative impact would **be minor adverse**.

27.5.10 Commercial and recreational navigation

Potential effect on commercial navigation during construction
During the construction phase of the proposed scheme, there is potential for a cumulative navigation impact to arise should the timing of the construction phases of the projects included in the CIA coincide. Such an impact could include potential delays to shipping, increased collision risk, obscuring navigation aids and the presence / interference of activities on other operators.

The proposed South Bank scheme is in close proximity to the footprints of the NGCT and the Anglo American Harbour Facilities scheme. The South Bank dredge footprint will pass adjacent to the site of the Anglo American Harbour Facilities and the NGCT dredge footprint (overlapping with the proposed dredge at the Tees Dock turning circle).

There is a range of mitigation measures that are typically adopted during construction works to manage the risks to navigation. These measures comprise the following:

- one-way control of vessels and potentially re-timing of commercial vessel movements – this will be implemented via the VTS;
- deployment of additional buoys (as required) to mark construction areas and to warn other shipping of the works that are taking place;
- red lights will mark the location of the construction works (e.g. at either end of the construction site) as an aid to navigation;
- Trinity House will be consulted prior to the implementation of changes to buoyage and lighting that may be required during construction; and,

- a Notice to Mariners will be issued which will set out all of the above measures.

It is anticipated that the implementation of these measures will effectively manage the risks to commercial navigation, should the construction phases of the relevant projects coincide. It is likely that there will be some effect on commercial navigation due to the need to adjust movements to accommodate any ongoing works, but the potential cumulative impact is predicted to be of **negligible** significance.

Mitigation measures and residual impact
No mitigation measures are required beyond those to be embedded into the proposed scheme and those to be taken account of during construction of the other projects in the Tees estuary. The residual cumulative impact would be of **negligible** significance.

Potential implications for vessel traffic management associated with increased commercial activity during operation
It is anticipated that the proposed scheme will result in an increase in traffic of approximately 390 vessel calls per year (equating to an additional 32 vessel calls per month). It is anticipated that the NGCT will result in an increase in traffic of approximately 100 movements per month in the estuary, whilst the Anglo American Harbour Facilities ES reported that there will be an increase in the annual shipping traffic of 191 vessels. It is therefore evident that the implementation of each scheme would result in increased vessel movements within the Tees during the operational phase.

The NRA has considered the potential for cumulative impacts on navigation as a result of the aforementioned schemes. The assessment concluded that all potential cumulative hazards were acceptable (from a navigation risk perspective), with all risks classified as negligible or low, with the exception of impact on ship contact risk which was assessed as being as low as reasonably possible. The mitigation measures outlined above would be adopted during the operational phase of the proposed scheme in order to manage cumulative navigational risks. As a result, significant cumulative impacts are not anticipated.

Mitigation measures and residual impact
No mitigation measures are required beyond those to be embedded into the proposed scheme and those to be taken account of during operation of the other projects in the Tees estuary. The residual cumulative impact would be of **negligible** significance.

27.5.11 Traffic and transport

The primary assessment identifies that the proposed schemes traffic demand would result in a negligible impact. It is therefore concluded that there is no pathway for cumulative impacts with other projects and **no cumulative impacts** are predicted.

Mitigation measures and residual impact
No mitigation measures. There would be **no residual cumulative impact.**

27.5.12 Archaeology and cultural heritage

Cumulative direct physical impacts upon heritage assets are not anticipated to occur as the footprints of the projects screened in **Table 27.1** do not overlap. As construction works are spatially discrete, direct impacts from the projects and plans screened in for cumulative impact assessment will not, therefore, also occur during the construction phase of the works proposed below mean high water springs. The only exceptions to this are the dredging footprint for the Tees Dock turning circle (which is also included as part of NGCT dredge footprint), and the landward part of the proposed scheme of this application (which overlaps in part with the South Industrial Zone scheme).

However, as the dredging for the turning circle will only take place once, either for NGCT or for the scheme proposed here, this will not constitute a cumulative impact. The same argument also applies to the landward part of the proposed scheme footprint which overlaps in part with the South Industrial Zone footprint (resulting in a conclusion that cumulative impacts would not occur).

Any direct impacts associated with the proposed works on land will be fully mitigated, and agreed through a WSI to be prepared for agreement with RCBC prior to works commencing. Direct impacts will not subsequently occur cumulatively as part of the proposed works below mean high water springs, which themselves will be addressed through a protocol for archaeological discoveries and WSI.

With regard to cumulative indirect physical impacts, the assessment of cumulative impacts for the hydrodynamics and sedimentary regime (**Section 27.5.2**) concludes that no significant cumulative impacts are predicted to arise. Therefore, these is no pathway for cumulative indirect physical impacts to heritage assets to occur.

With regard to cumulative impacts upon the setting of heritage assets, and specifically the Transporter Bridge, the landscape and visual assessment of cumulative impacts concludes that there will be no significant cumulative landscape and visual effects upon sites within the study area (**Section 27.5.15**). Due to the limited intervisibility between sites, the existing overarching industrial / urban character within the study area and the existing context of extensive industry and infrastructure features, it is likewise concluded that no cumulative impacts upon the setting of heritage assets will occur.

27.5.13 Noise and vibration

Noise disturbance impacts to human receptors may occur as a result of cumulative traffic flows on the local road network, particularly during the construction phase. Noise impacts associated with increased road traffic flow were assessed as part the NGCT EIA (Royal HaskoningDHV, 2020), Anglo American Harbour Facilities (Royal HaskoningDHV, 2014), Anglo American Materials Handling Facility and for a residential development on Kirkleatham Lane schemes. Changes in traffic flows associated with all schemes were considered not significant. Construction traffic impacts for the landside application at the South Industrial Zone were not undertaken at the time of this assessment; however, construction traffic impacts associated with the proposed scheme are considered not significant and indicate negligible impact, at worst. Therefore, significant cumulative impacts with the proposed scheme are considered unlikely and are temporary, local and reversible.

As detailed above, impacts during the construction phase at noise sensitive receptors within South Tees Business Parks associated with the proposed scheme are considered not significant. Separation distances between other schemes and South Tees Business Parks are all greater than 1km with the exception of the landside application at the South Industrial Zone site. South Tees Business Parks is predominantly industrial, and therefore considered low sensitivity as detailed in **Table 17.5**. Noise associated with the proposed scheme, predicted at the eastern boundary of the South Tees Business Parks, are more than 5 dB below the magnitude of effect criteria outlined in **Table 17.7**. Therefore, cumulative construction noise impacts with other schemes are considered unlikely. Given the above, cumulative noise impacts are considered to be **not significant**.

Mitigation measures and residual impact

No mitigation measures are required and there would be **no residual cumulative impact.**

27.5.14 Air quality

During construction, cumulative impacts of dust emissions would only occur where the boundaries of the works are within 700m of each other, as impacts of dust are not considered to be significant beyond 350m of a site boundary. With the exception of the planning application submitted for the proposed South Industrial Zone (reference R/2020/0357/OOM) and the Anglo American Harbour Facilities projects, all other projects are located at a greater distance than 700m from the proposed scheme and therefore cumulative dust impacts would not be experienced. The South Industrial Zone and the Anglo American Harbour Facilities would be required to implement best-practice construction dust minimisation methods during their construction phases; should these construction phases be undertaken concurrently, the implementation of these measures would ensure that significant impacts would not occur. This also applies to construction phase plant emissions.

A number of the cumulative projects screened into the assessment will generate additional vessel movements. Emissions from these vessels, coupled with process emissions from stack-based industrial sources such as the Anglo American MHF, the Grangetown Prairie energy recovery facility and the Teesside CCGT power plant, may give rise to cumulative impacts at receptors. With regard to human receptors, given the spatial separation between most of the cumulative projects and the proposed scheme it is unlikely that emissions dispersed across these distances would give rise to significant cumulative impacts at sensitive receptors. These projects would also be located at a distance from the sensitive saltmarsh and dune habitats within the Teesmouth and Cleveland Coast SPA and SSSI, and therefore it is unlikely that significant cumulative impacts would occur in these areas. Furthermore, the industrial processes would be required to operate under an Environmental Permit, the aim of which is to minimise the impacts of emissions to air by compliance with appropriate emission limits and maintenance regimes.

Impacts may also occur as a result of cumulative traffic flows on the local road network. Impacts of road traffic were assessed as part of the proposed South Industrial Zone development and were found to be not significant, with concentrations of all pollutants below their respective air quality Objectives. Changes in traffic flows associated with the proposed scheme were also considered to have an insignificant air quality impact, and therefore significant cumulative impacts are considered unlikely.

Given the above, cumulative air quality impacts are considered to be **not significant**.

Mitigation measures and residual impact

No mitigation measures. There would be **no residual cumulative impact.**

27.5.15 Landscape and visual

There will be no additional, combined effects to physical landscape features due to the construction and operation of other plans and projects within the zone of influence arising due to the proposed scheme. There would be no significant combined effects on landscape character, aesthetic or perceptual aspects due to limited intervisibility between sites and the existing overarching industrial / urban character within the study area.

There is limited intervisibility between the proposed scheme footprint and the development sites of other plans and projects due to intervening large scale industrial and urban conurbations that restrict views across the relatively flat topography. Visual receptors at elevated vantage points to the south / south eastern study area would obtain distant, in-combination views of development sites. Views would be in context of existing extensive industry and infrastructure features.

Assessment of sites within the study area that may incur cumulative landscape and visual effects concludes that there will be **no significant cumulative impacts**.

Mitigation measures and residual impact
No mitigation measures. There would be **no residual cumulative impact.**

27.5.16 Flood risk and coastal defence

Section 20 of this EIA report has confirmed that there would be no direct or indirect impact on flood risk and coastal defences a result of the proposed scheme. Therefore, there will be no additional, combined effects to flood risk and coastal defence features due to the construction and operation of other plans and projects arising due to the proposed scheme, as the other projects are either located on land, or far enough away to ensure the zones of influence do not overlap. No cumulative impacts are predicted.

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

27.5.17 Socio-economics

A review of supporting documentation for the identified cumulative schemes has enabled an estimation of the anticipated employment impacts – during both the construction and operational phases – which are presented here on an aggregate basis. A review of the cumulative schemes indicates a wide variety of major employment-generating schemes ranging from the offshore wind energy sector, to renewables and energy recovery, to a container terminal and a mineral processing and refining facility. It also includes the South Industrial Zone landside development located immediately adjacent to the proposed scheme and whose operation is intrinsically linked to the proposed scheme. The cumulative schemes also include residential development which has the potential to generate employment during construction phases. Due to the variation in approaches to the assessment and the presentation of employment impacts it is not possible to accurately quantify the aggregate employment effects; rather an estimate is presented. This approach does, however, provide a broad indication of the magnitude and significance of cumulative impacts.

As referenced above, the operation of the proposed South Industrial Zone landside development for distribution/warehousing uses is intrinsically linked to the operation of the proposed quay (the proposed scheme). The socio-economic chapter of the ES for the landside development (July 2020) assessed the following anticipated environmental impacts and their significance:

- Construction employment: supporting between 855 – 915 direct and indirect FTE jobs per annum throughout an 8 year construction phase (temporary, medium term and moderate beneficial);
- Construction economic output: generating between £50.1 - £53.4 million of direct and indirect GVA per annum throughout the construction phase (temporary, medium term and substantial beneficial);
- Operational employment: supporting up to 4,180 direct, indirect and induced FTE jobs at the regional level (permanent and substantial beneficial); and
- Operational economic output: generating up to £180 million of direct GVA per annum (permanent and substantial beneficial).

If all the cumulative schemes came forward for development, without the proposed scheme, it is likely that the construction of these schemes could lead to the generation of approximately 6,565 jobs (including direct, indirect and induced employment). Subject to there being no issues with regard to the availability of labour, it is reasonable to consider that the delivery of all cumulative schemes could represent a substantial and beneficial effect in terms of construction industry employment. Given that the cumulative schemes are likely to be built out at different times and that not all labour is likely to be local, the availability of construction labour is unlikely to be an issue.

If all the cumulative schemes came forward for development, without the proposed scheme, it is estimated that these could deliver in the region of 14,380 operational jobs (encompassing direct, indirect and induced effects). For reasons outlined above, this figure only represents an estimate since it reflects a spread of approaches: for some, only an assessment of gross direct impacts was made whereas others made allowances for net additionality/displacement and considering the multiplier (indirect and induced) employment effects throughout the wider economy. Notwithstanding, it is considered that the scale of estimated operational employment represents approximately 7% of the total workforce within the AOI (comprising Redcar and Cleveland, Middlesbrough and Stockton-on-Tees). Clearly, the delivery of this many jobs could have a significant interaction with the local labour market and could result in a tightening of the job market and bidding up of wages locally. However, the impact of these could be reduced by virtue of the fact that the delivery of these jobs would, in theory, be generated over a wider time period and across a range of sectors. In this context, the cumulative effect during the operational phase is likely to represent a substantial and **beneficial effect**.

Mitigation measures and residual impact

No mitigation measures. There would be **a substantial beneficial residual cumulative impact.**

27.5.18 Use of natural resources

As noted in **Section 23** of this report, although there will be a requirement for the use of natural resources during construction and operation, this is not considered to be significant / unusual for a project of this nature (and no significant natural resource demands are anticipated). Further assessment regarding the use of natural resources has therefore not been undertaken within this EIA. It is therefore concluded that there is no pathway for cumulative impacts to arise with any of the other plans or projects screened into the assessment.

Mitigation and residual impact

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

27.5.19 Disaster risk

As noted in **Section 24** of this report, disaster risks are not applicable to the proposed scheme. It is therefore concluded that there is no pathway for cumulative impacts to arise with any of the other plans or projects screened into the assessment.

Mitigation and residual impact

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

27.5.20 Human health

As no cumulative impacts are predicted with regard to noise and air quality, it is concluded that there would be no cumulative impacts with regard to human health of local residents.

Mitigation and residual impact

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

27.5.21 Climate change

As the global atmosphere is the receptor for the carbon and GHG assessment, where the effects of emissions are global, the assessment is considered to be inherently cumulative in nature. Other projects in the region will therefore contribute to GHG emissions but will be subject to their own GHG reduction measures schemes within their sectors, and are also factored in a general sense to future UK carbon projections. The future carbon budgets should include assumptions about scale of future development and its carbon efficiency. Therefore, no other projects or plans were considered cumulatively in the assessment.

27.5.22 Disposal of dredged material

The proposed scheme involves the requirement to dispose of up to 1,800,000m^3 of dredged material offshore, should no beneficial re-use options be forthcoming prior to the dredge taking place. **Section 26** concludes that the disposal of dredged material will have a negligible impact on fisheries, marine ecology and marine mammals, and no impact on navigation; hence, no significant cumulative effects are predicted.

Mitigation and residual impact

No mitigation measures are required. There would be a residual cumulative impact of **negligible** significance to fisheries, marine ecology and marine mammals, and **no residual cumulative impact** to navigation.

28 WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT

28.1 Introduction

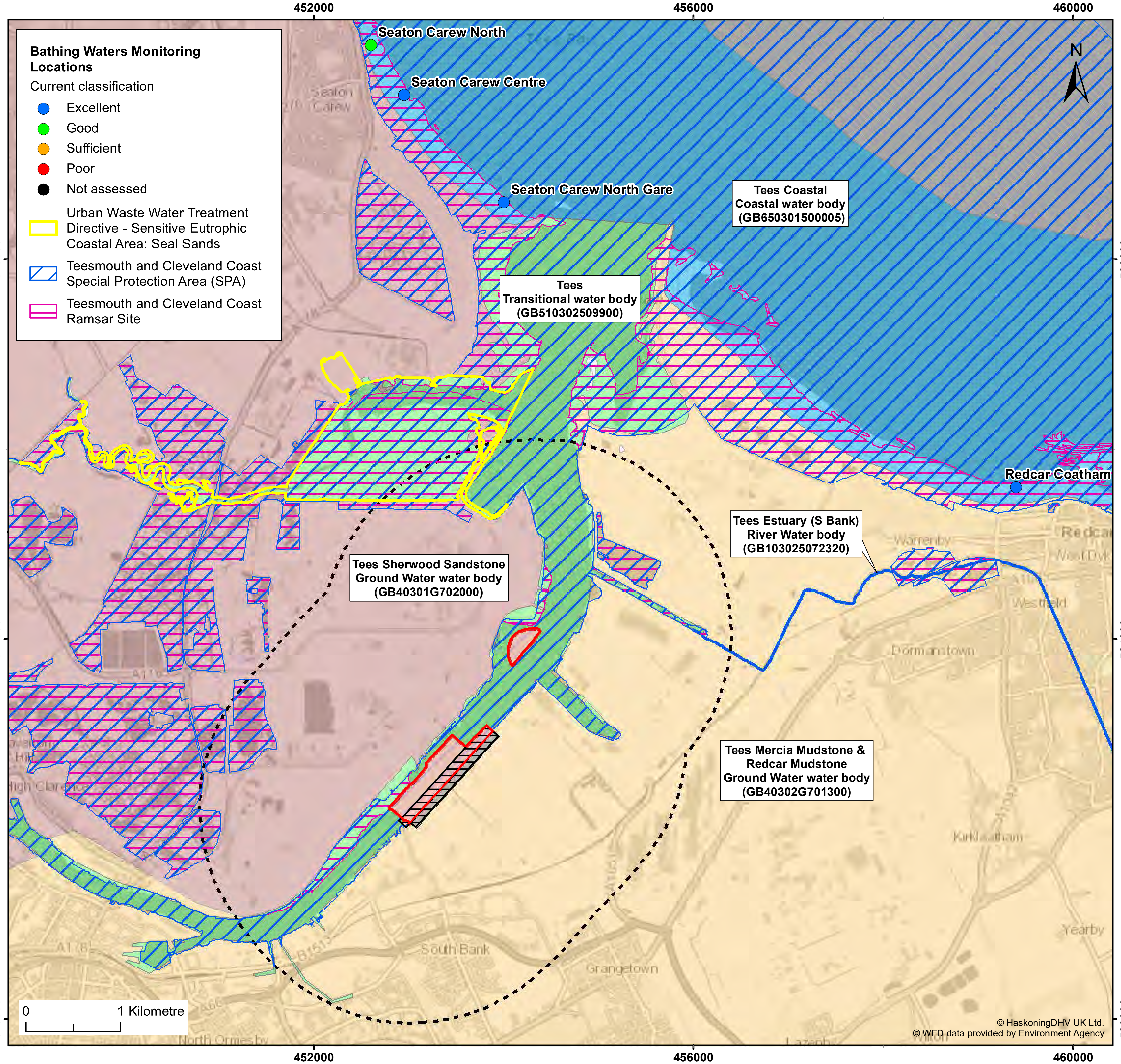
This WFD compliance assessment has been carried out in line with the '*Clearing the Waters for All'* guidance (Environment Agency, 2016) found at https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters. The proposed quay, dredge area, disposal site and WFD water body outlines are shown in **Figure 28.1**. WFD Protected Areas within 2km of the proposed scheme are also shown in **Figure 28.1**.

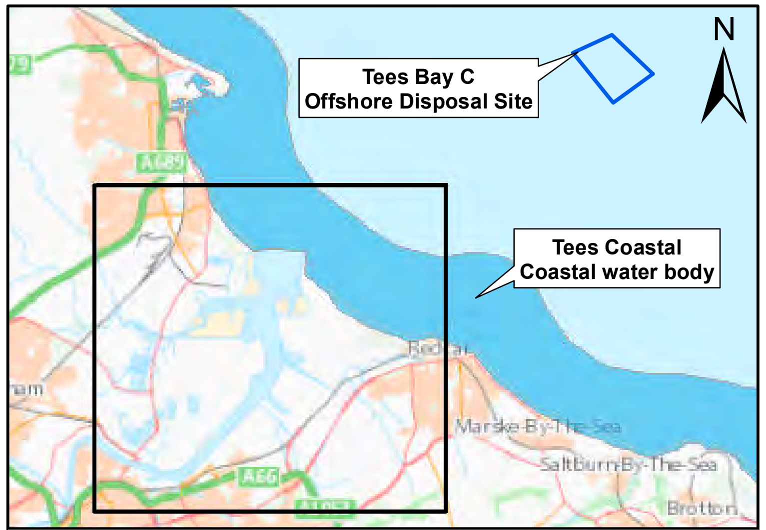
The project is located within the Tees estuary water body (GB510302509900) and the groundwater body Tees Mercia Mudstone & Redcar Mudstone (GB40302G701300) (see **Figure 28.1**). The disposal site is not, however, located within a WFD water body and given the distance of the disposal site to the nearest WFD water body (approximately 6.3km, see **Figure 28.1**) and plume modelling results described in **Section 6,** disposal is screened out of this assessment. Additionally, given that the potential effects associated with maintenance dredging campaigns would be on a significantly smaller scale than the capital dredging and that the estuary is already subject to ongoing maintenance dredging, scoping is undertaken on capital dredging only.

The proposed scheme does not have a planned decommissioning phase (see **Section 3.11**) and therefore decommissioning has not been considered in this assessment.

28.2 Consultation

As noted in **Section 5**, consultation has been undertaken with both the MMO and RCBC most recently during August and September 2020. The comments of relevance to this WFD compliance assessment are contained within **Table 28.1**.





Legend

- 2km Search Area
- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Offshore Disposal Site Tees Bay C

WFD River Water Body

- Tees Estuary (S Bank) (GB103025072320)

WFD Coastal Waterbody

- Tees Coastal (GB650301500005)

WFD Transitional Waterbody

- Tees (GB510302509900)

WFD Ground Waterbody

- Tees Mercia Mudstone & Redcar Mudstone (GB40302G701300)
- Tees Sherwood Sandstone (GB40301G702000)

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title:

WFD water bodies and protected areas

Figure: 28.1

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	CP	A3	1:40,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

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Table 28.1 Summary of scoping consultation responses from the Environment Agency with regard to the WFD

Comment	Response / section of report where comment addressed
The Environment Agency recommended following the *Clearing the Waters for All* guidance before ruling out a quantitative assessment of water quality.	It is confirmed that this guidance has been followed to undertake this assessment.
The applicant must ensure no deterioration in water quality as a result of the development in terms of WFD.	See **Sections 28.4**, **28.5, 28.6, 28.7**
The applicant should identify measures to comply with the requirements of the WFD through carrying out a WFD assessment of the proposal. As part of a WFD assessment, the following must be demonstrated: • Whether the proposed development will lead to a deterioration in status of any WFD waterbody; • Whether the proposed development will compromise the achievement of Good Status or Potential in any WFD waterbody; • Whether the proposed development will contribute towards a cumulative deterioration of WFD status or prevent cumulative enhancement of WFD status in any waterbody; • Whether the proposed development will support the delivery of measures identified in the Northumbrian River Basin Management Plan (RBMP) that are required to achieve waterbody objectives.	These points have been considered throughout this assessment and a summary of findings is provided in **Section 28.11**
The generic mitigation measures deemed applicable to this waterbody include: Enhance ecology, Bank rehabilitation, Remove or soften hard bank, Preserve or restore habitats.	Measures are included in the assessment alongside those listed in the *Clearing the Waters for All guidance* mitigation measures table for the Tees.
The design process for the wharf should look to include an assessment of incorporating bio-engineered designs such as Estuary Edges, to mitigate on site impacts.	See **Section 28.8**
Mention of various reports to inform mitigation to address WFD issues related to enhancement of marine ecology	Consideration of the findings and recommendations of these reports is being fed into the developing South Tees Regeneration Masterplan Environment & Biodiversity Strategy.
The objective for this waterbody is to achieve 'good' ecological potential. These environmental objectives are legally binding. All public bodies must have regard to these objectives when making decisions that could affect the quality of the water environment.	Noted

28.3 Activities and WFD water bodies

As required by the guidance, the proposals have been split into activities for assessment as follows:

During construction;

- C1 Demolition of the existing wharf and three jetties down-stream of the wharf.
- C2 Capital dredging (to deepen the northern half of the Tees Dock turning circle, a section of the existing approach channel and to create a berth pocket) via a combination of TSHD and backhoe dredger.
- C3 Excavation of soils/landside materials within the riverbank to create the berth pocket to be reused on site.

- C4 Installation of rock blanket within the footprint of the proposed berth pocket.
- C5 Construction of the new quay to be set back into the riverbank.
- C6 Accidental spills and leaks.
- C7 Landside works not already consented, such as removal of surface laid pipework to pumping station and demolition of substation.

During operation;

- O1 Presence of new permanent structure – quay wall.
- O2 Discharge of surface water.

28.3.1 In-built scheme control measures and screening out of activities

During the construction period there is the potential for pollution from spills or leaks of fuel and oil. The risk of this arising can be minimised by following standard good practice with regard to pollution prevention guidance (see **Section 3**). Additionally, PDT have an oil spill contingency plan in place which has been developed for use in the event of an operational incident. This plan will be modified where appropriate to take account of the risks during the construction phase. A CEMP will be produced and implemented for the construction phase to manage all risks associated with working in and around water (see **Section 3**) including ensuring debris from demolition activities is captured when working close to water and removed from site. Risks to water quality associated with working practices (i.e. activities C6 and C7) will be reduced as far as possible and therefore these activities are screened out of the assessment.

A biosecurity plan or ballast water management plan will be produced to manage the risk of introduction and spread of invasive species. This plan will include management measures such as filtering or treating of ballast water prior to being discharged into the water when not needed and would be produced in line with any management measures relating to biosecurity or ballast water management that are already put in place and enforced by PDT as statutory harbour authority. Additionally, strict biosecurity measures would be implemented to avoid the importing of non-native invasive species. Equipment, plant and PPE brought to site would be clean and free of material and vegetation. To ensure measures are implemented, biosecurity toolbox talks would be given to all site staff and rigorous inspections would be undertaken of all equipment delivered to site, following the Check Clean and Dry campaign. As a result, the risk of introducing INNS is not considered further in this assessment.

28.3.2 WFD water bodies

The assessment considers the pathway for effects for the WFD water body within which the activities will occur. Where a pathway for effect is identified, the potential for effects on adjoining WFD water bodies will be considered in Stage 3. The relevant adjoining water body is the Tees Coastal water body (GB650301500005) which is located downstream of the proposed scheme.

The information for the water body in which the activity will occur and adjoining water body is presented in **Table 28.2**. The protected areas located within 2km are also listed in **Table 28.2** and shown in **Figure 28.1**. The information for the groundwater body is presented in **Table 28.3**.

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Table 28.2 Summary of surface water WFD water body information

Water body	Description/notes	Description/notes
WFD water body name	Tees	Tees
Water body ID	GB510302509900	GB650301500005
River basin district name	Northumbria	Northumbria
Water body type (estuarine or coastal)	Transitional	Coastal
Water body total area (hectares)	1144.05	8838.15
Overall water body status (2015)	Moderate	Moderate
Ecological status	Moderate	Moderate
Chemical status	Fail	Fail
Target water body status and deadline	Moderate by 2015	Good by 2027
Hydromorphology status of water body	Supports good	Not assessed
Heavily modified water body and for what use	Yes (Flood Protection, Navigation Ports and Harbours)	Yes (Coastal Protection, Flood protection, Navigation, Ports and Harbours)
Higher sensitivity habitats present	Saltmarsh (46.24ha); Subtidal Kelp Beds (4.13ha)	Saltmarsh Mussel beds, including blue and horse mussel (121.9ha); Subtidal Kelp Beds (175.17ha)
Lower sensitivity habitats present	Cobbles, Gravel and Shingle (0.77ha); Intertidal soft sediments (400.13ha); rocky shore (26.93ha); subtidal rocky reef (4.13ha); subtidal soft sediments (610.31ha).	Cobbles, gravel and shingle (3.36ha), Intertidal soft sediment (845.53ha), Rocky shore (184.33ha), Subtidal rocky reef (7170.93ha), Subtidal soft sediments (1219.64ha)
Phytoplankton status	Good	-
History of harmful algae	Not monitored	Not monitored
WFD protected areas within 2km	See **Figure 28.1**. Note that European designated sites are considered within the Information to inform HRA (**Section 29** of this report) and therefore are not considered further in this assessment.	See **Figure 28.1**. Note that European designated sites are considered within the Information to inform HRA (**Section 29** of this report) and therefore are not considered further in this assessment.
Mitigation measures (taken from Clearing the Waters for All, 2016)	50.Vessel Management 22.Dredging disposal strategy 23.Reduce impact of dredging 24.Reduce sediment resuspension 25.Retime dredging or disposal 26.Sediment management 27. Dredge disposal site selection 28.Manage disturbance 1.Modify channel	None identified
Mitigation measures provided by the Environment Agency (scoping response August 2020)	Enhance ecology Bank rehabilitation Remove or soften hard bank Preserve or restore habitats.	None provided

Table 28.3 Summary of WFD water body information for the Tees Mercia Mudstone and Redcar Mudstone Groundwater body

Water body	Description
WFD water body name	Tees Mercia Mudstone and Redcar Mudstone
Water body ID	GB40302G701300
River basin district name	Northumbria
Water body type (groundwater, estuarine or coastal)	Groundwater
Water body total area (ha)	49457.045
Overall water body status (2016)	Poor
Quantitative status	Good
Chemical status	Poor (Chemical Dependent Surface Water body status)
Target water body status and deadline	Poor by 2015
WFD Protected Areas within the WFD water body	Drinking water protected area

28.4 WFD Scoping

The activities screened in have been compared with the scoping criteria as outlined in the *Clearing the Waters for All* guidance (Environment Agency, 2016). The output of this assessment is provided in **Appendix 16A** for surface waters and **Appendix 16B** for groundwater bodies. A summary of the findings of the scoping assessment is presented in **Tables 28.4** for surface water bodies and **28.5** for groundwater bodies.

Table 28.4 Summary of WFD scoping (Clearing the Waters for All, Environment Agency 2016)

<table>
<tr><th>Activity</th><th>Hydromorphology</th><th>Biology (habitats)</th><th>Biology (fish)</th><th>Water Quality</th><th>Invasive species</th><th>Protected Areas</th></tr>
<tr><td>C1 Demolition of wharf and jetties</td><td>No – small scale effects only. Removal of the structures would not threaten the WFD mitigation measures identified for the water body.</td><td>No – small scale effects only.</td><td colspan="2">No – small scale effects which would be localised to the works and only occur for a matter of hours for each pile removed.</td><td>No – control measures to be put in place and materials removed would be disposed of on land therefore limited risk of INNS spread if present.</td><td rowspan="5">Detailed assessment regarding designated sites is provided in Section 29. The project would not give rise to impacts on nutrient concentrations in the estuary and therefore Seal Sands sensitive area (eutrophic) is scoped out.</td></tr>
<tr><td>C2 Capital dredging</td><td>Yes – there is the potential to impact on hydromorphology and WFD mitigation measures identified for the Tees estuary.</td><td>Yes in relation to lower sensitivity habitats. There are no higher sensitivity habitats located within 500m.</td><td>Yes – there is the potential to impact on water quality due to sediment plumes created during dredging.</td><td>Yes – there is the potential to mobilise sediments with concentrations greater than Cefas Action Level 1.</td><td>No – control measures to be put in place to reduce risk of introducing INNS. INNS are already present in the estuary in very low numbers. A significant risk of spreading INNS is not predicted.</td></tr>
<tr><td>C3 Excavation of soils/landside materials</td><td>The potential effect of excavating soil to accommodate the new quay wall and berthing pocket on hydromorphology is considered in O1 below.</td><td>No - these materials would be excavated on land therefore would not directly affect marine habitats.</td><td>No - these materials would be excavated on land and the measures included to reduce risks to water quality when implemented, would not directly affect fish.</td><td>A site characterisation study will be undertaken to assess the potential risk associated with contaminants being present. If present, remediation works will be required prior to commencement of any excavation.</td><td>No – control measures to be put in place to reduce risk of introducing INNS.</td></tr>
<tr><td>C4 Installation of rock blanket</td><td>The installation and presence of the rock blanket would not impact on hydromorphology. WFD mitigation measures assessment scoped in.</td><td>No – the area to be impacted is less than trigger values. There are no higher sensitivity habitats within 500m of the rock blanket.</td><td>No - there might be temporary increases in suspended solids associated with working on the seabed however these would be temporary and localised to the works. No effects on fish predicted.</td><td>No - there might be temporary increases in suspended solids associated with working on the seabed however these would be temporary and localised to the works.</td><td>No – control measures to be put in place to reduce risk of introducing INNS.</td></tr>
<tr><td>C5 Construction of new quay</td><td>The potential for a permanent alteration to the existing riverbank and potential effects in relation to WFD mitigation measures are considered in O1</td><td>No - the new quay would be constructed on land therefore there would be no effects on existing</td><td>No - the construction of the quay wall would require piling on land. Evidence confirms that</td><td>No - the construction of the new quay would be on land therefore effects</td><td>No – control measures to be put in place to reduce risk of introducing INNS.</td></tr>
</table>

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Activity	Hydromorphology	Biology (habitats)	Biology (fish)	Water Quality	Invasive species	Protected Areas
		intertidal and subtidal habitats.	there is unlikely to be underwater noise impacts on fish as a result.	on water quality are not predicted.		
O1 Presence of new structure	Yes – there is the potential to impact on hydromorphological parameters as a result of changes to the riverbank. WFD mitigation measures also scoped in.	No - the new quay would be constructed on land therefore there would be no effects on existing intertidal and subtidal habitats.	There is no pathway for effects on fish.	There is no pathway for effects on water quality.	No pathway for effect	
O2 Discharge of surface water	No – there is no risk of impacting on hydromorphological parameters or mitigation measures identified for the water body.	No - the discharge of clean surface water is unlikely to affect habitats.	Installation of oil interceptors where required will remove the potential for effects on water quality. No other risks to water quality and fish.		No pathway for effect	

Table 28.5 Summary of scoping for the groundwater body

Activity	Quantitative quality elements	Chemical quality elements	Protected Areas
C1 Demolition of wharf and jetties	No – demolition of the structures would not impact on the groundwater body		Not located within 2km of the proposed scheme.
C2 Capital Dredging	No – dredging will not impact on the groundwater body		
C3 Excavation of soils/landside materials	No – excavation would not alter quantitative quality elements	Yes – there is the potential that contaminants would be present in the made ground which could be mobilised during excavation.	
C4 installation of rock blanket	No – the installation of the rock blanket would not impact on the groundwater body		
C5 Construction of new quay	No – the construction of the new quay would not impact on quantitative parameters.	Yes – there is the potential that contaminants would be present in the made ground which could be mobilised during construction of the quay wall.	
O1 Presence of new quay	No – whilst there may be local alterations to rainfall these are unlikely to be discernible.	No - Drainage managed and no infiltration to groundwater required.	
O2 Discharge of surface water	No – no pathway for effect.	No – no pathway for effect as control measures would be implemented to remove risks to discharging polluted surface water	

The following activities and parameters have been scoped into Stage 3 detailed assessment:

- For C2 - Hydromorphology and RBMP mitigation measures, biology (fish and habitats) and water quality.
- For C3 – Hydromorphology and groundwater – chemical quality elements.
- For C4 – RBMP mitigation measures.
- For C5 – Hydromorphology and RBMP mitigation measures, Groundwater – chemical quality elements.
- For O1 - Hydromorphology and RBMP mitigation measures assessment.

C1 and O2 were scoped out of requiring detailed assessment.

28.5 Detailed assessment – C2 Capital dredging

The potential effects of this activity that were scoped in at the end of Stage 2 are summarised in **Table 28.6**.

Table 28.6 Summary of water bodies, quality elements, RBMP mitigation measures and protected areas scoped in for assessment for C2

Water body	Quality elements	RBMP mitigation measures	Protected areas
Tees transitional water body	Hydromorphology, biology (habitat and fish), water quality	All	Whilst the SPA is located within 2km, detailed assessment is covered in **Section 29**. The activity would not give rise to increases in nutrients within the estuary and therefore Seal Sands sensitive area (eutrophic) is scoped out.

28.5.1 Hydromorphology

To assess the potential effects of deepening areas of the channel, numerical modelling was undertaken (see **Section 6** for more detail). The model runs also included the presence of the new quay (see activity O1) and therefore this assessment considers the cumulative effects of the channel deepening and the new quay together.

Baseline conditions indicate that maximum current speeds are greater on the spring tides than the neap tides with an ebb dominance during neap tides and flood dominance during spring tides. The ‘with scheme’ conditions were compared against the baseline conditions and the resulting difference plots show the changes in peak current speeds on the ebbing and flooding phases of neap and spring tides, respectively. An example plot is shown in **Figure 28.2** for the flood phase of a spring tide. The spring tide results for peak flood and ebb phases exhibit similar patterns to those described for the corresponding phases of the neap tide, but the area of effect is slightly larger and, in local areas, the magnitude of effect slightly larger.

The area of effect does not, however, extend significantly further along the axis of the channel (i.e. upstream or downstream), just across the width of the channel opposite the new quay. For example, during the peak of the flood much of the channel immediately opposite the quay experiences a slight reduction in baseline flows, whereas under the corresponding neap conditions is was only parts of the channel width (with changes elsewhere being less than 0.05 m/s). **Section 6** summaries the changes as follows:

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- The proposed new quay alignment and capital dredging to deepen the Tees Dock turning circle and approach channel and to create a berth pocket will not significantly affect the existing baseline hydrodynamic conditions.
- There will be flow newly occurring in the area of the new quay because it is being set-back from the existing riverbank, but the peak flows in this area will be low.
- Elsewhere, there will be a general small magnitude reduction in baseline flows varying during different phases of the tidal cycle, but always remaining within the reach immediately opposite the new quay. This reduction in baseline flows is caused by both a slight widening of the channel (due to the new quay alignment) and the local deepening of the bed due to the capital dredging.
- The reductions in baseline current speeds in these areas may lead to a slight increase in deposition of sediment. In areas adjacent to the north bank opposite the quay, this is deemed to be a positive effect as it will help the existing mudflat be sustained in light of sea level rise. In the main channel the deposition will require periodic dredging to maintain the design depths.
- There is no predicted effect on local wind-generated waves at the site since the changes in hydrodynamics are small and localised.
- There are no estuary scale effects on baseline hydrodynamic conditions.

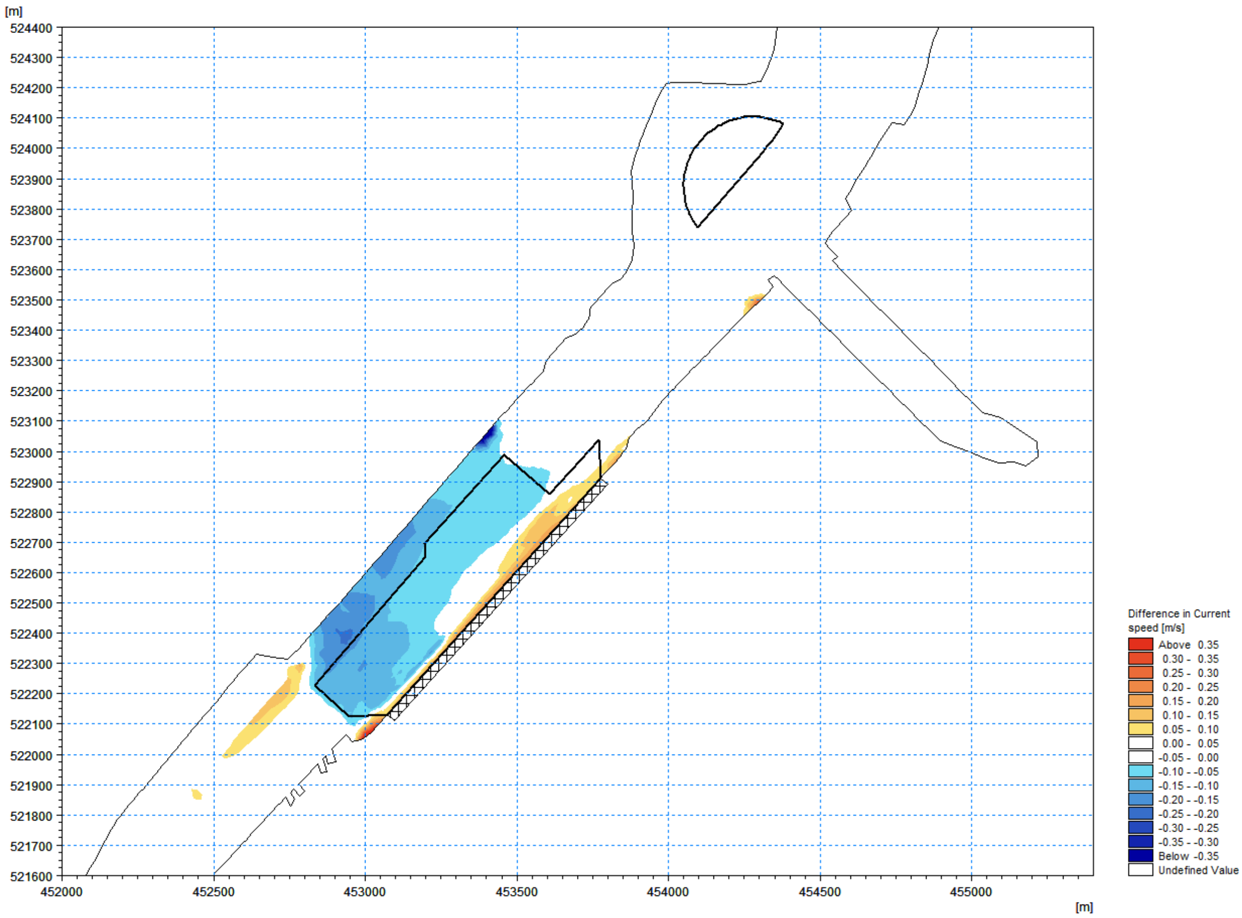


Figure 28. 2 Change in peak current velocities due to the scheme during the flood phase of a spring tide with ***mean daily river flow***

In terms of alterations to the tidal prism, design calculations for the proposed scheme show that the increase in mean tidal prism as a result of the new quay's set-back alignment and dredging of part of the existing estuary bed is 150,901 m^3. This represents an increase in the existing tidal prism of the estuary by 0.8%

and would not cause significant estuary-wide change to existing hydrodynamic processes (see **Section 6** for further information).

Overall therefore, the effects of the capital dredging and presence of new quay wall on the flow conditions and tidal prism of the estuary, would not impact on intertidal communities of the WFD water body and therefore a non-temporary deterioration in ecological class status is not predicted.

28.5.2 Water quality

Capital dredging within the river would result in sediment plumes. To consider the potential extent and severity of effect on suspended solid concentrations within the Tees, hydrodynamic modelling was undertaken. Full detail of the modelling is presented in **Section 6** (and **Appendix 5**) but the key points are summarised here for ease of reference.

Modelling was undertaken using a MIKE3-MT sediment dispersion model coupled with the 3D hydrodynamic model MIKE3-HD and run for the four-month period over which dredging is predicted to occur. The simulations also accounted for the movement of dredgers and transport barges (including dredging, sailing, disposal and downtime) and four stages were modelled to allow for the potential timing of phasing in the proposed construction. The results of the modelling are presented in **Table 28.7.**

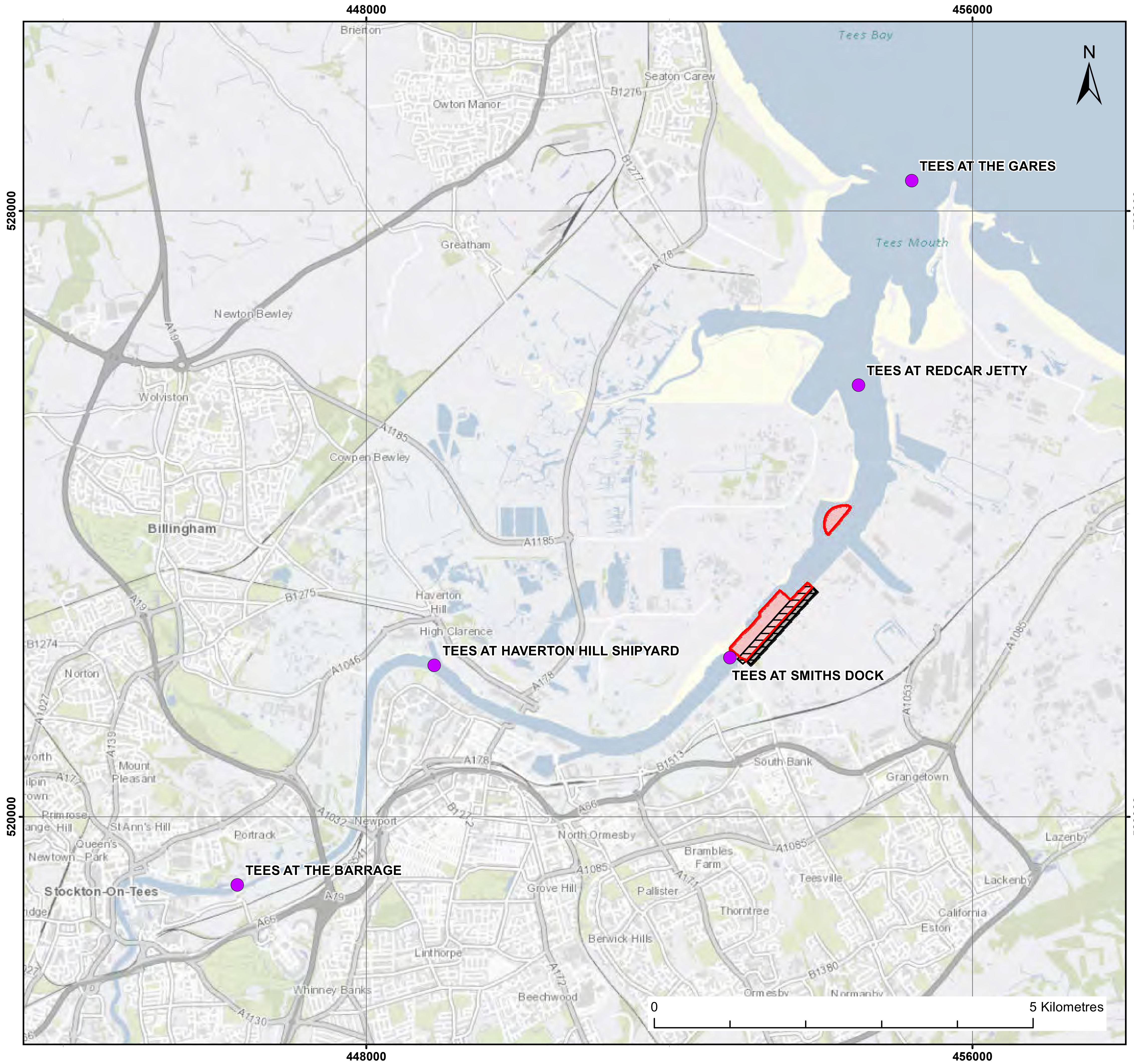
Table 28.7 Summary of output of hydrodynamic modelling (see Section 6 for further detail)

Stage	Description	Findings of the modelling study
1	BHD working to dredge the upper soft material in the berthing pocket and river channel.	In all tidal conditions modelled, the lateral extent of the plume across the river channel is very narrow and the magnitude of concentrations within the plume beyond a few hundred metres from the point of release is in the order of 10 - 20mg/l and in the extremities of the plume, reduces further to concentrations 0-10mg/l.
2	BHD and TSHD working in parallel to dredge the middle soft material in the berthing pocket and river channel.	Results for this stage were similar to those in Stage 1 but with separate plumes created by the different dredgers. At some points in the cycle, areas of these initially separate plumes combine as they move upstream and downstream according to the tidal phase, albeit at relatively low (typically <30mg/l and often <10 mg/l) concentrations once a few hundred metres away from the point of initial release.
3	BHD working to dredge the bottom hard material in the berthing pocket and river channel.	The maximum concentrations and the spatial extents of the plume arising from Stage 3 of the dredging are much lower than those experienced during Stage 1 largely because the material being released is coarser and the production rate of dredging is notably lower. Plume very small and located close to the dredging activity.
4	BHD and TSHD working in parallel to dredge the material in the Tees Dock turning circle.	Again, peak concentrations close to the dredger are shown in the plume modelling output. On the ebb phase, the plume can extend at low concentrations (<30mg/l) along the jetties of the Oil Terminal towards (but not entering) the Conoco Phillips Inset Dock, whilst on the flood phase it remains close to the northern bank over a narrow channel width extending along the North Tees Works jetties.

To investigate potential levels of suspended solid concentrations at the WFD water quality monitoring points (see **Figure 28.3**), time series plots were produced as follows:

- WQ1 – Water quality monitoring point (Tees at the Gares);
- WQ2 – Water quality monitoring point (Tees at Redcar Jetty);
- WQ3 – Water quality monitoring point (Tess at Smiths Dock);
- WQ4 – Water quality monitoring point (Tees at Haverton Hill Shipyard);
- WQ5 – Water quality monitoring point (Tees at the Barrage);

The results are presented in **Figure 28.4**.



Legend

- Proposed Dredge and Excavation Envelope (including side slopes)
- Proposed Quay Envelope
- Proposed Demolition Area
- Water Quality Monitoring Points

Client:	Project:
Tees Valley Combined Authority	South Bank Quay

Title: Water Quality Monitoring Points

Figure: 28.2

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	29/10/2020	TC	CP	A3	1:50,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together
ROYAL HASKONINGDHV
Marlborough House
Marlborough Crescent
Newcastle-upon-Tyne, NE1 4EE
+44 (0)191 211 1300
www.royalhaskoningdhv.com

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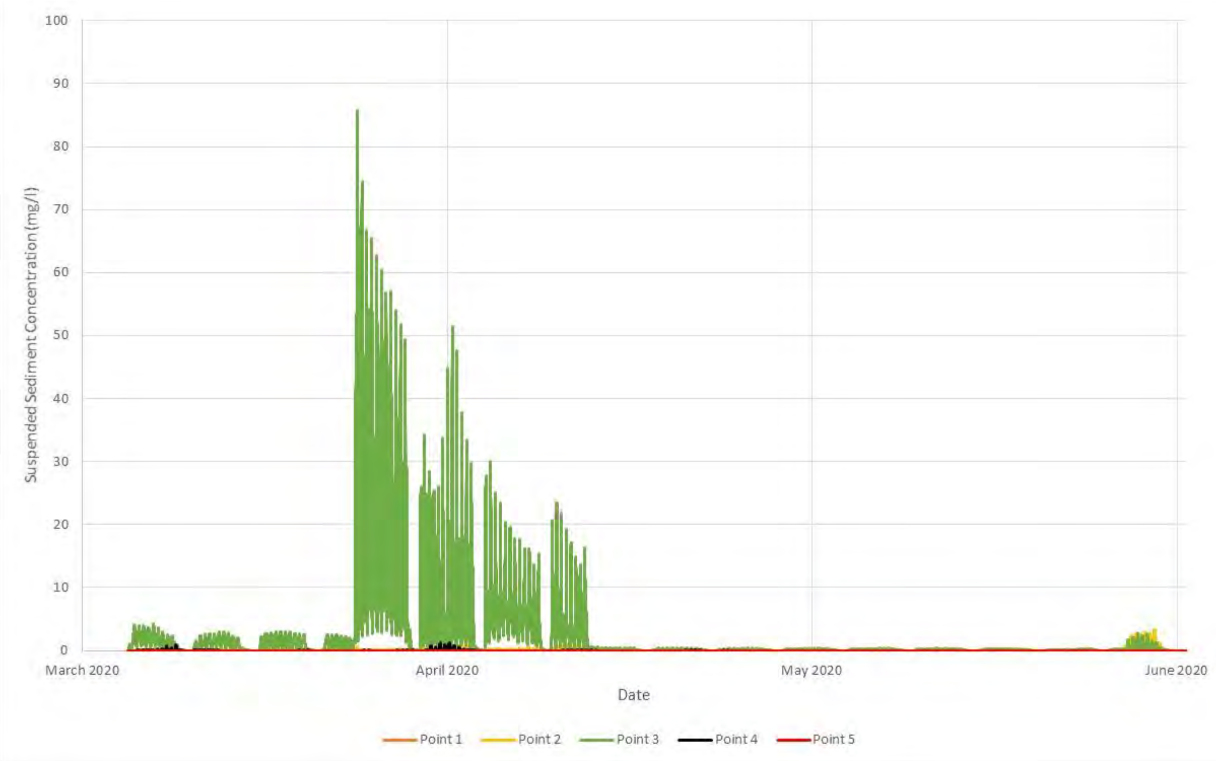

Figure 28.4 Timeseries of changes in suspended sediment concentrations at water quality monitoring points in the Tees estuary

Only water quality monitoring point WQ3 (Smiths Dock) shows elevated levels of suspended solid concentrations by any appeciable effect. Peak concentrations reach 85mg/l which reduce back to baseline within an hour followed by subsequent, but lower concentration peaks, again reducing to baseline concentations within an hour. All other stages of proposed dredging either do not cause elevations or only elevate concentrations by very small amounts (i.e. up to 5mg/l).

The resuspension of sediment could also potentially affect dissolved oxygen levels in the water. This is due to the introduction of organic matter and nutrients into the water column which are broken down by microbial activity (i.e. respiration) resulting in a short-term demand on dissolved oxygen concentrations.

Of relevance to this potential impact are the findings of the water quality modelling undertaken in the River Tyne for the New Tyne Crossing to predict the consequences of dredging on dissolved oxygen concentrations (Ove, Arup and Partners Ltd, 2002). In summary, under a variety of modelled conditions, such as dredging times, seasonal fluctuations and river flows, the modelling predicted only small differences between background and dredging impacted dissolved oxygen concentrations. No difference was noted between the summer and winter concentrations. Furthermore, dredging in the Tyne is considered to represent a more conservative scenario, as sediment plume modelling outlined above indicates relatively limited plume extents for the majority of the capital dredge for the proposed scheme.

These observations are reflected in the original guidance issued to assist in undertaking WFD compliance assessments *Clearing the Waters* (Environment Agency 2012), which acknowledges that effects on dissolved oxygen concentrations are only likely to be an issue when dredging within an area with an existing dissolved oxygen problem or where sediments have a high chemical oxygen demand and that in practice, monitoring of dredging suggests effects are unlikely. Given the water body has a classification status of high for dissolved oxygen and it is not anticipated that the sediments will have a high chemical oxygen demand, effects on dissolved oxygen concentrations are not predicted.

In terms of contaminants, the concentrations of PAHs and metals within the sediments in the Tees estuary could potentially affect water quality, given the elevated concentrations greater than Cefas Action Level 1 and the lower CSQG. An assessment to look at the potential for the release of sediments exceeding Cefas Action Level 1 to cause EQS failures was therefore undertaken to inform the marine sediment and water quality section of this report (see **Section 7**). To summarise, the calculations for low water volumes and maximum concentrations for baseline water quality and sediments in the estuary indicate that there is a risk of zinc and benzo(b)fluoranthene EQS failure. To provide a sensitivity analysis, calculations were also undertaken for high tide volumes in the estuary (for maximum sediment and water quality baseline conditions) for these two parameters to see whether the risk of EQS exceedance is reduced. The calculations were also re-run using average concentrations.

For high water with maximum water and sediment concentrations and use of average concentrations for both water and sediment quality, the estimated concentrations reduce below EQS. This indicates that the risk of EQS failure only occurs under a certain set of circumstances, but these are unlikely to occur because of the following;

- The calculations assume that all sediment remains in suspension. In reality, it is likely that some settlement will occur and this is demonstrated in **Section 28.5.3** below.
- A relatively large proportion of the total volume of dredged material is anticipated to comprise geological material (i.e. mudstone). It is generally accepted that geological material does not contain contaminants.
- The calculations assume that all contamination is released into the water column. In reality, it is likely that some contamination will remain bound to sediment particles.
- The maximum concentration within the sediments used for each parameter does not occur across the dredge area.
- The maximum values for water quality concentrations are not reflective of sediment conditions across the site.
- The daily dredge volume is likely to be less than that accounted for due to stoppages associated with transiting vessels and disposal activities.
- The calculation is based on loss from a TSHD whereas a considerable component of the dredge will be undertaken with a backhoe dredger which has a lower production rate and therefore releases less sediment into the water column.

Additionally, sediment plume results for Smiths Dock monitoring point (point 3) indicated only temporary increases in suspended solids concentrations above baseline (up to 85mg/l which decreases to baseline with hours) for Stage 2 which reduce as dredging progresses (see **Figure 28.4**).

Overall, whilst there are potential scenarios that indicate there would be effects on water quality, these would be temporary which would disperse following cessation of the works. Plume extents during each of the stages are relatively limited and only experience significant increases above background concentrations of suspended solids when in close proximity to the dredger. As a result, a non-temporary deterioration in water quality for either contamination or on physico-chemical parameters is not predicted.

28.5.3 Biology – habitats

The majority of the proposed dredge footprint is located within the subtidal parts of the Tees estuary and therefore the majority of the dredge would impact on the lower sensitivity habitat 'subtidal soft sediment' of which there is 6,103,100m^2 in the WFD water body (see **Table 28.2**). However, given the proposals to locate the quay in the riverbank (i.e. on land), dredging and excavation in front of the quay wall to create the berth pocket would remove 25,000m^2 of intertidal sediments, of which there are 4,001,300m^2 within the WFD water body (see **Table 28.2**).

Subtidal sediments

Information regarding the habitat located within the dredge footprint is to be confirmed with a site specific benthic ecology survey (see **Section 9**) but it is predicted that the communities recorded in the 2019 dataset collected to inform the ES for NGCT are likely to be similar in nature to those found within the dredge footprint, particularly the turning circle given this was sampled within the 2019 survey.

Results in 2019 indicate a variety of sediment types are present across the survey area and most samples range from poorly sorted to extremely poorly sorted. The samples in the Tees estuary are generally mud and sandy mud in the most upstream locations, becoming sandier with distance downstream.

Biotopes were determined based on the 2019 particle size and macrobenthic data; and those that occurred most frequently in the estuarine locations (and within the area to be dredged for this project) was EUNIS biotope A5.323 '*Nephtys hombergii* and *Tubificoides spp*. in variable salinity infralittoral soft mud'. One station 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.

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 in **Section 9**), 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. This species was widespread in the 2006 and 2014 surveys.

The biotopes recorded in the 2019 survey are likely to reflect those located in the dredge area given their presence downstream from the berth and in similar environmental conditions.

Whilst capital dredging would remove material from the seabed it would not alter the habitat type available or the exposure conditions (the exception being the rock blanket area considered in activity C4). Additionally, the species likely to be present are typical of a highly disturbed environment (MarLIN) and are dominated by fast growing opportunistic polychaetes. However, MarLIN notes that removal of the substratum to 30cm would result in the loss of the characterising species but that recovery of the biological assemblage may take place before the original topography is restored, if the exposed, underlying sediments are similar to those that were removed. Therefore, whilst there may be a temporary deterioration in species composition and numbers following dredging, it is predicted that the sediment communities would recover relatively quickly. A non-temporary deterioration in status classification of benthic invertebrates in the WFD water body is therefore not predicted.

Intertidal sediments

Section 9 provides a detailed assessment of the habitats within the intertidal area but to summarise, site walkovers confirm that the intertidal area to be lost comprises intertidal mud and gravelly sediment with rocks and high levels of debris (similar to other areas of the Tees estuary) (see **Plate 28.1**). The habitat at the base of the existing structures to be demolished (i.e. within the intertidal area to be lost) 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*.) No other species were observed during the site visit or from the photographs. The habitat is therefore deemed to be of poor quality (see **Section 9**).

Given the relatively small area to be lost compared to the area of this habitat present within the WFD water body (0.6%) and the poor quality of the habitat, a deterioration in status classification for biological communities this area supports is not predicted. However, it is acknowledged that the extent of intertidal habitat in the Tees 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. To address and compensate this loss, STDC is in the process of developing a South Tees Regeneration Masterplan Environment & 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 which is the subject of this report). The extent and location of compensatory habitat creation and enhancements will be agreed with Natural England, the Environment Agency and RCBC. Additionally, it is considered that incorporation of 'verti-pools' into the quay face would be possible; these pools are pocket rock pools that are designed to be applied to vertical sea defences to create water retentive habitat features. A number of verti-pools would be positioned along the length of the quay face at different heights within the tidal frame to provide a range of different habitat opportunities.

It is also recognised that the proposed dredge footprint is within close proximity to the North Tees mudflat, however, based on the results of the hydrodynamic modelling, erosive effects are not predicted (see **Section 6**).

Plate 28.1 Intertidal area to be lost as a result of excavation to create the berth pocket

Sediment settlement

Sediment suspended within the dredging plumes will fall to the riverbed, either soon after disturbance or spillage 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. **Figure 28.5** shows the maximum changes in riverbed thickness caused by deposition. It can be seen that much of the sediment falls to the bed within the dredged areas (from where it will be re-dredged to achieve the necessary bed depths), 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 a result, a deterioration in ecological class status is not predicted.

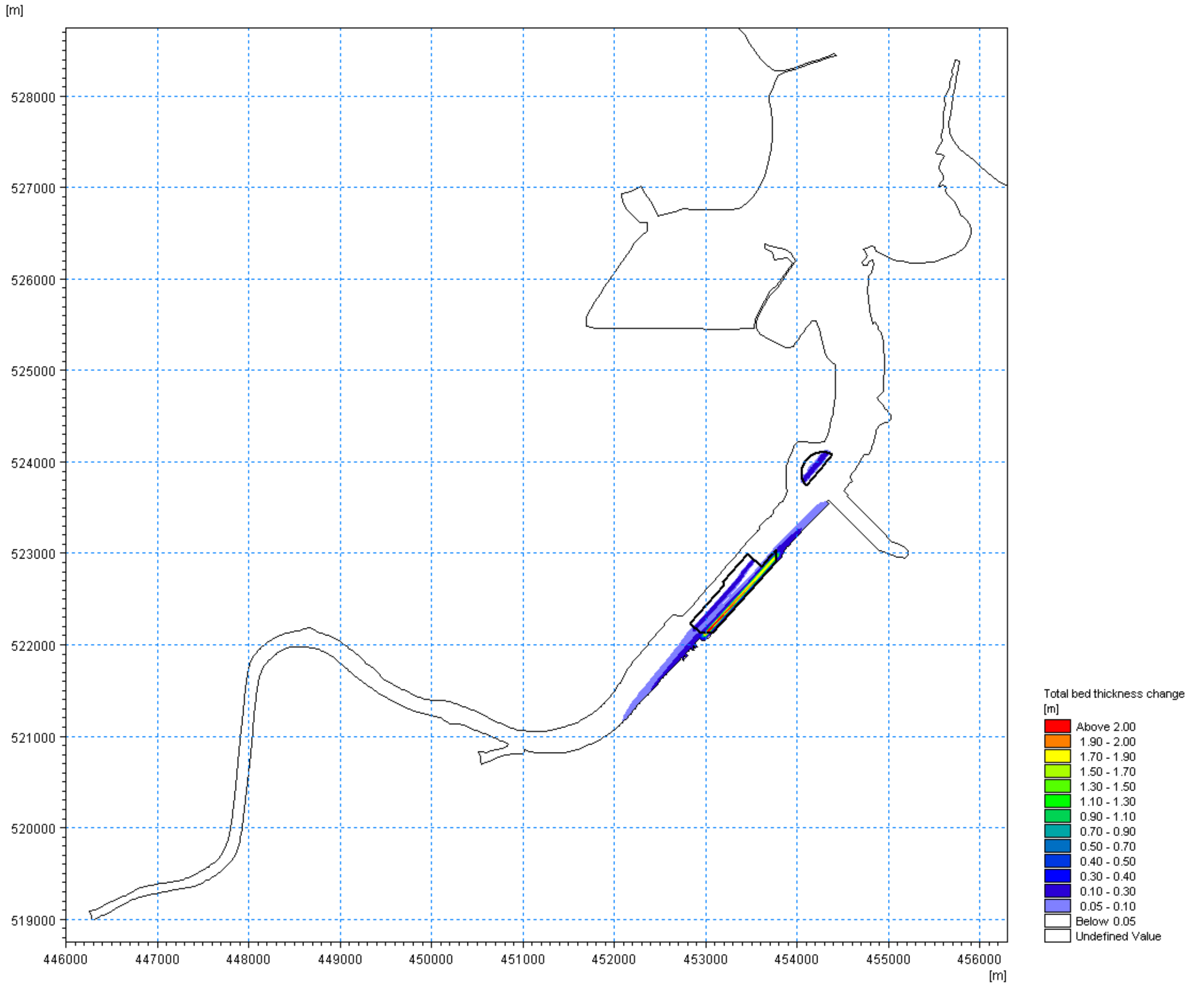

Figure 28.5 Maximum river bed thickness change due to sediment deposition arising from dredging activities during Stages 1 - 4 inclusive of the capital dredging programme

28.5.4 Biology – Fish

An increase in suspended sediment in the water column may lead to physiological effects in finfish, including impaired swimming ability, immunosuppression (i.e. increased susceptibility to disease) and reduced rates of growth and larval development (Robertson *et al*., 2006). Particles in the water column may also increase the risk of asphyxiation due to inhibition of gaseous exchanges at the gill lamellae or blockage of the opercular cavity. Water quality effects can also result in decreased foraging efficiency and a reduction in the ability to detect and evade predators.

As outlined in **Section 13**, estuarine fish and shellfish have a degree of resilience to relatively large changes in sediment concentrations due to the natural fluctuations associated with tidal activity, discharge from the river during high rainfall and increased wave action during storms. Sensitivity of lobsters and velvet swimming crabs, the species of highest commercial interest within the Tees Estuary (see **Section 13.4.2**) to increased suspended solids is low, according to the MarLIN sensitivity scoring index. Mobile species (including most adult finfish) are generally able to detect early onset of increased sediment concentrations and relocate away from the affected area. Some juveniles and larvae finfish, however, may be more susceptible given their sensory systems may be less developed. Similarly, juvenile and larval shellfish are more sensitive than adults as they have more limited mobility and hence are less capable of avoiding affected areas (Appleby and Scarratt, 1989). However, given that maintenance dredging is regularly undertaken with the Tees (almost daily), it can be reasonably assumed that resident individuals within the affected area would likely be relatively tolerant / acclimatised to the disturbances associated with dredging activity.

Migratory species move upstream and downstream within the Tees (see **Section 13.4.1.2**) and during the peak migratory season, when a sediment plume creating a 'barrier' effect could cause a significant disruption to the annual migration pattern, such species are considered to be more sensitive than resident species. However, as outlined above, water quality effects are only anticipated to be temporary and limited to certain areas of the estuary at any one time. Additionally, it is proposed that dredging would be limited to one side of the river at a time with operations undertaken in long strips along the axis of the estuary to reduce the extent and impact of the plume. This allows a passage through which migratory fish will be able to move past the dredging activity (and for resident species to relocate to largely undisturbed areas), thus reducing the magnitude of the impact. As a result, a non-temporary deterioration in fish species which could lead to a deterioration in classification status is not predicted.

28.5.5 River Basin Management Plan mitigation measures

The RBMP mitigation measures identified for the water body in which the activity would occur and the potential effects of the proposed scheme on these measures are outlined in **Table 28.8**.

Table 28.8 Summary of mitigation measures and assessment (taken from Clearing the Waters for All, Environment Agency 2016)

Mitigation measure	Assessment
Vessel management	There would be a temporary presence of dredging vessels but following completion of the works baseline conditions would be resumed.
Dredging disposal strategy	Whilst there would be a temporary increase in material that would require disposal, this would be a one-off event and would not alter significantly the maintenance dredging and disposal activities currently ongoing. Disposal would be undertaken at a licenced disposal site in discussion with the MMO and their advisors Cefas. Dredging would be managed in line with mitigation measures agreed for various environmental topics which include dredging along the axis of the river to ensure the plumes are minimised as far as possible and only to certain areas of the channel at any one time.
Reduce impact of dredging	
Reduce sediment resuspension	
Retime dredging or disposal	
Sediment management	
Dredge and disposal site selection	
Manage disturbance	
Modify channel	Whilst the channel would be modified, there are currently derelict structures which would be removed and replaced by a new quay set back into the riverbank. As a result, the channel would be widened and not further restricted.
Enhance ecology	The assessment regarding the potential effects on ecology as a result of the capital dredge is provided in **Section 28.5.3**. There will be a small loss of intertidal habitat as a result of the berth which equates to 0.6% of this type of habitat within the WFD water body. To compensate for this, STDC is in the process of developing a South Tees Regeneration Masterplan Environment & Biodiversity Strategy, which will define the
Bank rehabilitation	
Remove or soften hard bank	

Mitigation measure	Assessment
Preserve or restore habitats.	works required to offset the loss of habitat arising as a result of works being proposed by STDC (including the proposed scheme which is the subject of this report). The extent and location of compensatory habitat creation and enhancements will be agreed with the Environment Agency.

28.5.6 Adjoining water bodies

The predicted impacts are localised to the Tees transitional WFD water body and therefore effects are not predicted to occur on adjoining water bodies.

28.6 Detailed Assessment – C3 Riverbank excavation

The potential effects of this activity that were scoped in at the end of Stage 2 are summarised in **Table 28.9.**

Table 28.9 Summary of water bodies, quality elements, RBMP mitigation measures and protected areas scoped in for assessment for C3

Water body	Quality elements	RBMP mitigation measures	Protected Areas
Tees transitional water body	Hydromorphology, water quality	All	Whilst the SPA is located within 2km, detailed assessment is covered in **Section 29**. The activity would not give rise to increases in nutrients within the estuary and therefore Seal Sands sensitive area (eutrophic) is scoped out.
Tees Mercia Mudstone and Redcar Mudstone Groundwater body	Chemical quality	N/A	None located within 2km of proposed scheme

28.6.1 Hydromorphology

The combined effects of the dredge area and presence of new quay wall set back in the embankment are presented in **Section 28.3.1**.

28.6.2 RBMP mitigation measures

The RBMP mitigation measures identified for the water body in which the activity would occur and the potential effects of the proposed scheme on these measures are outlined in **Table 28.10**.

Table 28.10 Summary of mitigation measures and assessment (taken from Clearing the Waters for All, Environment Agency 2016)

Mitigation measure	Assessment
Vessel management	There may be the requirement for marine vessels to support construction, but these would only be present for the duration of the works. Effects are therefore not predicted on this mitigation measure.
Dredging disposal strategy	

Mitigation measure	Assessment
Reduce impact of dredging	Riverbank excavation would not impact on these mitigation measures
Reduce sediment resuspension	
Retime dredging or disposal	
Sediment management	
Dredge and disposal site selection	
Manage disturbance	
Modify channel	See C5 and O1
Enhance ecology	See C5 and O1
Bank rehabilitation	
Remove or soften hard bank	
Preserve or restore habitats.	

28.6.3 Groundwater body – chemical quality

Section 8.4.5 highlights a number of potential sources of contamination with the soils in the study area. Land affected by contamination is primarily managed in the UK through the Town Country Planning Act, 1990 but also by Part 2A of the Environmental Protection Act, 1990 (EPA,1990). Part 2A of the Environmental Protection Act requires local authorities to identify contaminated land and ensure potential risks are assessed and mitigated accordingly.

Prior to the commencement of construction activities, a programme of site characterisation works will be undertaken which would comprise a programme of intrusive ground investigation works across the proposed scheme footprint (landside) to facilitate the recovery of soil and groundwater samples for laboratory analysis, and to facilitate the monitoring of groundwater and ground gases. The findings of the intrusive investigation will allow appropriate assessments to be undertaken to ascertain if contaminants are present at concentrations that could result in harm to human health and controlled waters.

Following the execution of a pre-construction ground investigation, it will be possible to determine whether contaminated groundwater and mobile contaminants are present within the footprint of the proposed scheme. If identified, remediation will be required to mitigate the impact it may have to either the proposed scheme or the neighbouring sites / controlled waters. Given the above control measures, non-temporary effects on the groundwater body are not predicted.

28.6.4 Adjoining water bodies

The effects are localised to the water bodies in which activities will occur and therefore effects are not predicted to occur on adjoining water bodies.

28.7 Detailed Assessment – C5 Construction of the quay wall and O1 presence of new quay wall

The potential effects of these two activities that were scoped in at the end of Stage 2 are summarised in **Table 28.11.**

Table 28.11 Summary of water bodies, quality elements, RBMP mitigation measures and protected areas scoped in for assessment for C5

Water body	Quality elements	RBMP mitigation measures	Protected Areas
Tees transitional water body	Hydromorphology	All	Whilst the SPA is located within 2km, detailed assessment is covered in **Section 29**. The activity would not give rise to increases in nutrients within the estuary and therefore Seal Sands sensitive area (eutrophic) is scoped out.
Tees Mercia Mudstone and Redcar Mudstone Groundwater body	Chemical quality	N/A	None located within 2km of proposed scheme

28.7.1 Hydromorphology

The combined effects of the dredge area and presence of new quay wall set back in the embankment are presented in **Section 28.3.1**.

28.7.2 RBMP mitigation measures

The RBMP mitigation measures identified for the water body in which the activity would occur and the potential effects of the proposed scheme on these measures are outlined in **Table 28.12**.

Table 28.12 Summary of RBMP mitigation measures and assessment

Mitigation measure	Assessment
Vessel management	It is proposed that all piling works will be undertaken using land-based plant, with a safety / workboat proposed to support any activities following the removal of material in front of the quay. As a result, an effect on this mitigation measure is not predicted.
Dredging disposal strategy	The construction and presence of the new quay wall would not affect these mitigation measures
Reduce impact of dredging	
Reduce sediment resuspension	
Retime dredging or disposal	
Sediment management	
Dredge and disposal site selection	
Manage disturbance	
Modify channel	Whilst the channel would be modified, there are currently derelict structures which would be removed and replaced by a new quay set back into the riverbank. As a result, the channel would not be further restricted.
Enhance ecology	The quay wall would be effectively constructed above mean high water on land and therefore would not impact on marine habitats. The effects on marine ecology are related to dredging of the berth and are assessed in **Section 28.5.3** and **Table 28.7**. It is proposed that 'verti-pools' would be installed into the quay face; these pools are pocket rock pools that are designed to be applied to vertical sea defences to create water retentive habitat features. A number of verti-pools would be positioned along the length of the quay face at different heights within the tidal frame to provide a range of different habitat opportunities.
Bank rehabilitation	
Remove or soften hard bank	
Preserve or restore habitats.	

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28.7.3 Groundwater body - Chemical quality

Piling has the potential to create preferential pathways allowing contaminant migration to the Secondary B Aquifer associated with the bedrock, particularly if they penetrate material that may have previously being acting as an impermeable protective barrier between the Made Ground / superficial deposits and the Mercia Mudstone Group. Piling also has the potential to physically drag down contaminants from the overlying Made Ground deposits as well as allowing for potentially contaminated perched / shallow groundwater to migrate to the underlying aquifers.

A pre-construction piling risk assessment and hydrogeological risk assessment would be undertaken prior to the commencement of the works to reduce the above risks as far as possible. As a result, a non-temporary effect on a water body scale is not predicted.

28.7.4 Adjoining water bodies

There is the possibility that any contamination identified in the soils could be mobilised and discharged into the Tees estuary transitional water body. The control measures outlined above would remove the risks associated with this pathway and therefore effects on the transitional water body are not predicted.

28.8 Summary of water body enhancement

It is proposed that 'verti-pools' would be installed into the quay face; these pools are pocket rock pools that are designed to be applied to vertical sea defences to create water retentive habitat features. It is proposed that a number of verti-pools are positioned along the length of the quay face at different heights within the tidal frame to provide a range of different habitat opportunities.

Additionally, the South Tees Regeneration Masterplan Environment & Biodiversity Strategy will define the works required to offset the loss of intertidal habitat arising as a result of the proposed scheme. The extent and location of compensatory habitat creation and enhancements will be agreed with Natural England, the Environment Agency and RCBC.

28.9 Ability of water body to achieve objectives

The objective for this waterbody is to achieve 'good' ecological potential. Whilst the provision of a new quay wall would remove a small area of intertidal soft sediment, the measures outlined in **Section 28.8** would assist the water body in meeting its future objectives by providing opportunities to support pocket rock pools within the quay wall face and compensatory intertidal habitat with the opportunity to support higher value ecological communities thus potentially improving classification status for these quality elements (delivered via to the South Tees Regeneration Masterplan Environment & Biodiversity Strategy).

28.10 Cumulative impacts assessment

28.10.1 Within-project cumulative effects

The within project cumulative effects have been identified as:

- Combined effect of the proposed new quay wall set back into the riverbank and presence of deepened areas associated with the capital dredge which could have effects on ecological habitats in the WFD water body via effects on hydromorphology.
- The combined effect of the loss of intertidal habitat (dredged berth), loss of subtidal (rock blanket) and temporary disturbance of subtidal habitat (capital dredge) on ecological potential of the WFD water body.

- The combined effect of piling and riverbank excavation on the groundwater body (potentially affecting groundwater chemical quality).
- The combined effect of dredging and effects associated with piling and riverbank excavation on water quality.

The combined hydromorphological effects of the scheme have already been assessed in **Section 28.5.1**. The effects associated with soil excavation and piling on groundwater will be managed via appropriate control measures required to be implemented for potentially contaminated soils i.e. site characterisation and remediation, in addition, to the undertaking of a piling risk assessment. As a result, the combined effect is assessed as being the same as the individual effects (i.e. no non-temporary effect on the WFD water bodies).

In terms of combined effects on water quality, as outlined above the landside works would be managed with appropriate control measures therefore the combined effect of the scheme on water quality remains the same as the effects predicted for the capital dredging alone.

For marine ecology, whilst it is noted that there will be a loss of intertidal habitat, this will be compensated via development of intertidal habitat elsewhere in the water body in line with the developing South Tees Regeneration Masterplan Environment & Biodiversity Strategy. The majority of the subtidal effects are predicted to be temporary and a significant portion of the dredge area is already subject to maintenance dredging so is already disturbed and supports communities habituated to this disturbance. The remaining effect is therefore limited to the subtidal area lost under the rock blanket which equates to 50,000m^2. This is below the trigger value included in the *Clearing the Waters for All guidance* to indicate the potential for a deterioration in soft subtidal habitats.

Within project cumulative effects are therefore not predicted over and above those assessed for the individual activities.

28.10.2 Between project cumulative effects

Section 27 identifies the following projects that could potentially lead to cumulative effects on the WFD transitional water body Tees:

- NGCT.
- Anglo American Harbour Facilities schemes.
- Ongoing maintenance dredging in the Tees estuary.

All schemes require dredging and construction of new riverbank structures and therefore the following risks to the water body have been identified:

Construction:

- Cumulative effects of sediment plumes and associated effects on water quality and fish
- Disturbance of marine habitats associated with dredging.

Operation

- Permanent loss of marine habitats (both intertidal and subtidal) associated with new riverbank structures and rock blanket.
- Permanent alterations to hydrodynamic parameters which could lead to effects on marine habitats.

Construction

Section 27 considers the potential cumulative effects of the proposed schemes on sediment plumes and marine water quality. To summarise, whilst the sediment plumes could combine to cover a larger area of the estuary, additive effects in terms of increasing sediment peaks are not predicted. This is because the maximum concentrations of suspended solids are localised to the dredging activity and quickly disperse with distance from the dredger. Additionally, peaks are relatively short lived (approximately an hour at a time for the proposed scheme for example) and associated with specific dredging phases of each scheme. The chances of these peaks occurring at the same time is considered to be remote.

With respect to water quality, given the above, it is not predicted that concentrations of contaminants in the water column would be significantly increased by the projects all dredging at the same time. Where contaminated material has been identified in the Anglo American Harbour Facilities sediments (i.e. above Cefas Action Level 2 concentrations), additional mitigation measures would be implemented to reduce the risk of this material being released into the water.

Any alterations to water quality both in terms of concentrations or spatial extent, could potentially reduce the areas in which resident fish could shelter or for migratory fish to move past the works. NGCT and the proposed project both include mitigation measures to dredge in long strips to reduce the effects of sediment plumes spreading across the width of the channel. Additionally, due to navigational safety, it is unlikely that dredgers would be working on different sides of the estuary and therefore clear channels would be maintained for fish movements.

Any project that requires dredging would disturb the marine communities within the sediments to be dredged. However, PDT undertake maintenance dredging in the majority of the estuary. Consequently, all projects report communities in the subtidal environment which are typically associated with regular disturbance. Given dredging for all projects would not alter the substrate type or exposure, subtidal communities would be expected to recover and therefore alterations in the benthic invertebrate classification index are not predicted given the existing maintenance dredging which would be accounted for in the baseline sample data.

In terms of wider effects, significant deposition of sediment again is generally only predicted in close proximity to the dredging over the slack water period for all projects. In practice, much of this deposited material will be re-dredged as part of the capital works for each scheme. Beyond the immediate deposition footprint, significant deposition was not predicted for any of the schemes (with deposition in the order of a few millimetres only). Furthermore, as the deposited material will be unconsolidated, it is expected to disperse as tidal currents increase with no long-term accumulation on the seabed at the initial point of deposition.

Operation

There would be small permanent loss of soft subtidal habitat under the rock blanket for the proposed scheme, however, the other projects do not identify any permanent losses of subtidal habitat. As a result, cumulative effects on this habitat type are not predicted.

In terms of intertidal habitat loss, it is acknowledged that the extent of intertidal habitat in the Tees has been significantly reduced as the banks of the estuary have been developed and the projects identified require removal of intertidal habitat areas differing in condition and size. Therefore, to address this, each project is progressing proposals and measures to offset these losses in discussion with Natural England, RCBC and the Environment Agency. With these measures in place, a cumulative effect is not predicted.

Alterations to the channel either via deepening or installation of new hard riverbank structures could combine to cumulatively impact on hydrodynamic processes in the water body. **Table 28.13** summaries the potential effects on each hydrodynamic parameter.

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Table 28.13 Summary of cumulative effects on hydrodynamic parameters

Hydrodynamic parameter	Assessment
Tidal propagation	Calculations for the proposed scheme showed an increase in the existing tidal prism of the estuary by 0.8%, which is not deemed to be a cause of significant estuary-wide change in hydrodynamics. The NGCT is predicted to have a very small effect on water levels (tidal range in the Tees estuary is predicted to be increased by less than 4mm, with the tide arriving up to 2 minutes earlier). The EIA studies undertaken for the Anglo American Harbour Facilities predicted that there will be no impact on tidal propagation or water levels due to the limited area of proposed dredging for this project. Cumulative effects are therefore not predicted over and above those identified for the scheme alone.
Wave conditions	There is no predicted effect on local wind-generated waves at the site of the proposed scheme and swell waves do not penetrate far enough into the estuary to be affected. Wave modelling for the NGCT were predicted to be affected by the reflective properties of the terminal but unaffected by the increased depth of the channel. Swell waves would also be affected by the increased depth of the channel in the lower estuary required by NGCT. No effects were identified on waves for the Anglo American Harbour Facilities. Cumulative effects are therefore not predicted over and above those identified for NGCT.
Currents	Modelling for the proposed scheme showed that the new quay alignment and capital dredge would have very small localised effects predominantly near to the quay wall but these alterations would not be estuary wide. Modelling studies undertaken for the NGCT predict that current speed changes, of low magnitude, would occur in the vicinity of the NGCT development (1.5km downstream of the proposed scheme) and at the mouth of the estuary. A decrease in current speeds of up to 0.10m/s is predicted in the vicinity of the terminal, with increases of a similar order of magnitude closer to the shores of the estuary. This area (adjacent to the proposed reclamation) is predicted to experience the greatest effect on flows. Further downstream at the mouth of the estuary, very little effect on tidal current speeds is predicted (decreases in current speeds of the order of 0.05m/s). Modelling for Anglo American Harbour Facilities predicted that currents would be reduced within the deepened areas but effects are shown to be relatively localised to the proposed works. As a result, no cumulative effects over and above those identified for the proposed scheme are not predicted.
Sediment transport processes	Hydrodynamic modelling showed that the proposed scheme would give rise to only a small magnitude reduction in baseline flows varying during different phases of the tidal cycle, but always remaining largely within the reach immediately opposite the new quay. This reduction in baseline flows may lead to a slight increase in deposition of sediment at the North Tees mudflat which could be seen to be a positive effect in areas adjacent to the north bank opposite the quay. In the main channel, deposition will require periodic dredging equivalent to a 10% increase in annual maintenance dredging requirement. Hydrodynamic modelling for NGCT concluded that the effect of construction on tidal propagation will be minor, with no change in elevation of either high or low water downstream of the site of the proposed scheme. A minor increase in the level of low water of the order of 2mm (at low water on spring tides) was predicted at the site of the NGCT. The effect of this change would be to convert approximately 30 to 40m^2 of intertidal habitat at the North Tees mudflat to subtidal habitat. For the deepened approach channel, reduced through-depth flows were predicted which, combined with a strengthened near-bed landward flow, were expected to result in the increased import of fine material to the Tees estuary from offshore; with the potential to increase the maintenance dredging requirements by about 10%. No increase in sandy infill was predicted. A small morphological effect is predicted at Seal Sands, with an increase in the supply of fine material to Seal Sands via Seaton Channel. No changes to tidal flow were predicted in this area. No significant effects were predicted at North Gare and Bran Sands. Modelling for the Anglo American Harbour Facilities concluded that the only effects were likely to be localised redistribution of sediment deposition in response to predicted changes in current speeds but that this would not alter the present frequency of, or methodology used for, maintenance dredging. Additionally, no effect was identified on sediment supply to intertidal areas throughout the Tees estuary.

Hydrodynamic parameter	Assessment
	The ongoing maintenance dredging programme in the Tees estuary represents a potential supply of fine material to Seal Sands. However, the latest annual update to the Maintenance Dredging Baseline Document (Royal HaskoningDHV, 2019) concludes that the current maintenance dredging regime does not adversely affect the overall estuary morphology and the ongoing morphological processes at work. Additionally, maintenance dredging forms part of the baseline for WFD classification given that it is ongoing through WFD assessment periods. Cumulative effects with the other schemes, are therefore not predicted.

It can be seen in **Table 28.13** that whilst small effects are identified for the proposed scheme, these are localised and would not combine with the effects predicted as a result of the other schemes. As a result, cumulative effects on habitats of the WFD water body are not predicted.

Section 27 identifies that all landside schemes that could potentially impact on the Tees Mercia Mudstone and Redcar Mudstone Groundwater body by creation of pathways via excavation or piling for example, would require site characterisation and remediation/ mitigation (such as piling risk assessments to be undertaken) where the potential for an impact is identified. As a result, cumulative effects on the quality of the WFD water body are not predicted.

28.11 Overall findings

The comparison of the activities against the WFD scoping criteria identified the following risks to WFD compliance parameters:

- Surface waters: Hydromorphology (including the RBMP mitigation measures assessment)
- Surface waters: Water Quality
- Surface waters: Biology (habitats and fish)
- Groundwater: chemical quality

These parameters were therefore carried forward to Stage 3 detailed assessment. The activity ‘capital dredging’ identified risks to all WFD quality elements but detailed assessment deemed that the impacts would be temporary, and that the subtidal habitat would exhibit recovery. For the permanent loss of a small area of intertidal habitat (equating to 0.6% of this habitat type in the WFD water body) it is proposed to compensate for this loss via the developing South Tees Regeneration Masterplan Environment & Biodiversity Strategy. This will also support the implementation of the RBMP mitigation measures identified for this water body around enhancing ecology.

Whilst concentrations of contaminants in the sediments indicated a risk to water quality EQS’, assessment concludes that conditions around the assumptions to undertake the assessment limit this possibility. Additionally, modelling concludes that any mixing zone, should an exceedance occur, would be limited to the locality of the dredger and only for hours at a time during Stage 2 of the proposed dredge programme. All other stages of dredging required for the proposed scheme did not indicate significant concentrations of suspended sediment thus reducing the risk of significant water quality effects. Mitigation measures to protect resident and migratory fish further reduce this risk as dredging will be limited to occurring in long strips thus limiting the plume extent. As a result, non- temporary effects on water quality and associated parameters that rely on water quality, such as fish, are not predicted.

Effects associated with construction of the proposed new quay are due to the need for excavation and piling in potentially contaminated soils. Effective mitigation measures to ensure contamination is managed and remediated appropriately remove the risk to both the groundwater and the transitional water body.

The assessment to look at the potential for hydromorphological effects was undertaken for the whole scheme (i.e. included both the deepened areas of channel and the new quay set back in the riverbank). Effects were limited to the local area of the quay wall and would not lead to significant alterations to baseline conditions in the estuary. Both removal of derelict structures during the construction phase and discharge of surface water during the operational phase of the development were scoped out of requiring detailed assessment.

Consideration of the potential for cumulative effects identified a number of possibilities ‘within project’ but it was concluded that combined effects of various activities would not be greater than those identified for the proposed activities alone.

Three projects were identified as being potentially at risk of leading to cumulative effects ‘between projects’. These were NGCT, Anglo American Harbour Facilities and ongoing maintenance dredging in the estuary. Whilst each project is predicted to give rise to various effects, the only impact that could potentially overlap would be sediment plumes associated with dredging simultaneously. However, on further consideration, peak concentrations for all projects are restricted to close proximity to the dredger and disperse with distance. Additionally, peak concentrations are short lived (hours) therefore it is unlikely that peaks from all projects would occur at the same time. Mitigation measures such as dredging in long strips as required for the proposed project and NGCT to keep areas of the channel unaffected would also reduce any effects on biological parameters, particularly fish.

A non-temporary deterioration in WFD quality elements was therefore not identified. Additionally, mitigation to be provided by the developing South Tees Regeneration Masterplan Environment & Biodiversity Strategy is considered to be supportive of the implementation of the RBMP mitigation measures around ecological enhancement and contributing to achievement of good ecological potential of the transitional water body in the future.

29 HABITATS REGULATIONS ASSESSMENT

29.1 Introduction

This section of the EIA Report draws together information regarding the potential for the proposed scheme to affect European sites and presents an assessment of the potential effects with respect to the interest features, and the supporting habitats, of sites screened into the assessment.

The assessment process is explained below, but in summary the following is presented in this section:

- An overview of the HRA process (**Section 29.2**).
- Screening the predicted effects of the proposed scheme to determine likely significant effect (LSE) in respect of the designated interest features of the European sites, both alone and in-combination with other plans and projects (**Section 29.3**);
- Consideration of other plans and projects to include in the in-combination assessment (**Section 29.4**);
- Provision of information to inform the AA alone (**Section 29.5**);
- Provision of information to inform the AA in-combination with other plans and projects (**Section 29.6**);
- A summary and conclusion (**Section 29.7**).

29.2 Overview of the HRA process

In accordance with Regulation 63 of the Habitats Regulations, HRA is required for any plan or project, not connected with the management of a European site, which is likely to have an LSE on the site either alone or in-combination with other plans or projects.

Typically, a staged process to assessment under the Habitats Regulations is undertaken, as follows:

- **Screening/LSE assessment (Stage 1):** The process to identify the likely impacts of a project upon a European site, either alone or in combination with other plans and projects and consider whether the impacts are likely to be significant.
- **Appropriate Assessment (Stage 2):** A decision (by the competent authority) with regard to the effect on the integrity of the European site, either alone or in combination with other plans and projects. Where there are adverse impacts, an assessment of mitigation options is carried out to determine adverse effect on the integrity of the site. If these mitigation options cannot avoid adverse effects on site integrity, then development consent can only be given if subsequent tests (see Stages 3 and 4 below) can be satisfied.
- **Consideration of Alternative Solutions (Stage 3):** Examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid an effect - or have a lesser effect - on European sites.
- **Imperative Reasons of Overriding Public Interest (IROPI) (Stage 4):** If the above tests cannot be satisfied, it is necessary to demonstrate that the project is required for IROPI. If this test is met, then the project can only proceed if sufficient compensatory measures can be identified and implemented to maintain the overall coherence of the Natura 2000 network.

All four stages of the process are referred to collectively as the HRA, to clearly distinguish the whole process from the stage within it referred to as the 'Appropriate Assessment'.

With regard to Stage 1, a recent ruling (April 2018) by the Court of Justice of the European Union (CJEU) referred to as *People Over Wind and Sweetman v Coillte Teoranta* (C-323/17) has provided a judgement that *"…it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site"*. As such, no such mitigation measures have been taken into account when undertaking the LSE screening exercise.

With regard to Stage 2, the integrity of a European site is defined as: "*the coherence of the site's ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated*" (EC, 2001). An adverse effect on integrity, therefore, is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature(s) as it did at the time of designation.

Natural England's Habitats Regulations Guidance Note 1 'The Appropriate Assessment (Regulation 48)' (English Nature, 1997) described how an Appropriate Assessment should be undertaken. This guidance bases the assessment on a series of nine steps that the competent authority should follow in undertaking an Appropriate Assessment. These steps, including consultation, data collection, impact identification and assessment, recommendation of project modification and/or restriction and reporting, are outlined in **Table 29.1** below.

Table 29.1 Recommended key steps in the preparation of information for Appropriate Assessment

Step	Description of requirements
1	Must consult with Natural England
2	May consult with other organisations and the general public
3	Clearly define the site's conservation objectives
4	Require the applicant to provide such information as may reasonably be required to undertake the assessment
5	Identify the effects of the proposal on habitats and species of international importance and how those effects are likely to affect the site's conservation objectives
6	Decide whether the plan or project, as proposed, would adversely affect the integrity of the site in light of the site's conservation objectives
7	Consider the manner in which the plan or project is proposed to be carried out, whether it could be modified, or whether conditions or restrictions could be imposed, so as to avoid adverse effects on the integrity of the site
8	Conclude whether the proposal, as modified by conditions or restrictions, would adversely affect the integrity of the site
9	Record the assessment and notify Natural England of the conclusions

It is Natural England's role to advise the competent authority on the potential significance of effects on European sites. This section of the EIA Report is intended to present all of the information necessary to assist Natural England (and the competent authority) in reaching a conclusion.

29.2.1 Consultation and responses received

A scoping note was submitted to both the MMO and RCBC in July 2020. This confirmed that an HRA will be undertaken to consider the potential effects to European sites. Within its response, the MMO made no specific comments regarding HRA. RCBC confirmed that there are a number of major developments which have been consented and others which are currently being considered in proximity to the proposed scheme footprint, which should be taken into account. Such other plans and projects have been considered in the assessment presented below.

29.2.2 Implications of the scheme in-combination with other plans and projects

When assessing the implications of a plan or project in light of the conservation objectives of the European site in question (i.e. assessing the potential for LSE and ascertaining the potential for effect on site integrity), it is necessary to consider the potential for in-combination effects, as well as effects due to the project in isolation. Natural England's Habitats Regulations Guidance Note 4 (English Nature, 2001) provides guidance on in-combination effects and, at paragraph 2.3, states that other plans or projects should include:

- approved but as yet uncompleted plans or projects;
- permitted on-going activities such as discharge consents or abstraction licenses; and,
- plans and projects for which an application has been made and which are currently under consideration but not yet approved by competent authorities.

It is also noted that in some circumstances it may be appropriate to include plans and projects not yet submitted to a competent authority for consideration but for which sufficient detail exists on which to make judgements on their effect on the European site.

In undertaking an in-combination assessment, it is important to consider the potential for each plan or project to influence the site. In order for an in-combination effect to arise, the nature of two effects does not necessarily have to be the same. The in-combination effects assessment, therefore, focusses on the overall implications for the site's conservation objectives, regardless of the type of effect.

29.3 Screening for LSE

29.3.1 Introduction

The screening process comprises an assessment of the capacity for the likely effects of the proposed scheme to influence the qualifying interest features of the relevant European, such that an LSE could arise. There is no specific definition of what constitutes LSE; however, guidance produced by Natural England (English Nature, 1999) provides information on the determination process and the criteria that can be applied in reaching a decision.

The guidance states that:

> "*likely significant effect is, in this context, any effect that may reasonably be predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated, but excluding trivial or inconsequential effects. Proposals having no, or de minimis, effects can be progressed without further consideration under the Habitats Regulations (i.e. there is no requirement to undertake appropriate assessment), although reasons for reaching this decision must be justified and recorded*".

The following criteria are cited as potential types of effects that are likely to be significant:

- causing change to the coherence of the site or the Natura 2000 series (e.g. presenting a barrier between isolated fragments, or reducing the ability of the site to act as a source of new colonisers):
- causing reduction in the area of habitat or of the site;
- causing direct or indirect change to the physical quality of the environment (including the hydrology) or habitat within the site;
- causing on-going disturbance to species or habitats for which the site is notified;
- altering community structure (species composition);

- causing direct or indirect damage to the size, characteristics or reproductive ability of populations on the site;
- altering the vulnerability of populations to other impacts;
- causing a reduction in the resilience of the feature against external change (for example its ability to respond to extremes of environmental conditions); and,
- affecting restoration of a feature where this is a conservation objective.

The types of effects associated with a proposed scheme, particularly their spatial extent and duration, are of particular importance in identifying the European sites and associated designated interest features that may be influenced.

29.3.2 Screening for likely significant effect (alone)

Table 29.2 sets out the results of the screening for LSE associated with the proposed scheme in isolation. The potential environmental impacts have been assessed for each interest feature of the designated sites with the potential to be impacted by the proposed scheme.

Table 29.2 Screening of European and Ramsar sites for LSE

Site (distance and direction from proposed scheme)	Interest features	Supporting features	Potential pathway for likely significant effect during construction	Potential pathway for likely significant effect during operation	Screened in/out of Appropriate Assessment
Teesmouth and Cleveland Coast SPA / Ramsar site (0km)	The site qualifies under Article 4 of the Birds Directive for the following Annex I species: • During the breeding season: Little tern, avocet, ruff, common tern and Sandwich tern (non-breeding) The site regularly supports two regularly occurring migratory species not listed in Annex I: • Red knot and common redshank The site also qualifies under Article 4.2 of the Birds Directive as it is used regularly by over 20,000 waterbirds, including all Annex 1 species outlined above	• Sand and shingle • Intertidal sand and mudflats • Shallow coastal waters • Rocky shores • Terrestrial wet grassland • Saltmarsh • Deep and shallow pools	• Loss of supporting habitat for SPA features due to dredging, excavation and demolition works. • Noise and visual disturbance to waterbirds due to construction works, including impact pile driving. • Water quality reductions from demolition and dredging impacting on prey resources. • There are no potential pathways for likely significant effect on breeding little tern and avocet, nor on passage Sandwich terns, given the distribution of these species in the SPA and their use of the zone of influence of the proposed scheme. Further details are provided in **Section 29.3.3** below. • As the Tees Bay C disposal site is located beyond the seaward boundary of the Teesmouth and Cleveland Coast SPA / Ramsar site, and the potential effects of the disposal activity are predicted to remain largely within the boundary of the disposal site, impacts associated with offshore disposal of dredged material have been screened out of the assessment.	• Noise and visual disturbance to waterbirds due to operation of the quay. • Effects on waterbird feeding habitat due to changes in coastal processes.	• Screened in (with the exception of breeding little tern, Sandwich tern and avocet, which are screened out)
Durham Coast SAC (9.5km north)	The SAC is designated under Article 4(4) of the Directive (92/43/EEC) for the following habitats listed in Annex I: • Vegetated sea cliffs of the Atlantic and Baltic coasts	• Not applicable	• This feature is not present within the proposed scheme footprint and no effects on coastal processes within the SAC boundary are predicted.		• Screened out
Northumbria Coast SPA (9.5km north)	The site qualifies under Article 4.1 of the Birds Directive for the following Annex I species: • During the breeding season: Little tern (breeding) The site also qualifies under Article 4.2 of the Birds Directive for:	• Shallow inshore waters • Sandy beaches • Rocky shores with associated boulder and cobble beaches • Hide tide artificial roost sites	• No pathway for disturbance exists due to the separation distance between the source of disturbance and the SPA boundary. • Foraging grounds of common and little tern are unlikely to interact with the proposed scheme as the colony is located over 90km north.	• No pathway for effects during operation given the separation distance in relation to the predicted zone of influence from operational phase effects.	• Screened out

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Site (distance and direction from proposed scheme)	Interest features	Supporting features	Potential pathway for likely significant effect during construction	Potential pathway for likely significant effect during operation	Screened in/out of Appropriate Assessment
	• Over-wintering: ruddy turnstone and purple sandpiper				
Northumbria Coast Ramsar site (9.5m north)	Ramsar criteria 6 Species / populations occurring at levels of international importance. Species regularly supported during the breeding season: • Little tern Species with peak counts in winter: • Purple sandpiper • Ruddy turnstone	• As for the Northumbria Coast SPA	• As for the Northumbria Coast SPA	• As for the Northumbria Coast SPA	• Screened out
Berwickshire and North Northumberland Coast SAC (90km north)	Annex I habitats that are a primary reason for selection of the site: • Mudflats and sandflats not covered by seawater at low tide. • Large shallow inlets and bays. • Reefs • Submerged or partially submerged sea caves. Annex II species present as a qualifying feature but not a primary reason for site selection: • Grey seal	• Not applicable	• Given the separation distance, there is no pathway for any direct effect on the SAC. • There would be no potential for any PTS to grey seal as a result of underwater noise during dredging and offshore disposal. As outlined in **Section 10.5.1**, underwater noise levels are below the thresholds which could result in any permanent auditory injury, ensuring grey seal remains a viable component of the SAC.	• No pathways for effect predicted.	• Screened out.
Southern North Sea SAC	Harbour porpoise	• Not applicable	• Given the separation distance, there is no pathway for any direct effect on the SAC.	• No pathways for effect predicted.	• Screened out.

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Site (distance and direction from proposed scheme)	Interest features	Supporting features	Potential pathway for likely significant effect during construction	Potential pathway for likely significant effect during operation	Screened in/out of Appropriate Assessment
(100km south east)			• There would be no potential for any PTS to harbour porpoise as a result of underwater noise during dredging and offshore disposal. As outlined in **Section 10.5.1**, underwater noise levels are below the thresholds which could result in any permanent auditory injury, ensuring harbour porpoise remains a viable component of the SAC.		
Tweed Estuary SAC (approximately 140km north)	Annex I habitats that are a primary reason for selection of the site: • Estuaries. • Mudflats and sandflats not covered by seawater at low tide. Annex II species present as a qualifying feature but not a primary reason for site selection: • Sea lamprey. • River lamprey.	• Not applicable	• Given the separation distance, there is no pathway for any direct on the SAC; • There would be no potential for disturbance to migrating fish from the SAC arising from offshore disposal, as outlined in **Section 26.3.1**.	• No pathways for effect predicted.	• Screened out.
The Wash and North Norfolk Coast SAC (approximately 200km south)	Qualifying habitats: • Atlantic salt meadows • Coastal lagoons • Large shallow inlets and bays • Mediterranean and thermo-Atlantic halophilous scrubs • Mudflats and sandflats not covered by sea water at low tide • Reefs • Salicornia and other annuals colonising mud and sand	• Not applicable	• Given the separation distance, there is no pathway for any direct effect on the SAC. • There is no potential for PTS to common seal or otter due to underwater noise from dredging and offshore disposal.	• No pathways for effect predicted.	• Screened out.

Site (distance and direction from proposed scheme)	Interest features	Supporting features	Potential pathway for likely significant effect during construction	Potential pathway for likely significant effect during operation	Screened in/out of Appropriate Assessment
	• Sandbanks which are slightly covered by sea water all the time Qualifying species: • Common seal • Otter				

Based on the information presented within **Table 29.2**, it is considered that the Teesmouth and Cleveland Coast SPA and Ramsar site should be screened into the AA stage for construction and operational activities (i.e. there is potential for LSE alone). The location of the SPA / Ramsar site in relation to the proposed scheme is presented in **Figure 11.2**.

Background information for the Teesmouth and Cleveland Coast SPA and Ramsar site is presented in **Section 12** of this EIA Report. Although the qualifying interest features of the Teesmouth and Cleveland Coast SPA differ slightly from the qualifying criteria for the Ramsar site, the proposed scheme will affect the features / criteria in the same way, given that the habitats of importance to the features of / criteria for both the SPA and Ramsar site are the same. For this reason, the potential effects of the proposed scheme are presented for both the SPA and Ramsar sites together.

There is no potential for LSE on the Northumbria Coast SPA and Ramsar site, the Durham Coast SAC, Berwickshire and North Northumberland Coast SAC, Southern North Sea SAC, Tweed Estuary SAC or the Wash and North Norfolk SAC on the basis of their location and qualifying interest features (i.e. there is no conceivable pathway for effect on these sites). No further consideration of potential impacts to the interest features of these sites has been undertaken within this HRA.

29.3.3 Screened out features of the Teesmouth and Cleveland Coast SPA / Ramsar site

As outlined in **Table 29.2**, breeding little tern and avocet and passage Sandwich terns have been screened out of appropriate assessment, since there are no LSE predicted as a result of the scheme either alone or in-combination with other projects and plans. This section provides justification for this conclusion.

Breeding little tern

The little tern colony is located at Crimdon Dene, approximately 13km north of the proposed scheme footprint (Natural England, 2018a). The feeding grounds of the little terns that nest at Crimdon Dene lie predominantly in marine areas within 5km alongshore of the colony and within 3.5km offshore. This area does not overlap with the proposed scheme footprint, or the zone of influence from any impacts arising from it. While discussions with Natural England indicate that the little tern colony has relocated to Seaton Carew, approximately 2km north of the Tees estuary, survey work undertaken by INCA in June to August 2020 indicated that no little tern were present in the Tees. Even at Seaton Carew, the predicted maximum foraging range for little tern in the SPA (Parsons *et al.*, 2015) would not encompass the footprint of the proposed scheme nor the modelled extent of the maximum-expected sediment plume from the capital dredging.

When considering intra-project effects (i.e. the combined effect of the various impact pathways arising from the proposed scheme), the maximum area affected will be driven by the most far-reaching of impacts. Following modelling of noise levels and sediment dispersion, it has been concluded that the overall zone of influence of the proposed scheme will be determined by the sediment plume during dredging activities. Given that the little tern nesting and foraging extent is outside the overall zone of influence, there is no risk of intra-project effects. Furthermore, since there will be no effects as a result of the proposed scheme, there can be no interaction effects on the little tern SPA population when considering the proposed scheme in combination with other plans and projects.

Breeding avocet

The majority of breeding avocet breed on No.4 Brinefield, mainly on the saline lagoon south of Greatham Creek, with smaller numbers on Greenabella Marsh (Natural England, 2018a). This is located 2 – 3km from the proposed scheme and is again outwith the overall zone of influence from the proposed scheme. There have been no avocets recorded during WeBS counts from 2014/15 to 2018/19 at the two sectors affected by the proposed scheme (see **Section 12.4.2**), therefore there is no functional linkage to foraging birds that may commute from the breeding site. Again, this indicates that there would be no effect on the SPA breeding avocet population and distribution as a result of the scheme, even when considering all impact pathways of the proposed scheme together, and hence there would be no pathway for interaction effects when considering the proposed scheme in combination with other plans and projects.

Passage Sandwich tern

The proportion of the passage Sandwich tern population that uses the affected area is considered to be insignificant, given that a mean peak count of four individuals was recorded at WeBS sectors affected by the scheme over the period (2014/15 to 2018/19) (see **Section 12.4.2**), which represents 0.2% of the SPA reference passage population. Roosting birds use Coatham Sands, Seal Sands, North Gare Sands/Seaton Snook and Bran Sands (Natural England, 2018a), all of which lie outside the overall zone of influence from the proposed scheme. Again, this indicates that there would be no effect on the SPA passage Sandwich tern population and distribution as a result of the scheme, even when considering all impact pathways of the proposed scheme together, and hence there would be no pathway for interaction effects when considering the proposed scheme in combination with other plans and projects.

29.3.4 Conservation objectives for European sites screened into the assessment

Natural England has developed conservation objectives for the Teesmouth and Cleveland Coast SPA which aim to maintain, in favourable condition, the quality, distribution and extent of the designated habitats which support the cited bird species.

The conservation objectives which apply to the Teesmouth and Cleveland Coast SPA are provided below (Natural England, 2018b):

> *"With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified, and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;*
> - *The extent and distribution of the habitats of the qualifying features;*
> - *The structure and function of the habitats of the qualifying features;*
> - *The supporting processes on which the habitats of the qualifying features rely;*
> - *The population of each of the qualifying features; and,*
> - *The distribution of the qualifying features within the site."*

29.4 Consideration of other plans and projects to include in the in-combination assessment

Relevant plans and projects to be considered in the in-combination assessment have been identified through a search of MMO and RCBC public registers, as well as via consultation with RCBC. A high-level screening exercise has been undertaken to remove certain types of development that are judged to be insignificant in nature and scale (e.g. minor change of use application or conversions to existing buildings, minor residential developments etc.) and, as such, there is no pathway for in-combination effects due to the minor nature of those schemes. Relevant plans and projects identified within the vicinity of the proposed scheme are screened in **Table 29.3**. Where data is available, details of project type, construction dates, duration of works and other relevant data are provided, along with the distance from the proposed works.

Table 29.3 Plans and projects identified in the vicinity of the proposed scheme

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
AV Dawson	Proposed quayside works and dredging at its North Sea supply base and Dawson's Wharf.	Approximately 4.5km upstream	No marine licence application submitted to date.	There is no environmental assessment information available for this proposed scheme. It is therefore not possible to include the AA. **Screened out of the AA.**
South Industrial Zone	Outline planning application for demolition of existing structures on site and the development of up to 418,000sqm (gross) of general industry (Use Class B2) and storage or distribution facilities (Use Class B8) with office accommodation (Use Class B1), HGV and car parking and associated infrastructure works. All matters reserved other than access.	Immediately adjacent (inland)	Outline planning application submitted but awaiting approval.	The South Industrial scheme is located in very close proximity to the proposed scheme footprint. A review of the application documents confirms that Natural England have no objection to the scheme subject to appropriate mitigation being secured to ensure no impact to the SPA / Ramsar. Specifically, Natural England confirmed that additional HRA should be undertaken for any reserved matters applications once detail on construction method and likely development is known as well as adoption of all mitigation identified in the shadow HRA. LSE could not be ruled out due to loss of habitat suitable to support SPA / Ramsar species, disturbance due to construction related pollution, noise and visual disturbance during construction and risk of pollution during operation. Intertidal mud sampling confirmed within the South Industrial Zone site confirmed that the Slems does not support foraging waterbirds due to a lack of invertebrates. However, the Slems is likely to be used by wintering birds for loafing and sheltering and such habitat would be lost as a result of the scheme. In addition, areas of woodland, scrub, grassland, open mosaic habitat and wetland habitats all provide suitable foraging habitat for wintering birds; such habitat would be lost due to the proposed scheme. In-combination effects on

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
				the SPA / Ramsar site cannot therefore be ruled out. **Screened into the AA.**
NGCT	The NGCT scheme comprises capital dredging up to 4.8 million m^3 of sediment from the riverbed, realignment of the approach channel, disposal of dredged material offshore, construction of a new container terminal facility and construction of various landside elements (buildings, rail terminal, road access, lighting, drainage and a pumping station). PDT is proposing to fully construct the proposed NGCT in advance of the existing Harbour Revision Order expiring on 7th May 2028.	Approximately 1.5km downstream. Dredge footprint overlaps at Tees Dock turning circle.	Planning permission granted and implemented. Marine licence application submitted but awaiting approval.	Should the NGCT scheme coincide with the proposed scheme, in-combination effects to the interest features of the SPA / Ramsar site could occur in the form of underwater and airborne noise, visual disturbance and water quality reductions, which have the potential to reduce the available foraging area for qualifying species. **Screened into the AA.**
Anglo American Harbour Facilities	The Anglo American Harbour Facilities scheme was granted a DCO in 2016. The DCO permits the following activities which are yet to commence: Phase 1 • site compounds; • construction of a 28m wide and 280m long quay including ship loads and ship loader rails; • dredging up to 750,000m^3 of material from the approach channel and berth pocket; • lagoon habitat enhancement works; • installation of a surge bin; • installation of a conveyor system and transport towers; • construction of buildings and parking area; • erection of security fencing; • provision of ancillary infrastructure. Phase 2 • extension of the quay to provide a total quay length of 486m including ship loader and ship loader rails; • dredging up to 372,000m3 of material from the approach channel and berth pocket;	Immediately downstream	Marine licence granted.	Should the proposed Anglo American Harbour facilities scheme coincide with the proposed scheme, in-combination effects to the interest features of the SPA / Ramsar site could occur in the form of underwater and airborne noise and water quality reductions, which have the potential to reduce the available foraging area for qualifying species. **Screened into the AA.**

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
	• installation of a second surge bin; • installation of a second conveyor within the conveyor housing installed during Phase 1; • provision of ancillary infrastructure.			
Hartlepool approach channel	PDT is proposing to undertake a programme of works within and adjacent to the existing approach channel into Victoria Harbour, located to the immediate south of Hartlepool Headland on the north-east coast of England. The current approach channel dimensions are limiting the size of vessels which can gain entry into the harbour. PDT is therefore proposing to deepen, realign, widen and extend the length of the approach channel, to allow Victoria Harbour to accept deeper drafted and larger beam vessels through a wider tidal window. In addition to the proposed dredge (and associated disposal of dredged material), PDT is proposing to construct an underwater retaining wall, immediately adjacent to the Middleton Breakwater, which is located at the mouth of Victoria Harbour. The underwater retaining wall is required to avoid the risk of Middleton Breakwater being undermined following the proposed dredge.	Approximately 6km north	Marine licence granted	Should the Hartlepool channel scheme coincide with the proposed scheme, in-combination effects to the interest features of the SPA / Ramsar site could occur in the form of underwater and airborne noise and water quality reductions, which have the potential to reduce the available foraging area for qualifying species. **Screened into the AA**
Ongoing maintenance dredging at Hartlepool and in the Tees estuary	This activity has been ongoing for many years.	0km	Marine licence granted for offshore disposal.	Given the frequency, duration and long-term nature of this activity, maintenance dredging and disposal is represented in the baseline conditions for the area. Although maintenance dredging would not be undertaken in the footprint of the proposed scheme at the same time as the capital dredging for the scheme, there is potential for maintenance dredging elsewhere within the Tees to coincide with the capital dredging, which could result in in-combination effects on water quality. The effects of maintenance dredging at Hartlepool (which is also within the source area on PDT's maintenance dredge disposal licence) would not extend into the Tees estuary and therefore this is screened out of the assessment.

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
				Screened into the AA (for the Tees only).
Inter Terminals Jetty 1 refurbishment	Inter Terminals has submitted a planning application and a marine licence application to undertake refurbishment works to its existing Jetty 1 on the northern bank of the Tees estuary. The scheme involves minor 'top-side' works to the existing infrastructure at Jetty 1 and Dolphin D, and a dredge of the river bed (with associated disposal of dredged material) to extend the existing berth pocket downstream. The works would result in Dolphin D being used as an operational structure rather than simply a berthing dolphin.	Immediately adjacent to the dredge footprint	Consent in place	The proposed works to Jetty 1 are highly localised and the construction works would be short term. The works are considered to be of a sufficiently small scale that there would be no significant in-combination effects. **Screened out of the AA.**
Tees Channel Dredge	The Tees Channel Dredge project involves a proposed deepening of the Tees navigation channel, the turning circle and Tees Dock to a maximum maintained depth of 14m below CD. An Environmental Scoping Report (Royal HaskoningDHV, 2016) was submitted to the MMO alongside a request for a scoping opinion for the project in 2016; however, the environmental assessment proposed within that report has not yet been undertaken.	0km	No application submitted to date	The dredge footprint for the proposed scheme overlaps with the proposed Tees channel dredge. There is very limited environmental assessment information on the latter project, as the scheme has not progressed beyond the Environmental Scoping process. However, it is understood that the Tees Channel dredge would not be undertaken should the proposed scheme commence first. **Screened out of AA**
Tees GasPort	Trafigura is proposing a scheme to import Liquefied Natural Gas (LNG) at Teesport (within the Tees estuary), on the north-east coast of England. The proposed LNG import scheme comprises floating storage regasification unit (FSRU) at an existing, currently unused jetty. Once the FSRU is in place, LNG carriers will berth next to the FRSU in a side-to-side mooring configuration and discharge the LNG into the FSRU before leaving again. In order to enable the LNG import facility to function the following works are required, referred to herein as the 'proposed works': • Concrete and steel work repairs to the existing jetty. • Modifications to the existing mooring dolphins. • Replacement / repair of ancillary items on the existing jetty.	Approximately 1.5km downstream	Application submitted but no licence granted	The marine licence application has been submitted. The non-statutory environment assessment undertaken in support of the marine licence application concluded that there would be no significant impact on any environmental parameters as a result of the Tees GasPort scheme. It is therefore concluded that this project should be screened out of the AA. **Screened out of the AA.**

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
	• Modifications to onshore mooring blocks. • Dredging of the existing berth and disposal of dredged material.			
Anglo American Materials Handling Facility at Wilton and Storage Facility at Bran Sands	Anglo American secured planning permission from RCBC for a Materials Handing Facility (MHF) on land at Wilton, Teesside, in 2015 (reference R/2014/0626/FFM). The associated Anglo American Harbour Facilities DCO was also granted under s114 (1)(a) of the Planning Act 2008 (reference SI 2016 No. 772). Together the permission and consent provide for the construction and operation of facilities to process, transfer and handle for export the material emerging from a portal at the Wilton site, which will serve the consented mine and underground materials transfer system. The permissions led to progression of detailed design engineering, from which emerged requirements for an amended conveyor routing, and an additional storage facility (Use Class B8) at Bran Sands, Redcar. The Storage Facility has indicative dimensions of 1300m long x 170m wide x 40m high.	4km and 3.5km respectively	Both schemes are consented by RCBC	Should the Anglo American Materials Handling Facility scheme coincide with the proposed scheme, in-combination effects to the interest features of the SPA / Ramsar site could occur in the form of airborne noise and visual disturbance, which have the potential to reduce the available foraging area for qualifying species. **Screened into the AA.**
Dogger Bank Teesside A and Dogger Bank Teesside B (now Sofia Offshore Wind Farm, referred to throughout as Sofia)	Dogger Bank Teesside was Forewind's second stage of development of the Dogger Bank Zone. Originally planned to be four separate wind farms known collectively as Dogger Bank Teesside, this stage was divided into two separate applications - Dogger Bank Teesside A & Sofia and Dogger Bank Teesside C&D. Only Dogger Bank Teesside A & Sofia was progressed through to application. The A & Sofia application comprised two wind farms, each with a maximum installed capacity of 1.2GW. They will connect to the national grid at the existing Lackenby Substation in Teesside via an export cable to be located within an export cable corridor. The Dogger Bank Teesside A & Sofia schemes both have consent, currently sharing the same DCO. The DCO states that construction should commence by August 2022. It is understood that both Teesside A and Sofia will potentially bid into the next Contracts for Difference (CfD) round in Spring 2019, which would commit the developers to construction timelines.	5km	DCO granted for the scheme which contains a deemed marine licence from the MMO	The consented Dogger Bank Teesside A & Sofia scheme is located within the coastal waters of Tees Bay. A trench of approximately 2.2km long required for export cable burial overlaps with the SPA / Ramsar site. Although this scheme has received consent, it is yet to be constructed, and therefore the potential exists during cable laying for in-combination impacts from underwater noise and reductions in water quality to affect prey species of qualifying features. **Screened into the AA.**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
	As the programme for construction works has not yet been determined, there is potential for construction works to coincide with the proposed scheme.			
Tees navigation channel deepening	PDT is proposing to undertake a dredge of the approach channel to locally deepen from 5.1m bCD to 5.7m bCD. Consultation with the MMO has confirmed that PDT should submit a variation request to its existing maintenance dredge licence in order to dispose of the dredged material (i.e. the MMO sees the proposed dredge as a maintenance dredge activity). PDT's intention is to undertake the dredge during 2020/2021.	Approximately 2km upstream	Application submitted August 2020.	The MMO sees the Tees navigation channel dredge as a maintenance dredge activity. Given the frequency, duration and long-term nature of maintenance dredging within the Tees, this activity is represented in the baseline conditions. However, the deepening could coincide with the capital dredging activity required for the proposed scheme (albeit within a different part of the estuary). **Screened into the AA (but considered to fall under the 'maintenance dredge' umbrella rather than a separate plan or project).**
Grangetown Prairie	An Energy Recovery Facility is proposed capable of processing up to 450,000 tonnes of waste per annum. The need for the scheme has arisen from the Tees Valley Joint Waste Strategy, which has been extended from 2020 to 2035. The proposed site is located on the former South Tees Eco Park, Grangetown Prairie, located approximately 4 miles north-east of Middlesbrough town centre.	Approximately 1.4km south-east	Outline planning permission granted in July 2020.	No works are required within the estuary itself, with all works being located on land. A review of the HRA screening report undertaken in support of the marine licence application concluded no LSE in isolation (due to the separation distance between the scheme and the SPA / Ramsar site). On this basis, it is concluded that there is no pathway for in-combination effects with the proposed scheme. **Screened out of the AA.**
Land at Former South Bank Works; Grangetown Prairie; British Steel and Warrenby Area	Demolition of structures and engineering operations associated with ground preparation and the temporary storage of soils in mounds, for their final use in the remediation and preparation of land for regeneration and development.	Approximately 1.4km south-east	Full planning permission granted May 2017	No environmental assessment was submitted in support of the application, as no significant environmental impacts were envisaged. Given the nature of the ground preparation and storage works in relation to the footprint of the proposed scheme, it is concluded that there is no pathway for in-combination effects.

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
				Screened out of the AA.
Land at Low Grange Farm, South Bank	Outline application for residential development (up to 1250 dwellings) (all matters reserved).	Approximately 1.6km south	Outline planning permission granted March 2016.	Natural England confirmed that although an HRA was not submitted in support of this application, the proposed residential development would not result in an LSE and was screened out from further assessment. This decision was made on the basis of its location in relation to the SPA / Ramsar site and its setting (surrounded by existing residential and industrial development). On this basis, there is no pathway for in-combination effects with the proposed scheme. **Screened out of the AA.**
Residential development	Outline planning application for up to 550 residential units with associated access, landscaping and open space. Reserved matters application (appearance, landscaping, layout and scale) following approval of outline planning permission R/2016/0663/OOM for up to 550 residential units with associated access, landscaping and open space.	Approximately 5.5km east	Planning permission granted July 2020 Planning permission granted October 2019	A review of the supporting documentation submitted with the outline planning application confirmed that there would be no impacts upon the qualifying features of the SPA / Ramsar site. None of the qualifying features were found during breeding bird surveys. The habitat within the site does, however, offer limited potential for roosting and foraging lapwing, oystercatcher and redshank. A review of the planning officer's report confirmed that Natural England originally objected to the proposed residential development due to adverse effects on the SPA / Ramsar site. Natural England subsequently removed its objection through the adoption of mitigation, including the provision of open space within the development at the reserved matters stage. Natural England raised no objection to the reserved matters application. Although there is potential for the proposed scheme to affect the same features as the consented residential development, the mitigation measures to be adopted and built into the reserved matters application for the residential development

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Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
				will remove the potential for significant in-combination effects. **Screened out of the AA.**
Teesside Combined Cycle Power Plant	Construction of a 1,700mwe combined-cycle gas turbine power station at Wilton International.		Order made April 2019	The HRA for the combined cycle power plant confirmed that only the effect of air emissions was taken forward for further assessment. The assessment presented in **Section 18** of this report concludes that there would be not significant impacts as a result of the proposed scheme. It is therefore concluded that there is no pathway for significant in-combination effects. **Screened out of the AA.**
Lianhetech, Seal Sands (Stockton Council)	Proposed new buildings, plant upgrade, swale and associated access and car parking provision	Approximately 1.5km north	Planning permission granted February 2020	The supporting environmental assessment to the Lianhetech works concluded that any direct or indirect impacts to the interest features of the SPA / Ramsar site would be negligible. On this basis, there is no potential for an in-combination effect to occur. **Screened out of the AA.**
New cinema development	Demolition of existing cinema and replacement with a new cinema including external terraces, landscaping and temporary sea wall	Approximately 7km east	Planning permission granted August 2020	The HRA submitted in support of the new cinema development confirmed that LSE could not be ruled out during the construction and operational phase. LSE could not be ruled out for redshank, knot, ringed plover, ruff and the waterbird assemblage during construction and operation. Although the proposed schemes are geographically separate, there is potential for effects arising from both schemes to result in in-combination effects on the same receptors. **Screened into the AA.**

Plan or project	Description and timing	Distance from proposed scheme	Status	Screening assessment rationale, including potential effects and impacts
Engineering operations at Metals Recovery Area	Demolition of existing buildings/structures and engineering operations associated with ground remediation and preparation of land for development.	Approximately 500m east	Application submitted and awaiting decision	No works are required within the estuary itself, with all works being located on land. Although the works are in close proximity to the proposed scheme, the works are very minor in nature and no significant in-combination effects are predicted. **Screened out of AA.**

Where there is potential for these projects and plans to have an in-combination effect on the SPA / Ramsar site, these have been screened in for AA and are considered further in **Section 29.5**. Unless otherwise stated, it is assumed that if LSE for the project alone is determined with respect to a particular site / feature, this conclusion also stands with regard to potential in-combination effects.

As detailed in **Section 29.3.3**, features of the Teesmouth and Cleveland Coast SPA / Ramsar site that are screened out of the 'alone' assessment have been considered in terms of LSE arising from interactions between the effects of the proposed scheme and those of other projects. It was concluded that, for all of the screened-out features (i.e. breeding little tern and avocet, passage Sandwich tern), no LSE is predicted from in-combination effects.

29.4.1 Summary of HRA screening

The HRA screening stage has determined that the proposed scheme has potential to result in LSE on the following European (when considered in isolation):

- Teesmouth and Cleveland Coast SPA / Ramsar site (excluding little tern, Sandwich tern and avocet).

The following potential construction phase effects will be assessed:

- Loss of intertidal feeding resource due to dredging and excavation to create the berth pocket.
- Airborne noise disturbance to waterbirds due to demolition and construction works.
- Indirect impacts on foraging behaviour as a result of impacts to prey resource from capital dredging and excavation works (water quality reductions).

The following operational phase effects will be assessed:

- Disturbance due to operation of the quay.
- Effects on existing habitats due to changes in coastal processes.

It is concluded that LSE in-combination cannot be ruled out when considering the proposed scheme alongside the following plans and projects:

- Anglo American Harbour Facility
- Anglo American MHF.
- Dogger Bank Teesside A and Sofia.
- Hartlepool approach channel.
- Maintenance dredging.
- NGCT.
- New cinema development.
- South Industrial Zone development.

All other plans and projects have been screened out of the in-combination assessment, either due to a lack of pathway for in-combination effects or due to the lack of environmental information to allow a sufficient in-combination assessment to be undertaken.

29.5 Information to inform the Appropriate Assessment

29.5.1 Introduction

This section of the HRA provides the information required for AA of the proposed scheme on the Teesmouth and Cleveland Coast SPA and Ramsar site. With reference to the relevant sections of the EIA Report where appropriate, this section describes the potential impacts of the proposed scheme insofar as they are relevant to the qualifying features. The potential impacts are then considered in the context of the defined conservation objectives for the relevant features and a view is given on whether the proposed scheme (when considered in isolation) is predicted to have a significant adverse effect on the integrity of the SPA and Ramsar site.

Information to inform an in-combination assessment with the plans and projects outlined above is provided in **Section 29.6**.

29.5.2 Approach to assessment of potential adverse effects

Determining whether, in view of the SPA and Ramsar site's conservation objectives, the plan or project either alone or in combination with other plans or projects would have an adverse effect (or risk of this) on the integrity of the site has been assessed in light of:

- site-specific information obtained from surveys and studies undertaken as part of the EIA for the proposed scheme;
- the advice of statutory bodies;
- the potential effects on the SPA and Ramsar site;
- evidence provided within the EIA Report; and,
- professional judgement and lessons learned from other development projects.

The following definitions and approach were used to determine whether the proposed scheme would result in an adverse effect on the SPA / Ramsar site:

Site integrity

The assessment of adverse effects on the integrity of the site is addressed in light of the conservation objectives. The integrity of a site is defined as the "*the coherence of the site's ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated*" (ODPM Circular 06/2005).

EC guidance (European Commission, 2000) emphasises that site integrity involves its ecological functions and that the assessment of adverse effect should focus on, and be limited to, the site's conservation objectives.

Adverse effect

The potential impacts of the proposed scheme during the construction and operation phases have been considered in the context of their effects on the qualifying features (i.e. the species and their supporting habitats) of the SPA and Ramsar site.

An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of designation. In addition, an adverse effect would be one which caused a detectable reduction in the species for which the sites are designated, *at the scale of the site rather than at the scale of the location of the impact*.

Article 1 of the Habitats Directive defines the conservation status of a natural habitat as 'favourable' when "*the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future*". An adverse effect on site integrity will not occur if it can be shown that, in the long term, the habitat or population of the species in question as a viable component of the site will be maintained despite potential impacts. Long-term is considered to be a period of at least five years. This is considered to be an appropriate timescale for the assessment of adverse effect on integrity because, for example, SPAs are usually designated in the UK on the basis of five-year population estimates. A five-year rolling mean is used because it is considered to take account of sufficient data to demonstrate that birds use sites regularly, smoothing out any short-term peaks and troughs in numbers.

Using the same argument, it is therefore logical to continue to review populations over the same timescale in order to demonstrate that observed use or 'non-use' of habitat is typical, and not a chance event. In addition, bird breeding performance and productivity varies between species and between years, and many species have long life spans. Population dynamics data therefore need to take into account the possible short-term fluctuations in the numbers of any species.

European Commission (2000) also recommends that, when considering the 'integrity of the site', it is important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term.

29.5.3 Estuarine processes

An assessment of the potential effects of the proposed scheme on estuarine processes (comprising effects on tidal propagation, wave climate, current speeds and sediment budget of the estuarine system) has been undertaken and is presented in **Section 6** of this report (with further detail provided in **Appendix 5**). A summary of the predicted effects is provided below to inform the assessment of potential adverse effects on the features of the SPA and Ramsar site.

Effects on estuarine processes due to demolition activities

During construction, the demolition of the existing wharf and jetties will have only minor, localised and temporary effects that are not of significant concern. Construction of the new quay (to be set back from the riverbank) will be from land using predominantly land-based plant, with no construction activity in the river and so will cause no effects on the hydrodynamic and sedimentary regime.

Effects on water quality due to dredging and disposal

The capital dredging of the river will cause plumes of sediment to form. The plume effects arising from the river dredging are characterised by a short-lived localised increase in suspended sediment concentrations by the order of a few hundred mg/l at the point of dredging activity, followed by a general dispersion in spatial extent and reduction in concentration over the following hours. Since the dredging is a near-continuous operation, the plume effects will be observed throughout much of the approximately five-month period, but at varying extents depending on the dredging activities undertaken at any one time. Deposition thicknesses of sediment from the plumes on the river or seabed will be very small.

Effects of completed scheme on hydrodynamic conditions

Since the new quay is to be set back from the existing riverbank, there are expected to be local changes to the baseline hydrodynamics due to the new alignment. Changes in hydrodynamics could also arise from the absence of the existing wharf and jetties and the deepened areas in the Tees Dock turning circle, approach channel and berth pocket.

Numerical modelling during both neap and spring tides show that general baseline tendencies (i.e. maximum current speeds being greater on the spring tides than the neap tides, an ebb dominance during neap tides and a flood dominance during spring tides) remain unaffected by the scheme.

The tidal current velocities along the length of the quay's new set-back alignment will mostly be 0.05 – 0.10 m/s during flood spring tides, and less than 0.05m/s during ebb neap tides. Under both spring and neap tide conditions there are predicted to be general small reductions in baseline flow rate, which will vary during different phases of the tidal cycle but are generally between 0.05 and 0.15 m/s, with small areas of reduction of around 0.20 m/s. Such reductions may extend across the width of the river but are not predicted to extend along the axis of the river beyond that adjacent to the new quay. There is predicted to be no measurable change in the Tees Dock turning circle.

The reductions in baseline current speeds may lead to a slight increase in deposition of sediment. 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 design depths. An increase in annual maintenance dredging requirement considered in **Section 6** is predicted to yield a very low overall contribution to the net annual maintenance dredging requirements from the estuary as a whole and the potential increase in maintenance dredging requirement could easily be managed within existing maintenance dredging regimes (i.e. no change to the existing maintenance dredge strategy is required).

There are no predicted effects on local wind-generated waves at the site since the changes in hydrodynamics are so small and localised, and there will be no estuary-scale effects on baseline hydrodynamic conditions.

Effects of completed scheme on tidal range

Design calculations for the proposed scheme show that the increase in mean tidal prism as a result of the new quay's set-back alignment and dredging of part of the existing estuary bed is 150,901m^3. This represents an increase in the existing tidal prism of the estuary by less than one percent (0.8% to one decimal place) and is not deemed to be a cause of significant estuary-wide change in hydrodynamics.

29.5.4 Effects on the extent, distribution and function of supporting habitat for wintering waterbird species

The proposed scheme will result in the conversion of approximately 2.5ha of intertidal habitat within the SPA, behind the existing wharf, to subtidal habitat, due to the capital dredging and excavation required to create the berth pocket. The dredging footprint in the channel and the Tees Dock turning circle does not overlap with intertidal habitat at North Tees Mudflat, Vopak Foreshore nor any other areas of extensive mudflat / other intertidal types in the estuary (i.e. the dredge will be within subtidal areas only). Dredging in existing subtidal habitat (an area of 32.5ha) will result in a temporary change to the seabed benthic community, although the excavation of the landside materials to create the berth pocket will result in the creation of additional subtidal habitat in the long term.

Walkover survey observations of the site in 2020 indicate that the intertidal habitat is similar to that recorded during 2019 intertidal surveys undertaken for the NGCT scheme (full details are presented in **Section 9.4**). As such, it is concluded that the intertidal habitat present in the footprint of the proposed scheme is impoverished and predominantly artificial due to historic industrial development, which restricts the ability for a more natural rocky shore community to develop. As outlined in the WFD compliance assessment (see **Section 28**), there is approximately 400ha of "intertidal sediment" habitat within the estuary. The area of intertidal habitat that would be lost during excavation / demolition would represent approximately 0.6% of this. While the priority habitat data presented in **Figure 11.2** indicates that there may be small, isolated patches of intertidal mudflat within the footprint, amounting to a total area of approximately 0.79ha, there was no evidence of such habitat being present during the walkover survey.

The site-specific bird counts undertaken to date (July to September 2020) support the conclusion drawn in **Section 9** that the affected intertidal area is of poor quality. The bird counts indicate that the intertidal habitat and the existing wharf and jetty structures are of relatively low value for SPA and Ramsar qualifying features. While it should be noted that the counts do not take into account wintering numbers, it suggests that the alternative habitat present at North Tees Mudflat is preferable for redshank (the only SPA / Ramsar feature recorded at South Bank during the counts), during both high and low tide. Full details are provided in **Section 12.4.3**, but, in summary, low tide peak counts of redshank at South Bank (inclusive of birds observed on the intertidal habitat and on the existing wharf structures) were up to two individuals (0.1% of the SPA reference population), compared to peak counts of up to 82 individuals (5.0% of the SPA population) at North Tees Mudflat. Though numbers at South Bank may be higher during winter months, there is still likely to be a strong preference for the North Tees Mudflat, and localised redistribution of birds from South Bank to North Tees Mudflat would not represent a significant effect on the SPA-wide distribution of waterbirds. Furthermore, assessments undertaken for other projects in the Tees (such as the NGCT scheme and the Anglo American Harbour facilities scheme (Royal HaskoningDHV, 2015 and 2020)) indicate that there are other high-value habitats, such as *inter alia* Bran Sands, Bran Sands lagoon, Dabholm Gut, Seal Sands and North Gare Sands within the SPA / Ramsar site that would provide ample alternative intertidal foraging and roosting opportunities for the very low numbers of birds recorded at South Bank.

The subtidal areas to be affected by the proposed scheme are infrequently used by breeding common terns as foraging grounds, indicated by WeBS core counts for the two sectors in which capital dredging will be undertaken (see **Section 12.4.2**) and the site-specific tern surveys undertaken in 2020 (see **Section 12.4.4**). For example, the most recent common tern 5-year mean peak count was 19 (2.4% of the SPA population), and the peak count recorded over the summer of 2020 was 12. Regardless, the subtidal habitat affected is subject to regular (almost daily) maintenance dredging by PDT therefore the impact of the capital dredge is not expected to result in any significant long-term changes to benthic composition. The findings of ecological surveys in the Tees (detailed further in **Section 9.4.3**) show that the benthic community in the river channel is characteristic of disturbed seabed, and it is expected to return to a similar state following completion of the proposed capital dredge. Furthermore, the subtidal area within the proposed dredge footprint represents approximately 0.3% of the overall subtidal area available in the SPA.

As outlined, the assessments set out in **Sections 9** and **12** indicate that the subtidal, intertidal and artificial habitats within the direct footprint of the scheme do not constitute high value supporting habitats for SPA / Ramsar site features. Given the very minor extent of the potentially-affected habitat in terms of the SPA-wide supporting habitat available, and the fact that other habitats within the SPA are likely to be of significantly higher value to SPA / Ramsar site features, it can be reasonably assumed that the loss / alteration of the affected habitat would not have an adverse effect on the integrity of the site.

Furthermore, in light of the changes in coastal processes outlined above in **Section 29.5.3**, there are predicted to be no significant estuary-wide changes in the tidal prism. The slight reductions in tidal flow at the north bank of the Tees would be beneficial in that the resulting minor increases in deposition may help to sustain North Tees Mudflat in light of future sea levels rise (with no significant effect on the benthic communities anticipated as a result, as detailed in **Section 9**). As such, an adverse effect on the integrity of the SPA and Ramsar site would not occur.

29.5.5 Displacement of food resources

Common tern feed on a wide variety of small fish, including clupeids (i.e. largely herring and sprat) and sandeels. The potential effects on resident and migratory fish within the Tees are presented in the fish and fisheries assessment in **Section 13**, and the findings of that assessment are applied here to assess the resulting indirect effects on SPA / Ramsar site features. **Section 13** indicates that notable impacts on fish are not anticipated to arise from disturbances associated with underwater noise and increases in SSC during dredging.

While 32.5ha of subtidal will be affected by the proposed capital dredging, the area already experiences regular (almost daily) maintenance dredging by PDT so there are not expected to be any long-term changes to the suitability of the site in supporting fish resources. The marine water quality assessment undertaken in **Section 7** indicates that there are not expected to be any significant risks to fish as a result of contaminant release or reduced DO (details are provided in **Section 13.5.1**). Further assessment is presented below.

Effects of changes in water quality

With the application of mitigation in the form of ensuring that the capital dredging transects run along the axis of the river, rather than across it (further details are provided in **Sections 12.5.2** and **13.5.1**), the dredging activities associated with the highest modelled increase in SSC (i.e. Stage 2 of the dredging, which requires use of TSHD and BHD on soft sediment in the channel and berth pocket) will result in plumes of elevated SSC that collectively occupy around half the width of the river channel as they move up and downstream. The zone of influence affected by increases in SSC during Stage 2 has been described in **Figure 6.39**; in summary, measurable increases in SSC will not be experienced (at any time) at a distance of more than *c.*750m downstream and *c.*2,500m upstream, and it is important to note that, in reality, only a fraction of this would be affected at any one time.

The sediment dispersion modelling of Stage 2 dredging indicates that, at any given time, significant SSC excesses from the capital dredging are confined to the dredging transects and are predicted to decrease significantly with increased distance from the dredging vessel, both laterally and along the line of the vessel, with plumes diminishing typically to levels of <30 mg/l but often <10mg/l at a distance of no more than a few hundred metres. Baseline levels are expected to be restored within a few minutes to a few hours of release. Full details of the sediment dispersion modelling are presented in **Section 6.5.2**.

With mitigation in place, the predicted impacts on fish as a result of SSC increases are predicted to manifest as a very localised redistribution to less-affected areas, and the movement of fish along the river is expected to be largely uninterrupted (see **Section 13.5.1** for full details). There would be no estuary-wide effects, therefore the provision of fish in the estuary is expected to remain unchanged. However, it should be noted that the localised displacement of fish, plus decreased visibility through the water, may represent a temporary disruption to the foraging behaviour of terns. This may continue across the approximately five-month dredging programme.

Common terns breeding at Saltholme will forage along the length of the Tees and within adjacent offshore areas, and it should be noted that the January 2020 subtidal extension to the SPA was partly based on the identification of an area of approximately 9,400ha within the expected foraging range of this species (Natural England, 2018a). The area affected by the sediment plume generated from proposed dredging, though spatially and temporally variable, will represent a minute proportion of the foraging area within the SPA. Maintenance dredging in the channel, undertaken by PDT on an almost-daily basis, infers that terns using the channel are habituated to foraging in spite of localised increases in SSC and other sources of disruption to their fish prey; in fact, the revised boundary of the SPA covers the area that has been, and is, regularly dredged.

With the above in mind, the localised redistribution of fish and consequent temporary reduction in tern foraging opportunities during the capital dredging are not considered to represent a significant change to foraging ability in the context of the wider SPA, and would not be expected to affect the distribution or population of terns using the site. Furthermore, impacts would not be expected to extend beyond the approximately five-month duration of the capital dredging campaign. As such, there are expected to be no adverse effects on the integrity of the SPA / Ramsar site.

Effects of underwater noise

An assessment of the impacts of underwater noise on fish is detailed in **Section 13.5.3** and **13.5.4**, which concludes that the periodic nature of underwater noise, plus the likely habituation to background dredging noise due to regular maintenance dredging, means that impacts on fish are considered to be of minor significance only. There would be no reduction in the number of fish within the estuary as a result of injurious noise levels. Land-based impact pile driving noises that propagate through the water are expected to occur over an estimated 40 minutes per day (assuming ten minutes of impact piling per rig for four piling rigs) and are predicted to fall below thresholds likely to result in significant behavioural responses at a distance of greater than approximately 200m from source (see **Appendix 8**). There would be negligible effects on fish during the operation phase, since the increase in vessels movements is minimal in the context of baseline traffic within the Tees (see **Section 13.5.4**).

With mitigation in place, the predicted impacts on fish as a result of underwater noise is again predicted to manifest as a very localised redistribution to less-affected areas, and the movement of fish along the river is expected to be largely uninterrupted (see **Section 13.5.3** for full details). There would be no estuary-wide effects, therefore the provision of fish as a feeding resource in the estuary is expected to remain unchanged. Again, it should be noted that localised displacement of fish may represent a temporary disruption to the foraging behaviour of terns and may continue throughout the construction phase.

As previously stated, localised redistribution of fish and consequent temporary reduction in tern foraging opportunities during the capital dredging are not considered to represent a significant change to foraging ability in the context of the wider SPA and Ramsar site, and would not be expected to affect the distribution or population of terns using the site. Furthermore, impacts would not be expected to extend beyond the duration of the construction phase. As such, it is concluded that there would be no adverse effect on the integrity of the SPA and Ramsar site.

29.5.6 Disturbance effects on the population and distribution of SPA / Ramsar site features

Since the footprint of the proposed scheme overlaps with the SPA and is adjacent to the Ramsar site, there is potential disturbance to SPA and Ramsar site features that forage and roost in nearby areas, such as the North Tees Mudflat. Disturbance could arise due to the following:

- Airborne noise disturbance to birds during demolition, construction and operation.
- Visual disturbance during construction and operation.

Given that common terns forage and commute through the site and have a large foraging range within which to feed, they would not be significantly affected by local disturbances at the site of the proposed scheme. As such, this assessment focuses on foraging / roosting waterbirds at North Tees Mudflat and other areas that may fall within the impact range.

Airborne noise disturbance to birds during construction (including demolition) and operation

The demolition, construction and operation phases of the proposed scheme will inevitably result in the creation of noise which could disturb SPA / Ramsar site species.

Sections 12.5.4 and **12.6.1** fully assess the impacts of both construction and operation phase noise, and use the output of airborne noise modelling at ecologically-important receptors (i.e. those within the SPA /

Ramsar site that are known to support significant numbers of waterbirds) to demonstrate that disturbance thresholds set out by studies such as Cutts *et al.* (2009 and 2013) and Wright *et al.* (2010) are not exceeded at any locations downstream of the North Tees Mudflat. As such, any effects of noise-related disturbance on the conservation objectives of the SPA and Ramsar site would be driven by impacts on wintering / passage waterbirds using North Tees Mudflat.

As set out in **Section 12.5.4**, the construction phase noise levels at modelled receptors on the North Tees Mudflat range from 46.8 to 59.5 dB L_{Aeq} (continuous noise) and 68.8 to 80.0 dB L_{Amax} (impulsive noise from e.g. pile driving). With the incorporation of the mitigation measures detailed in **Section 12.5.4** (i.e. employment of shrouding around the piling rigs during construction works), the predicted noise levels at the North Tees Mudflat are reduced to 44.8 to 58.5 dB L_{Aeq} and 54.8 to 66.0 dB L_{Amax}.

The Waterbird Disturbance Mitigation Toolkit, developed by Cutts *et al.* (2013), provides noise level thresholds acceptable for 16 different waterbird species based on their respective sensitivities. While this does not cover all of the SPA / Ramsar site features, it does include redshank, the only SPA / Ramsar site feature recorded to date in the site-specific surveys (see **Section 12.4.3**) and the only qualifying feature for which WeBS counts in the two affected count sectors exceed 5%[12] of the SPA reference population (see **Section 12.4.2**). The Toolkit also provides thresholds for knot (a qualifying feature of the SPA / Ramsar site), plus lapwing and sanderling (major component species of the SPA assemblage). According to the Toolkit, redshank and knot are *"particularly sensitive to noise stimuli"*, and the acceptable noise level threshold of 70dB(A) for redshank and knot is the highest of all the species included (Cutts *et al.*, 2013). As such, these are considered to be appropriate representative species for the purpose of the noise disturbance assessment in **Section 12.5.4**.

With the piling shrouding employed, the noise levels produced during construction (including during pile driving) are therefore within the "acceptable" limits for redshank and knot at the nearest modelled receptor (i.e. the downstream section of the North Tees Mudflat). There may be some behavioural responses to impulsive piling noises, including non-flight responses such as head turning, scanning and movement away and/or flight with return, but these would be limited to an estimated forty minutes per day (assuming four rigs, with ten minutes of impact pile driving per day per rig), and there are suitable alternative, unaffected foraging locations within a short distance. This includes upstream sections of the North Tees Mudflat (which extend approximately 1km upstream of the proposed scheme footprint), since noise levels are lower at the central and upstream section, plus other intertidal areas (e.g. Bran Sands, Dabholm Gut, Seal Sands). At worst, therefore, the proposed scheme would lead to some localised, temporary redistribution of sensitive species in the immediate area, likely on the same mudflat.

Modelled predictions of operational noise levels are presented in **Section 12.6.1**. Modelled L_{Aeq} is less than 50 dB at all receptor locations (including North Tees Mudflat), indicating that there would be no noticeable impact on foraging or roosting birds (Cutts *et al.*, 2009; Wright *et al.*, 2010). Threshold exceedances would be sufficiently occasional that there would be no-long-term impacts; regardless, the modelled L_{Amax} is predicted to be no more than 61.9dB at North Tees Mudflat, which falls within the low to moderate range (Cutts *et al.*, 2009 and 2013) and is likely to have no significant behavioural effect according to Wright *et al.* (2010), but as a worst case may lead to non-flight responses.

With the above in mind, the outcome of the assessments set out in **Section 12.5.4** and **12.6.1** is that any impacts on waterbirds within the local area from construction or operation phase noises would be minor

[12] *A 5% threshold was used to determine significant populations within the Teesmouth and Cleveland Coast pSPA/Ramsar Departmental Brief, which is consistent with assessments of the importance of prospective extensions to other sites in England (Natural England, 2018a)*

adverse, at worst. When considering the impacts in the terms of the functioning, distribution and population on a SPA and Ramsar site wide scale, there is no risk of adverse effect on the integrity of the site.

Visual disturbance during construction and operation

In addition to noise disturbances, there may be accompanying visual disturbances due to the presence of construction personnel, plant / machinery, dredgers / other vessels and construction lighting. **Sections 12.5.4, 12.6.1**, **12.6.2** and **12.6.3** fully assess the impacts of both construction and operation phase visual disturbances. As with the noise disturbances outlined above, the assessments demonstrate that visual disturbance thresholds set out by studies such as Cutts *et al.* (2009 and 2013) are not exceeded at any locations downstream of the North Tees Mudflat and Vopak Foreshore. As such, any effects on the conservation objectives of the SPA and Ramsar site would be driven by impacts on the birds using these areas.

Construction phase works (including demolition) are predicted to be undertaken 24 hours a day and, therefore, lighting will be required at night during such works. Additionally, the operational phase will see the use of an estimated 18 lighting columns along the quayside. Under existing conditions there is little light spill from the proposed scheme footprint given its largely derelict nature, however, there is light spill into the water column from operations throughout the majority the estuary. An assessment of the disturbance impacts of artificial lighting on fish, set out in **Section 13.6.2**, concludes that effects associated with lighting would be negligible, therefore any effects on SPA / Ramsar site features would manifest as a direct behavioural response to lighting, rather than as a displacement of food resources.

Given the industrial use of the Tees, it is likely that there will be some level of habituation to riverside lighting. Waterbirds may feed nocturnally and some may actually take advantage of artificial light sources to extend feeding opportunities in darkness (e.g. Dwyer *et al.*, 2013). The area directly affected (i.e. adjacent to the proposed quay) has, as described in **Section 29.5.4**, little value to SPA / Ramsar site features. Regardless, birds that may otherwise be affected will have been displaced from the site during demolition of existing features and excavation of the intertidal area at South Bank. Areas considered to be of higher value, such as North Tees Mudflat, are sufficiently distant to avoid impacts on roosting or foraging behaviour, particularly with the implication of mitigation measures set out in **Sections 12.5.4** and **12.6.3** (i.e. sympathetic placement and orientation of lighting to minimise light spill across the water). As such, the use of artificial lighting is not expected to have any adverse effect on the distribution or extent of qualifying SPA / Ramsar site features either at North Tees Mudflat or on a wider SPA and Ramsar site level.

In addition to the above, the construction phase of the proposed scheme will require various personnel and demolition / construction plant and machinery to be present at South Bank, depending on the nature of the works being undertaken. There is no requirement for personnel or plant to enter the North Tees Mudflat or any other intertidal areas outside the project footprint.

The assessment in **Section 12.5.4** considered the range of potential impacts in terms of a conservative proximity threshold of 300m, as set by Cutts *et al*. (2009 and 2013). This threshold was based on the most sensitive of species considered and is therefore an appropriate threshold to use for SPA / Ramsar site features. Most areas of supporting habitat for waterbirds in the SPA / Ramsar site, including *inter alia* Vopak Foreshore, Bran Sands, Seal Sands and North Gare Sands, lie beyond the 300m threshold and would not be affected by visual disturbance at South Bank. However, at the nearest point North Tees Mudflat is located approximately 250m from the existing South Bank Wharf. According to Cutts *et al.* (2009), at a 250m distance feeding activity may be disrupted by some species taking flight and showing other behavioural changes, such as a potential reduction in feeding.

The 300m threshold is, however, based on the sensitivity of unhabituated birds, whereas at North Tees Mudflat it is likely that most birds would be habituated to activity along the riverbank, given that the Tees along this stretch (including the area immediately downstream of North Tees Mudflat on the northern bank) is characterised by industrial activity. Furthermore, the proximity threshold would only be exceeded at the downstream extent of the mudflat, and only during works at the extreme upstream end of the proposed scheme footprint (not including dredging activities, which are considered separately below), therefore for the majority of the time foraging and roosting SPA / Ramsar site features will be outside of the impact range. At worst, disturbance from the site may lead to some localised, temporary redistribution of sensitive species in the immediate area, likely on the same mudflat. In the context of the wider SPA and Ramsar site, this is not considered to represent a significant change in the distribution of features within the site.

During dredging of the main channel and the turning circle, dredging vessels will operate in close proximity to the North Tees Mudflat and Vopak Foreshore. Most notably, sections of the channel dredge footprint run adjacent to the North Tees Mudflat, therefore the presence of dredging vessels may result in disturbance to waterbirds foraging or roosting on the mudflat. Such disturbance, especially if it is repeated, could reduce the time that birds can feed within the tidal cycle and could therefore potentially reduce the overall feeding efficiency. This can be critical during the winter months and during periods of particularly severe weather when maximising available feeding time is of paramount importance.

The sensitivity of such species is offset by the fact that there is regular vessel traffic in the estuary (there are between 800 and 900 vessel movements in the Tees per month from commercial vessels alone (for more information on shipping movements, refer to **Section 14**). This also includes regular maintenance dredging vessels which operate on an almost daily basis within the channel, including within 30m of the Vopak Foreshore and adjacent to North Tees Mudflat, therefore it is likely that birds foraging on the mudflat would have some level of habituation to such activities. Furthermore, it is likely that there will be further habituation over the proposed capital dredging period and any effects would lessen through the course of the campaign.

Disturbances at Vopak Foreshore would be limited to the approximately one week of dredging required to deepen the Tees Dock turning circle. Disturbance to birds at North Tees Mudflat would be limited to the approximately 4.5 months of dredging required further upstream, but only during times when the dredging transect runs close to the mudflat (for example, when dredging the southern half of the river it is unlikely to have any significant effect on foraging at North Tees Mudflat). It should also be noted that only birds foraging at the downstream end of the North Tees Mudflat would be affected, even when considering a 300m threshold, and the mudflat itself extends over a kilometre upstream of the proposed dredge footprint. As such, any displacement of birds would likely amount to local redistribution on the same area of intertidal.

With the above in mind, the outcome of the assessments set out in **Section 12.5.4, 12.6.2** and **12.6.3** is that any impacts on waterbirds within the local area from construction or operation phase disturbances would be minor adverse, at worst. When considering the impacts in the terms of the functioning, distribution and population at the SPA and Ramsar site scale, there would be no adverse effect on the integrity of the site nor on the achievement of conservation objectives.

29.5.7 Intra-project effects

As well as considering potential effects on SPA features from the individual impact pathways associated with the proposed scheme, it is necessary to understand the interaction between the impact pathways to determine whether, cumulatively, they may result in an adverse effect on the integrity of the site.

Hypothetically, an intra-project cumulative effect could mean that effects (on SPA / Ramsar site features) of, for example, a loss of supporting habitat could be compounded when considered alongside the likely effects of visual or noise disturbance, or effects on prey resources.

It is anticipated that the very low number of SPA features that may be displaced by the demolition and excavation works at South Bank would be likely to relocate at North Tees Mudflat, Vopak Foreshore and/or other appropriate intertidal habitats in the lower Tees. Impacts on North Tees Mudflat and the Vopak Foreshore due to noise and visual disturbance could, in theory, result in further redistribution of the same features. However, as outlined in **Section 29.5.6**, the minor disturbance impacts on North Tees Mudflat and Vopak Foreshore are not anticipated to have a significant effect on the distribution of wintering waterbirds using the site, and any redistribution would likely occur at a highly localised scale (i.e. on the same area of intertidal or on other nearby areas). In other words, while features may relocate from South Bank to North Tees Mudflat and the Vopak Foreshore as a result of lost habitat in the proposed scheme, this local redistribution will not be exacerbated by other disturbances and there is little risk of the combination of impacts resulting in significant adverse effects on the distribution of features at an SPA level.

Conversely, the effects caused by visual and / or noise disturbance at North Tees Mudflat and Vopak Foreshore would not be compounded by the loss of habitat associated with the proposed scheme, since it is likely that any localised displacement would see birds relocate elsewhere on the North Tees Mudflat or the Vopak Foreshore, or to other areas of high-value habitat nearby (e.g. Bran Sands and Lagoon, Dabholm Gut). None of these areas would be affected by the loss of low-value habitat at South Bank.

In terms of intra-project effects on foraging common terns, the zone of influence from the sediment plume associated with the capital dredging has been assumed to represent a temporary loss of foraging habitat in the assessment set out in **Section 29.5.5**. When set into the context of foraging ground availability across the SPA, it has been concluded that there would be no significant effect on the population or distribution of common terns in the SPA. Considering other potential impacts in conjunction with this, the maximum extent of the area would not be increased since the plume is considered to be the most far-reaching effect on tern foraging ability. Regardless, it is likely that common terns foraging in the Tees would be habituated to the various impacts commonly associated with dredging and industrial work in the Tees. As such, the number of birds that may be affected would not change, nor the magnitude of impacts on those that are affected.

With the above in mind, it has been concluded that there would be no adverse effect on the integrity of the SPA / Ramsar site.

29.5.8 Conclusion in light of conservations objectives

The conservation objectives for the Teesmouth and Cleveland Coast SPA are:

"With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified, and subject to natural change:

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- *The extent and distribution of the habitats of the qualifying features.*
- *The structure and function of the habitats of the qualifying features.*
- *The supporting processes on which the habitats of the qualifying features rely.*
- *The population of each of the qualifying features.*
- *The distribution of the qualifying features within the site."*

The assessment presented above has illustrated that impacts arising from the construction phase and operation of the proposed scheme, when considered independently of other projects and plans, will not lead to an adverse effect on the integrity of the SPA or Ramsar site.

29.6 Assessment of in-combination effects

This section considers the in-combination effects of the proposed scheme with other plans and projects screened into the assessment on the Teesmouth and Cleveland Coast SPA and Ramsar site. The potential in-combination effects screened into the assessment comprise:

- effects on the extent, distribution and functioning of supporting habitat;
- disturbance effects on the population and distribution of interest features;
- effects on the distribution of prey resources; and,
- effects on the hydrodynamic and sedimentary regime.

These potential in-combination effects are considered further below.

29.6.1 In-combination effects on the extent, distribution and functioning of supporting habitat

As detailed in **Section 29.5.4**, the potential supporting habitats likely to be affected by the proposed scheme are the intertidal habitats and artificial structures present at South Bank and the subtidal area within and adjacent to the dredging footprint. The proposed scheme will result in the conversion of approximately 2.5ha of intertidal to subtidal habitat, demolition of artificial structures and dredging of an area of approximately 32.5ha of subtidal habitat. While this is not anticipated to have an adverse effect on the integrity of the SPA / Ramsar site when considering the proposed scheme alone, the effects on SPA / Ramsar site features may be compounded should other projects and plans have an effect on similar habitats.

As stated in **Section 29.5.4**, the effects of capital dredging on subtidal habitat are considered to be temporary, with a return to baseline conditions expected upon completion (i.e. a seabed community characteristic of a disturbed environment regularly affected by ongoing maintenance dredging). Impacts on the subtidal from the scheme, therefore, do not represent a long-term change to the extent, distribution or functioning of this as a supporting habitat; consequently, there is no risk of in-combination effects with other projects. As such, projects that may have an in-combination effect are those that may result in loss or change in subtidal within the SPA and Ramsar site, i.e. the adjoining South Industrial Zone scheme, the NGCT scheme, the Anglo American Harbour Facilities scheme, the Dogger Bank Teesside A and Sofia project and the proposed new cinema development project at Redcar. The Hartlepool approach channel would not result in the loss of intertidal as all works are located within the subtidal. There is therefore no pathway for in-combination effect on potential feeding grounds with the proposed scheme.

HRAs produced for each of the above projects have indicated that, when considered alone, none of the projects will have a significant effect on the distribution and extent of supporting habitats within the SPA / Ramsar site, though cumulatively there will be a greater overall loss in supporting habitat than when considering each of the projects in isolation. The NGCT scheme will result in a loss of 1.19ha of intertidal habitat, though it was concluded in the HRA for the scheme that this represents poor quality habitat that is not important for foraging waterbirds. Likewise, 3.6ha of poor quality, semi-artificial intertidal habitat is predicted to be lost during the Anglo American Harbour Facilities scheme, which will be offset by habitat enhancement in Bran Sands Lagoon as part of the same scheme and will result in a net gain in supporting habitat. In the South Industrial Zone scheme (adjacent to the proposed scheme), 11ha of saltmarsh, open water and intertidal mud will be lost, including ‘The Slems’ (an area of wetland), though the HRA for that scheme concludes that the site is not used by a significant number of SPA / Ramsar features (based on the findings of invertebrate sampling undertaken on sediment samples from The Slems). The HRA undertaken for the new cinema development at Redcar concluded no LSE associated with habitat loss for any of the SPA and Ramsar site species and therefore no further assessment of this project is required.

None of the above projects will result in any loss to key areas of intertidal supporting habitat referred to in the site citation or the supporting scientific evidence (Natural England, 2018a), such as *inter alia* North Tees Mudflat, Bran Sands, Seal Sands, North Gare Sands. In all instances, the respective HRAs for the above schemes conclude no adverse effects from the schemes in isolation, due to the low value of the affected habitat and the low number of SPA / Ramsar site features affected. As such, the further loss of 2.5ha of similarly low-value intertidal habitat at South Bank would not be expected to significantly affect the distribution of features within the site. To put into context, the intertidal habitat loss within the SPA from the proposed scheme in combination with the NGCT scheme represents less than 1% of “intertidal sediment” habitat within the estuary alone (let alone when including intertidal areas in coastal waters). The South Industrial Zone is outwith the boundary of the SPA and habitat loss in the Anglo American Harbour Facilities scheme will be offset by the habitat enhancement measures and therefore these projects have been excluded from the calculation above.

In light of the above, the in-combination effects on the extent and functioning of supporting habitat at the SPA and Ramsar site level are not considered to be significant, hence there would be no adverse effect on the integrity of the site.

A further HRA is to be undertaken for the South Industrial Zone scheme at the reserved matters stage, so any updates in the use of the site by SPA features (i.e. following the completion of wintering bird surveys) will be encompassed in the in-combination assessment undertaken at that stage for that project.

29.6.2 In-combination disturbance effects on the population and distribution of SPA / Ramsar site features

While disturbances arising from the proposed scheme are not anticipated to result in any adverse effects on SPA / Ramsar site features when considered in isolation, this section assesses the potential for combined disturbances from other projects to compound the potential disturbance impacts. This would only be a possibility in the unlikely event that at least one of the other schemes coincides temporally with the proposed scheme.

Without mitigation in place, the construction phase of the proposed scheme may result in redistribution of wintering waterbirds at North Tees Mudflat as a result of disturbance from noise-related impacts (notably the impulsive noises from impact pile driving). In the unlikely event that other projects coincide with the proposed scheme, which also result in disturbances to SPA / Ramsar site features, such effects could be compounded on an estuary wide scale. However, with the use of shrouding on piling rigs during the proposed scheme, the significantly reduced noise levels at the nearest sensitive intertidal receptor (North Tees Mudflat) are not expected to result in any significant effects on SPA / Ramsar site features (see **Section 29.5.6**). At worst this would lead to some localised, temporary redistribution of sensitive species in the immediate area, likely on the same mudflat.

As such, in-combination effects on waterbirds can only occur if there is likely to be noise-related disturbance that prevents local redistribution on the North Tees Mudflat or other nearby areas of mudflat, which consequently could see more widespread movement away from the site. The nearest projects are the adjacent South Industrial Zone scheme, the Anglo American Harbour Facilities scheme and the NGCT scheme. The proposed new cinema development at Redcar and the proposed Hartlepool approach channel scheme would result in disturbance to SPA features, but the effect would be spatially separated from that arising from the proposed scheme and any impacts would not interact. Hence, an in-combination effect is not predicted in conjunction with the construction of operational phases of the proposed scheme.

The Anglo American Harbour Facilities ES (Royal HaskoningDHV, 2015) presented the findings of a cumulative noise impact assessment of the NGCT, Dogger Bank Teesside A & Sofia project and the Harbour Facilities project. The assessment concluded that the cumulative impact of noise and vibration on sensitive receptors was not predicted to be significant at any of the noise-sensitive receptor sites considered, and the noise sources are sufficiently distant that wintering waterbirds using the North Tees Mudflat would not be affected. The South Industrial Zone is immediately landward of the proposed scheme, but best practice mitigation measures will be in place and noise levels within the SPA would be less than 50dB(A) (i.e. below the disturbance thresholds set out in Cutts *et al.* (2009 and 2013)) and would not have a disturbance effect on waterbirds using the North Tees Mudflat. In any case, noise impacts from the proposed scheme and other projects are mostly associated with the construction works and would be temporary in nature, therefore there would be no long-term impacts on waterbirds. As such, significant in-combination effects on the distribution and population of waterbirds at the SPA and Ramsar site scale would not occur.

Construction and operation activity at the site of the demolition, intertidal excavation and quay construction are not anticipated to cause significant visual disturbance to waterbirds roosting or foraging on North Tees Mudflat. Such activities, therefore, are not likely to have any effect on the functioning or distribution of SPA / Ramsar site features and would not contribute to in-combination effects from other nearby plans and projects. However, dredging activity may, at worst, lead to some localised redistribution on North Tees Mudflat and the Vopak Foreshore due to visual disturbance. This is anticipated to be highly localised, and would have no bearing on distribution of SPA / Ramsar site features in the wider estuary, therefore the only other projects that may have in-combination effects on the integrity of the site are those that would similarly affect North Tees Mudflat and the Vopak Foreshore.

The South Industrial Zone scheme, located immediately landward of the proposed scheme, will include the erection of hoardings around the site to minimise the visual disturbance risk from personnel and low-level equipment / machinery. Regardless, it is further from the North Tees Mudflat / Vopak Foreshore than the proposed scheme and lies outwith the 300m threshold stated within the Waterbird Disturbance & Mitigation Toolkit (Cutts *et al.,* 2013). Other projects, such as the NGCT scheme, the Anglo American scheme and the ongoing PDT maintenance dredging, have the potential to cause similar disturbance to the Vopak Foreshore and / or North Tees Mudflat due to dredging activity in the channel. However, the dredge footprint for the proposed scheme overlaps in part with the NGCT dredge footprint at the Tees Dock turning circle. The dredge at Tees Dock turning circle would therefore only be undertaken by one of these schemes, which reduces the potential for in-combination disturbance to birds at Vopak foreshore. Maintenance dredging within the estuary occurs on an almost daily basis; such dredging was ongoing at the time the SPA and Ramsar site was extended and has been occurring for many years. It is therefore concluded that dredging does not cause significant visual disturbance to birds within the SPA and Ramsar site. Consequently, should dredging for all schemes screened into the assessment be required at the same time (which is highly unlikely), a significant in-combination visual impact is not expected.

With this is mind, it is concluded that there would be no adverse effects on the integrity of the SPA / Ramsar site due to disturbance.

29.6.3 In-combination effects on the distribution of prey resources

Effects on fish may be compounded by the combined sediment plumes of other projects or plans that may lead to increases in SSC, which would infer a consequent effect on foraging common terns. As such, projects that may have an in-combination effect with the proposed scheme are the NGCT scheme, the Anglo

American Harbour Facilities scheme, Dogger Bank Teesside A & Sofia offshore cable works, the Hartlepool approach channel scheme and the ongoing maintenance dredging by PDT.

An interaction between the sediment plumes would only occur in the unlikely event that the capital dredging for the proposed scheme should overlap (temporally) with elements of at least one other project which may lead to increased SSC. Furthermore, to affect the foraging of common terns in the SPA / Ramsar site, the programmes would both have to overlap with the breeding season for this species (i.e. May to August). If the programmes do overlap, the effect is predicted to be a greater increase in SSC than that predicted as a result of the proposed scheme in isolation, and across a wider area, although it should be noted from the assessment in **Section 29.5.5** that the area of foraging habitat likely to be affected by the proposed scheme is minute.

The ES for the NGCT scheme (Royal HaskoningDHV, 2020) concluded that the scheme would have a negligible effect on feeding resources for terns. When this is considered alongside the localised increase in SSC from the proposed scheme described in **Section 29.5.5**, the combined effect on potential common tern foraging areas is predicted to remain very low in the context of the available foraging habitat in the SPA. Plumes from each project would be temporary and short-lived. The same applies for the Anglo American Harbour Facilities scheme and the Dogger Bank Teesside A & Sofia cable works; assessments for each (Royal HaskoningDHV, 2015, Forewind, 2014) indicate that the area affected by the individual projects is small and all effects are temporary. Again, in the context of the foraging habitat available, the effect of the combined plumes is expected to be minor.

The magnitude of the potential effect on water quality due to the consented Hartlepool approach channel is low, with any effect confined to the footprint of the proposed dredge. The predicted increase in suspended sediment from Hartlepool channel is not considered sufficient to result in a lethal effect on fish, with any impact dissipating within 10 minutes following completion of the dredge (Royal HaskoningDHV, 2018).

The HRA for the NGCT scheme (Royal HaskoningDHV, 2020) indicated that there would be no adverse effect on the integrity of the SPA / Ramsar site as a result of in-combination effects with the Anglo American Harbour Facilities scheme, the ongoing maintenance dredging and the Dogger Bank Teesside A & Sofia cable works. In the context of the overall foraging area available to common terns within the SPA (an area of approximately 9,400ha (Natural England, 2018a)), the inclusion of localised, temporary and short-lived effects from the proposed scheme are not considered to significantly change this conclusion.

It should be noted that the mitigation measures described for the proposed scheme in **Section 12.5.2** (i.e. dredging transects oriented along the axis of the river rather than across to ensure that, at any one time, sediment plumes occupy only half of the river cross section) has also been proposed for the NGCT project. For the Anglo American Harbours facilities scheme specialist dredging equipment (i.e. an enclosed grab loading into a sealed barge) will be used for dredging of unconsolidated material to minimise resuspension in the water column. With mitigation measures in place for all schemes, the combined impact will be reduced as far as possible, and the risk of creating barriers to prey fish movement and stretches of turbid water spanning the width of the river is minimised. Common terns are mobile foragers and, given that there is extensive (and on-going) maintenance dredging within the channel on an almost-daily basis, common terns from Saltholme are likely to be habituated to foraging in spite of regular disturbances to water quality in the Tees.

With the above taken into consideration, there are expected to be no significant adverse effects on common tern distribution or foraging ability even when considering the in-combination effects of increased SSC from the aforementioned projects.

Sections 9.5.3 and **12.5.3** assess the impacts of the proposed scheme on the benthic food resources in the intertidal zone at North Tees Mudflat and any other locations outside the project footprint; in summary, there are anticipated to be no significant effects on the availability of such resources for foraging waterbirds. As such, there is no pathway by which effects on the distribution of prey resources from other projects and plans may be compounded by the proposed scheme.

As such, it can be concluded that in-combination effects are not likely to have significant adverse effect on the foraging ability of any SPA / Ramsar site features as a result of indirect impacts on food resources.

In summary, there would be no adverse effect on the integrity of the SPA and Ramsar site.

29.6.4 In-combination effects on the hydrodynamic and sedimentary regime

Given the marine nature of this potential effect, all other plans and projects screened into the assessment on land are excluded. The ongoing maintenance dredging is also not considered here as this forms part of the baseline environment.

As reported in **Section 6**, there are no predicted changes in water level or wave conditions near the site or in the wider estuary, other than locally in the area of newly set-back quay. The change in the overall tidal prism of the estuary will be minor (0.8% increase) and is not deemed to be a cause of significant estuary-wide change in hydrodynamics. There is no predicted effect on the baseline sediment transport regime and seabed or shore morphology across the wider study area of the Tees Estuary or Tees Bay. The potential increase in maintenance dredging requirement is not expected to be significant and could easily be managed within existing maintenance dredging and offshore disposal regimes.

With regard to NGCT, it is predicted that there would be an increased supply of material to the Tees estuary from offshore (by 10%). This effect arises due to the deepening of the approach channel through the mouth of the Tees and the resultant effect on tidal flows and sediment transport.

The studies for the Anglo American Harbour Facilities concluded that the Harbour Facilities would not change the supply of fine sediment to the Tees, and the sediment predicted to deposit in its berth pocket would be material that would have deposited in the approach channel anyway. Such material would have been subject to maintenance dredging and offshore disposal as part of ongoing maintenance dredging. Predicted modelling for the Anglo American Harbour Facilities scheme concluded that there would be no potential for an effect on the sediment budget of the estuary to arise and, therefore, there would be no impact on morphology of intertidal areas.

Sedimentary and hydrodynamic modelling undertaken for the consented Hartlepool approach channel project confirmed that the magnitude of effect on tidal hydrodynamics and wave regime arising from the proposed scheme is predicted to be low. The magnitude of effect on the baseline sediment transport regime and seabed morphology arising from the Hartlepool approach channel scheme during its operational phase is medium, directly in the vicinity of the approach channel. There is no predicted effect on the baseline sediment transport regime and seabed or shore morphology across the wider study area as a result of Hartlepool approach channel. Given the localised nature of potential effects during the operational phase of the Hartlepool approach channel scheme, it is concluded that there is no pathway for in-combination effects with the proposed scheme.

29.6.5 Overall in-combination effects

As well as considering potential in-combination effects on SPA features from the individual impact pathways, it is necessary to understand the interaction between impact pathways to determine whether, cumulatively, they may result in an adverse effect on the integrity of the site.

When considering the in-combination effects of intertidal habitat loss, visual and noise disturbance, displacement of foraging resources for piscivorous species and effects on the hydrodynamic scheme together, this has the potential to have an increased effect on SPA / Ramsar site features than when one impact pathway is considered in isolation. Hypothetically, in-combination effects (on SPA / Ramsar site features) of, for example, a loss of supporting habitat could be compounded when considered alongside the likely in-combination effects of visual or noise disturbance, or effects on prey resources.

The same rationale for assessing intra-project effects of the proposed scheme alone (see **Section 29.5.6**) equally applies when assessing the combined inter-project effects. Again, it is anticipated that the value of the intertidal habitat lost across all projects is low, and any SPA / Ramsar site features that may be displaced due to a loss of habitat in the various projects would likely relocate to higher value sites (e.g. exposed mudflats) known to be important for supporting such features. With regard to the proposed scheme, this will most likely include North Tees Mudflat and the Vopak Foreshore. Impacts on North Tees Mudflat and the Vopak Foreshore due to the disturbances arising from the proposed scheme and other projects could, in theory, result in further redistribution of features. However, as outlined in **Section 29.6.2**, there are no significant in-combination disturbance effects on the North Tees Mudflat and Vopak Foreshore and any redistribution would likely occur at a highly localised scale, without the need for wider displacement. In other words, while features may relocate from South Bank to North Tees Mudflat and the Vopak Foreshore as a result of lost habitat in the proposed scheme (and others), this local redistribution will not be exacerbated by other disturbances and there is little risk of the combination of impacts resulting in significant adverse effects on the distribution of features at an SPA level.

Conversely, the effects caused by combined disturbances at North Tees Mudflat and Vopak Foreshore would not be compounded by direct loss of intertidal habitat due to the proposed scheme and other projects, since it is likely that any localised displacement would see birds relocate elsewhere on the North Tees Mudflat or the Vopak Foreshore, or to other areas of high-value habitat nearby (e.g. Bran Sands and Lagoon, Dabholm Gut). None of these areas would be lost due to the proposed scheme or any others.

The zone of influence from predicted sediment plumes (including the combined plumes from the proposed scheme, the NGCT scheme, the Anglo American Harbour Facilities scheme and the Hartlepool approach channel scheme) would encompass the marine area affected by other impacts, such as visual and/or noise disturbance. Given that the conclusion of no adverse effect described in **Section 29.6.3** was based on assumed temporary loss of such habitat for foraging common terns, there is no additional area that may be affected by a combination of impact pathways nor would there be an increase in the average number of birds affected. Again, it is likely that common terns foraging in the Tees would be habituated to the various impacts commonly associated with dredging and industrial work in the Tees, regardless. As such, the conclusion from **Section 29.6.3** remains valid when considered alongside the other impacts described in this assessment.

With the above in mind, it has been concluded that there would be no adverse effects on the integrity of the SPA / Ramsar site.

29.7 Conclusion

In light of the conservation objectives for the Teesmouth and Cleveland Coast SPA, it is predicted that the proposed scheme, when assessed alone and in-combination with other plans and projects, will not have an adverse effect on the integrity of the Teesmouth and Cleveland Coast SPA and Ramsar site.

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