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.

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**).

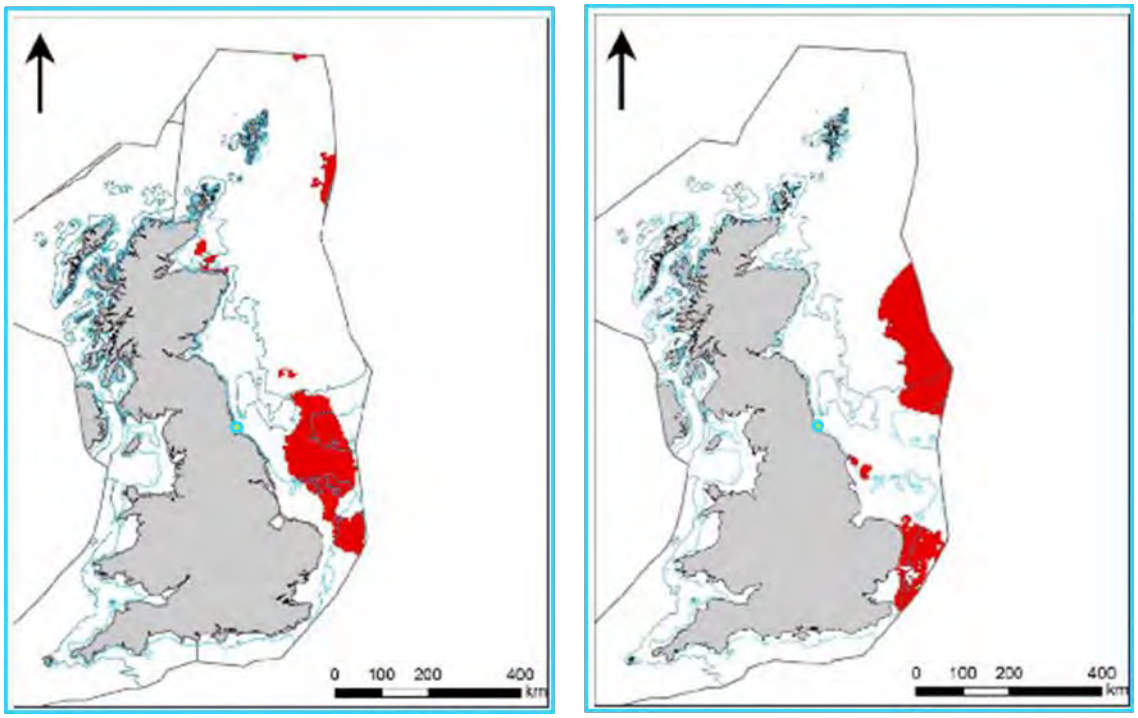


Figure 10.1 Persistent high-density areas identified during the summer months. The red colours mark areas with where persistent high densities as defined by the upper 90th percentile have been identified (Heinänen and Skov, 2015). The approximate location of the proposed scheme is indicated by the blue 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

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).

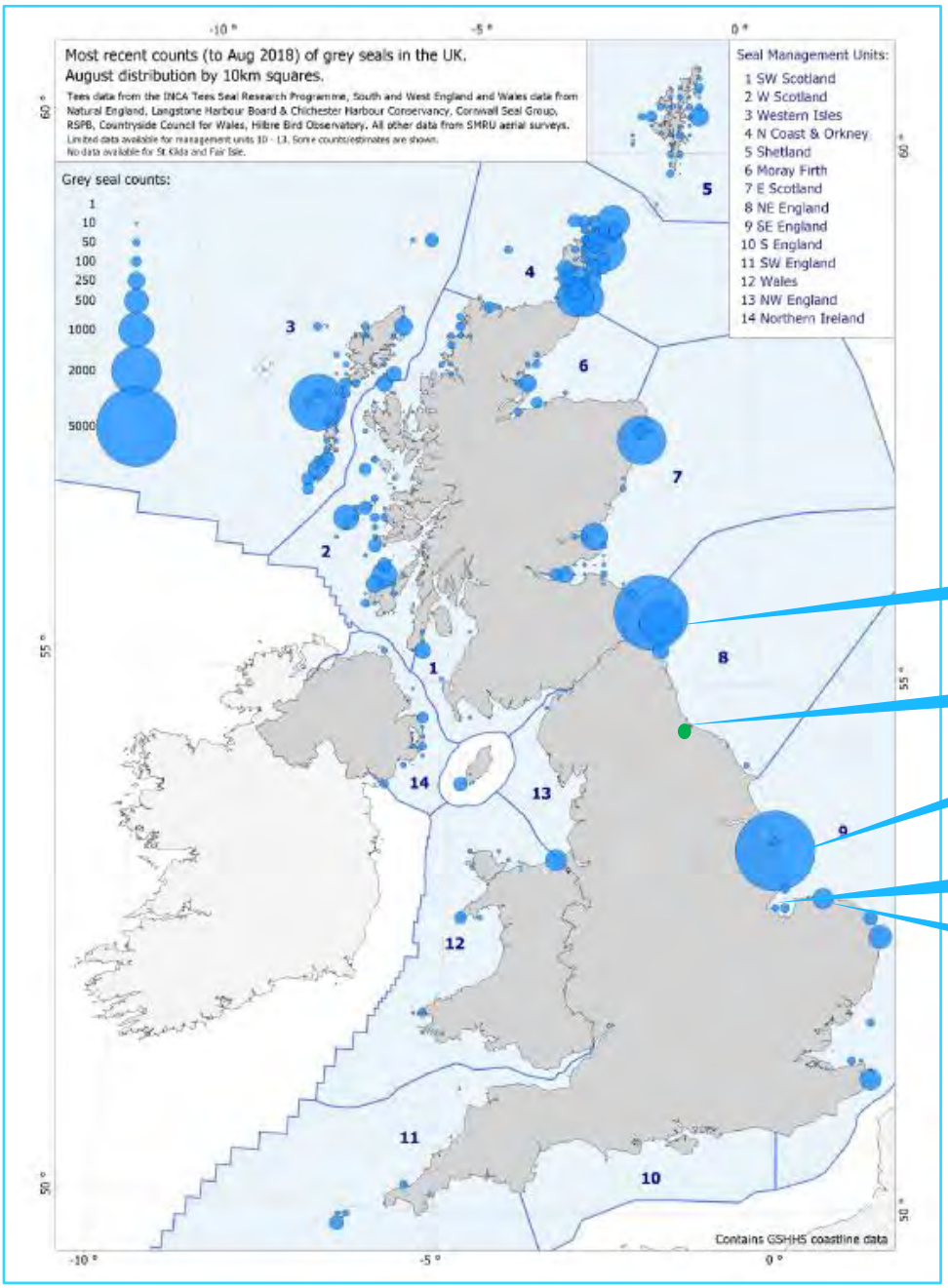
The most recent counts of grey seal in the August 2017 surveys estimated that the total count of grey seals in the UK was 42,997 (SCOS, 2019). The grey seal MU within which the proposed scheme is located is the North-East England MU (**Figure 10.2**), which has an estimated population of 6,502 (SCOS, 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).



The Farne Islands

Seal Sands

Donna Nook

The Wash

Blakeney Point

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).

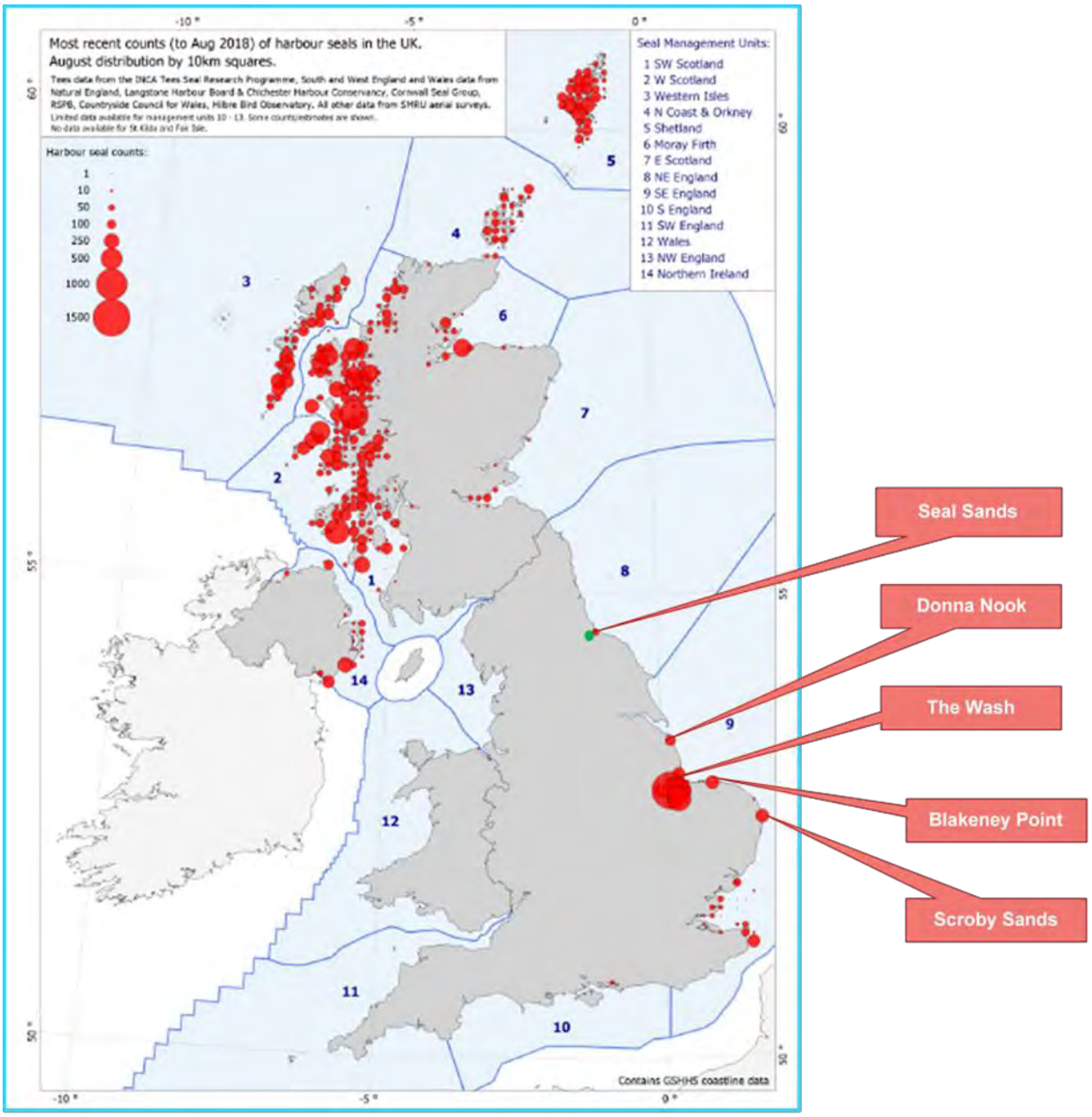


Figure 10.3 Location of the major harbour seal haul-out sites and the populations around the UK coasts (SCOS, 2019). The location of the proposed scheme is indicated by the green dot.

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.

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 μPa^2s)
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 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.