# 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).

## 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.

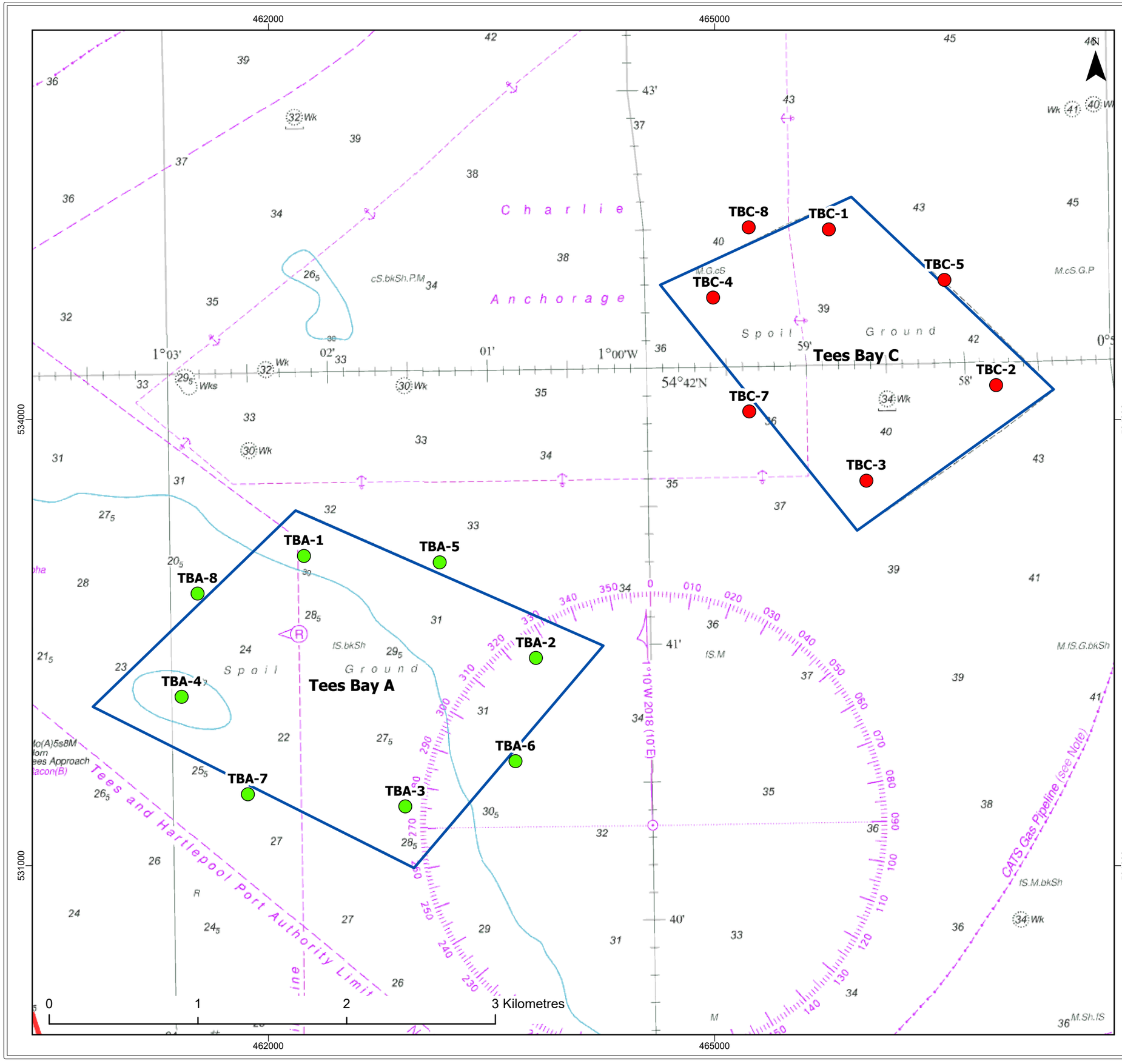
***Mitigation measures and residual impact***
No mitigation measures are required. There would be a residual impact of **negligible** significance**.**

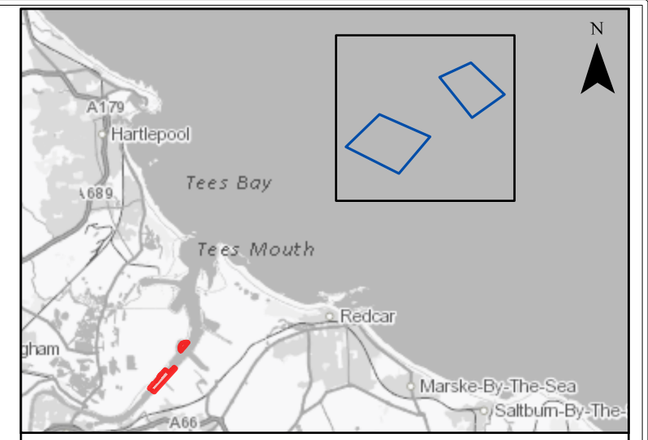
### 26.3.2 Benthic ecology

**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: | Project: |
|---|---|
| Tees Valley Combined Authority | South Bank Quay |

Title:

Location of grab samples within and adjacent to the Tees Bay offshore disposal sites from 2019

Figure: 26.1

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| 0 | 30/10/2020 | TC | SR | A3 | 1:25,000 |

Co-ordinate system: British National Grid

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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 | | | |

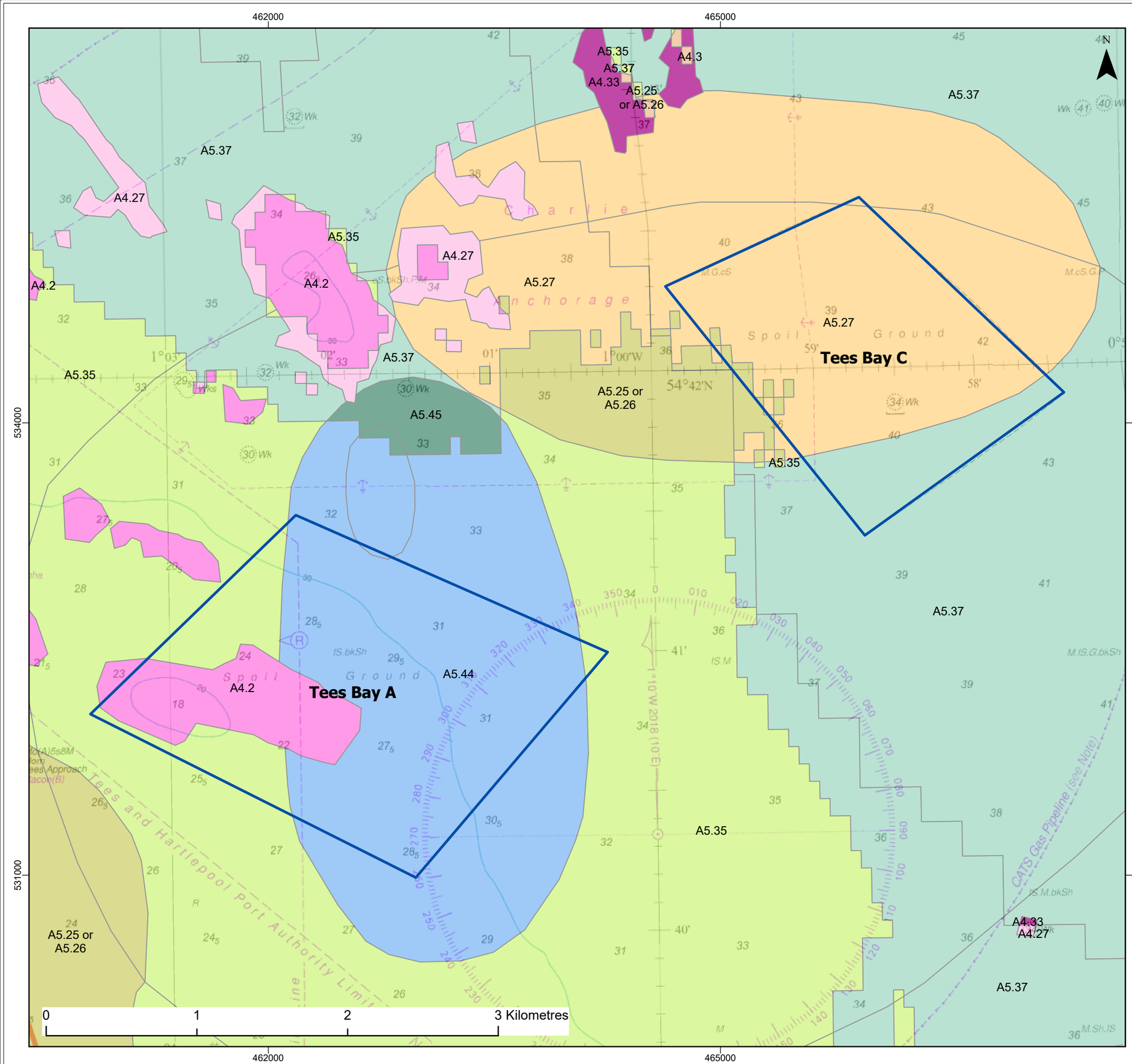
The short-term impact of the disposal activity would be expected to smother the seabed within the footprint of the disposal site. Hydrodynamic and sedimentary modelling has predicted some short-term build-up of sediment at the disposal site, however, this would be dispersed over time.

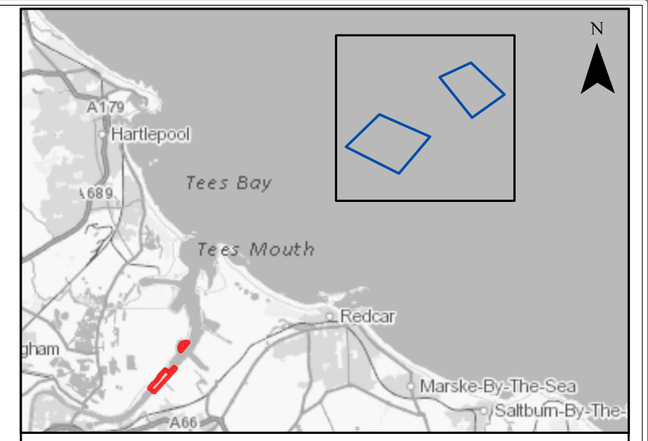
Based on the information available from MarLIN, the species which was by far the most abundant within the samples recovered in and adjacent to the Tees Bay C offshore disposal site (i.e. *Sabellaria spinulosa*) is not sensitive to smothering or increases in suspended sediment.

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: | Project: |
|---|---|
| Tees Valley Combined Authority | South Bank Quay |

Title:

**Broad-scale Seabed Habitat Mapping at the Tees Bay Offshore Disposal Sites**

Figure: 26.2

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Co-ordinate system: British National Grid

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**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.**

## 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<br>1.54$km^2$ |
| | Minke whale | 179 dB re 1 µPa MF $SEL_{cum}$ | <0.01km<br>0.003$km^2$ |
| | Grey and harbour seal | 181 dB re 1 µPa PW $SEL_{cum}$ | <0.01km<br>0.003$km^2$ 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**).

*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.