7 MARINE SEDIMENT AND WATER QUALITY

7.1 Introduction

7.1.1 This section of the ES describes the existing environment in relation to marine water and sediment quality and assesses the potential impacts of the construction, operation and decommissioning phases of the proposed scheme (decommissioning is considered in this context, given the potential for the decommissioning of the conveyor to influence suspended sediment levels in Dabholm Gut). Proposed mitigation measures are detailed and a discussion of the residual impacts is presented, where significant impacts have been identified.

7.1.2 This section has been informed by the findings of the modelling studies undertaken to predict the potential effects of the proposed scheme on the hydrodynamic and sedimentary regime and, therefore, references are made to these findings throughout this section, as appropriate.

7.2 Policy, legislation and consultation

National Policy Statement for Ports

7.2.1 The assessment of potential impacts on marine water and sediment quality has been made with reference to the NPS for Ports. **Table 7-1** summarises the requirements of the NPS which are of relevance to this section of the ES.

Table 7-1 Summary of NPS for Ports requirements with regard to marine water and sediment quality

NPS for Ports requirement	NPS reference	ES reference
Infrastructure development can have adverse effects on the water environment, including groundwater, inland surface water, transitional waters and coastal waters. During the construction, operation and decommissioning phases, it can lead to increased demand for water, involve discharges to water and cause adverse ecological effects resulting from physical modifications to the water environment.	Section 5.6, paragraph 5.6.1	Section 7.5 and Section 7.6
There may be increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health or on protected species and habitats and could, in particular, result in surface waters, groundwaters or protected areas failing to meet environmental objectives established under the Water Framework Directive.	Section 5.6, paragraph 5.6.2	Section 7.5 and Section 7.6
Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of, the proposed project on water quality, water resources and physical characteristics of the water environment as part of the ES or equivalent.	Section 5.6, paragraph 5.6.3	Section 7.5 and Section 7.6

Relevant legislation

7.2.2 The principal European and International legislation used to inform the assessment of the potential impact on marine water and sediment quality for this proposed scheme includes:

- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (the Water Framework Directive (WFD));
- Directive 76/464/EEC Water pollution by discharges of certain dangerous substances (Dangerous Substances Directive) and Priority Substances Directive (2008/105/EC);
- Directive 91/271/EC concerning urban waste water treatment (Urban Waste Water Directive)
- Directive 91/676/EC concerning the protection of waters against pollution caused by nitrates from agricultural sources (the Nitrates Directive);
- Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (the Marine Strategy Framework Directive);
- Directive 2006/7/EC concerning the management of bathing water quality and repealing Directive 76/160/EEC (the Bathing Waters Directive); and,
- The International Convention for the Prevention of Marine Pollution by Ships (MARPOL Convention) 73/78.

7.2.3 The European Directives listed above are transposed into UK law through a number of regulations, set out below.

Water Framework Directive

7.2.4 As set out in **Section 2**, the WFD is a key piece of European legislation relating to the protection of water quality and the ecological status of freshwaters, transitional waters and coastal waters out to one nautical mile (nm).

7.2.5 The WFD provides a mechanism by which regulatory controls on human activities, that have the potential to impact on water quality, can be managed effectively and consistently. In addition to a range of inland surface waters and groundwater, the WFD covers transitional waters (estuaries and lagoons) and coastal waters out to 1nm. The WFD is implemented in England and Wales primarily through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (known as the Water Framework Regulations).

7.2.6 UK surface waters have been divided into a number of discrete units termed 'water bodies', with typologies that relate to both their physical and ecological characteristics. Based on ecology and water quality, these water bodies have then been classified into different status classes which have specific objectives in relation to achieving good ecological status.

7.2.7 The WFD requires that all inland and coastal waters must reach at least 'good' status by 2015 and that the status of all surface water bodies should not deteriorate. Individual water bodies that have been modified to the extent that it will not be possible for them to meet the WFD targets are categorised as Heavily Modified Water Bodies.

7.2.8 The WFD is relevant to this chapter as it provides context for the assessment of water quality impacts (also see Priority Substances Directive below). A WFD compliance assessment has been undertaken for the proposed scheme and forms Accompanying Document 2.

Priority Substances Directive / Dangerous Substances Directive

7.2.9 The Priority Substances Directive (2008/105/EC) is implemented in England and Wales by the River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Direction 2010. Compliance with these standards forms the basis of good surface water chemical status under the WFD. The EQSs within this Directive supersede EQSs initially introduced by the Dangerous Substances Directive (76/464/EEC). However, where EQSs are not listed for substances, limit values set by the Dangerous Substances Directive and its daughter Directives remain in force.

7.2.10 The EQSs under the Dangerous Substances Directive and Priority Substances Directive for selected List I substances (substances for which uniform emission standards are stipulated) are shown in **Table 7-2**.

Table7-2 Selected List I Dangerous Substances (Environment Agency, 2011)

Substance	EQS Type	EQS under Priority Substances Directive (annual average, μg/l)	EQS under Dangerous Substances Directive (annual average, μg/l)
Mercury (dissolved)	Annual average	0.05	0.3
Cadmium (dissolved)	Annual average	0.2	2.5
HCH (Lindane)	Annual average	0.002	0.02
Total DDT	Annual average	0.025	0.025
ppDDT	Annual average	0.01	0.01
Pentachorophenol	Annual average	0.4	2
Aldrin	Annual average	Σ = 0.01	0.01
Dieldrin	Annual average	Σ = 0.01	0.01
Endrin	Annual average	Σ = 0.01	0.005
Isodrin	Annual average	Σ = 0.01	0.005
Total 'Drins'	Annual average	-	0.03
Hexachlorobenzene	Annual average	0.01	0.03
Hexachlorobutadiene	Annual average	0.1	0.1
Carbon tetrachloride	Annual average	12	12
Chloroform	Annual average	-	12
1,2-dichloroethane	Annual average	10	10

Substance	EQS Type	EQS under Priority Substances Directive (annual average, µg/l)	EQS under Dangerous Substances Directive (annual average, µg/l)
Trichloroethyleme	Annual average	10	10
Perchloroethylene	Annual average	-	10
Trichlorobenzene	Annual average	0.4	0.4

7.2.11 The EQSs for selected List II substances (substances for which member states have determined EQSs) are shown in **Table 7-3.** **Table 7-3** also includes the relevant EQSs under the Priority Substances Directive (where applicable).

Table 7-3 Selected List II Dangerous Substances (Environment Agency, 2011)

Substance	EQS Type	EQS under Priority Substances Directive (annual average, µg/l)	EQS under Dangerous Substances Directive (annual average, µg/l)
Arsenic (dissolved)	Annual average	-	25
Chromium (dissolved)	Annual average	-	15
Copper (dissolved)	Annual average	-	5
Lead (dissolved)	Annual average	7.2	25
Nickel (dissolved)	Annual average	20	30
Tributyl tin (TBT)	Maximum concentration	0.0002	0.002
Zinc (total)	Annual average	-	40

Bathing Waters Directive

7.2.12 The Bathing Waters Directive (76/160/EEC) is implemented through the Bathing Waters Regulations 2008. The Environment Agency monitors and assesses bathing water quality at each designated bathing water in England and Wales between May and September. A resulting annual water quality classification is then allocated for every season. This classification is calculated from 20 samples on the basis of concentration of bacteria in each of the following groups:

- Total coliforms.
- Faecal coliforms.
- Faecal streptococci.

7.2.13 Designated bathing waters also come under the umbrella of protected areas as identified by the WFD and this Directive will be replaced by the revised Bathing Waters Directive (2006/7/EC) in 2015. This new Directive aims to set more stringent water quality standards and also puts a stronger emphasis on beach management and public information. General parameters to be assessed and reduced, and which will replace the bacterial parameters listed above, comprise:

- *Escherichia coli*.
- Intestinal enterococci.

7.2.14 The new Directive also proposes to put in place three new compliance categories – excellent, good and sufficient (the existing poor quality category remains). The Government will be required to ensure that all bathing waters are of sufficient standard by 2015 and that appropriate measures are taken to increase the number of bathing waters classified as excellent or good. Classification will be based on four years' worth of data.

Marine Strategy Framework Directive

7.2.15 The objective of the Marine Strategy Framework Directive (2005/56/EC) (MSFD) is to achieve ''good environmental status'' in Europe's seas by 2020, to enable the sustainable use of the marine environment and to safeguard its use for future generations.

7.2.16 The MSFD establishes a comprehensive structure within which EU Member States are required to develop and implement the cost effective measures necessary to achieve or maintain ''good environmental status'' in the marine environment.

7.2.17 The Directive establishes European Marine Regions and requires Member States to apply an ecosystem based approach to the management of human activities. The timetable for implementation of the strategy is from July 2010 through to December 2016. In the UK, the Directive is implemented via the Marine Strategy Regulation, 2010.

7.2.18 In coastal waters out to 1nm, both the WFD and the MSFD apply. However, in these areas, the MSFD only applies for aspects of good environmental status that are not already addressed by the WFD. These include issues such as the impacts of marine noise and litter, and certain aspects of biodiversity, but not water quality.

MARPOL Convention

7.2.19 The UK is also a signatory to the International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) and all ships flagged under signatory countries are subject to its requirements, regardless of where they sail. The convention includes regulations aimed at preventing and minimising pollution from ships, both accidental and that arising from routine operations.

Consultation

7.2.20 **Table 7-4** provides a summary of comments received from PINS through its Scoping Opinion (**Appendix 4.2**) and during consultation under Section 42 of the Planning Act 2008 of relevance to marine sediment and water quality.

Table 7-4 Summary of comments in the PINS Scoping Opinion and received under Section 42 of the Planning Act 2008 with regard to marine sediment and water quality

Consultation Comment	Response / Section of the ES in which the comment has been addressed
Scoping Opinion (January 2014)	
Secretary of State	
The Secretary of State was pleased to note that a site specific sediment quality survey will be carried out at the proposed berth pocket and the methodology will be agreed in consultation with Cefas and the MMO.	The results of the sediment quality survey were not available for inclusion with the PER, however the results have been used to inform this section of the ES.
The Secretary of State notes that the Environment Agency will be consulted to gather data on water quality on and around the site. The applicant is not proposing to carry out any water quality sampling. The Secretary of State advises that the approach is agreed with the Environment Agency and the MMO, and relevant water quality sampling carried out as necessary.	The approach to the sediment and water quality assessment was presented within the PER. Environment Agency water quality data was also included in the PER.
The ES should include an assessment of potential impact of the release of polyhalite entering the water environment, and describe the measures that would be taken to prevent any identified risk.	**Section 7.6**
Environment Agency	
The EIA should provide results of sediment quality testing from the berth pocket and dredge channel.	**Section 7.4**
The commitment to undertake a WFD compliance assessment was welcomed. It was recommended that this is presented in a separate section within the ES.	**Accompanying Document 2**
MMO	
The MMO considers that the potential impacts on marine sediment and water quality must be assessed with relation to sensitive marine receptors such as shell fisheries, spawning and nursery areas, benthic ecology and migratory routes.	**Section 8** and **Section 11**
The MMO concurs with the list of analyses proposed.	Point noted regarding the list of analyses proposed.
Natural England	
Further information on the chemical and thermal natures of the discharge from the materials handling facility, and where/how it will be discharged should be provided to enable assessment of impact on habitat quality for Special	See footnote below table

Consultation Comment	Response / Section of the ES in which the comment has been addressed
Protection Area (SPA) qualifying features*.	
If there is potential for release to the environment, the effects of polyhalite/potash on the marine environment should be fully assessed.	**Section 7.6**
The impact of piled structures within the marine environment will need to be fully assessed with respect to receptors including fish, marine mammals, birds, contaminated sediment and benthic communities.	**Sections 7.5**, **8.5**, **9.5** and **11.5**
An appraisal of dredging techniques and their associated impacts on the marine environment in relation to water quality and suspended sediment concentrations (SSC) and designated sites should be presented in the EIA.	**Section 7.5**
Section 42 consultation	
Environment Agency	
Sediment contamination results should be made available at the earliest opportunity to allow consideration of options for the fate of dredged spoil. Monitoring of sediment levels needs to be agreed to allow for background and threshold levels to be set.	**Section 7.4**
Natural England	
Further clarity on the effects of polyhalite on both marine and freshwater ecosystems in case of spills and confirmation of the conveyor design (closed/open).	**Section 7.6**
Natural England notes that sediment quality data are awaited which are essential for a proper understanding of impacts.	**Section 7.4**
A full assessment of impacts due to dredging will be needed in the ES.	**Sections 7.4** and **7.5**
Natural England notes more recent sediment quality samples have been taken for the No.1 quay project by PD Ports than those referred to which are older projects.	**Section 7.4**

* The discharge of brine from the MHF was linked to the initial proposal to transport product from the Mine to the MHF through the pipeline as a slurry. The current proposals comprise transporting dry material from the Mine via the MTS to the MHF and, therefore, there is currently no requirement to discharge brine from the MHF.

Consultation undertaken following receipt of the Scoping Opinion from PINS (January 2014)

7.2.21 In addition to the formal consultation as outlined above, a specification for the sediment quality (and benthic ecology) survey was prepared. The specification outlined proposed sampling methodologies (equipment and depths of samples), locations and a list of contaminants for analysis. The specification was issued to Natural England, the MMO and the Environment Agency in advance of the survey for comment and agreement.

7.2.22 **Table 7-5** provides a summary of consultation responses received on the scope of the benthic ecology and sediment quality survey. In response to these comments, a revised specification was developed (which also reflected changes to the scheme design since the original specification was produced) in March 2014. The scope of the surveys was agreed in April 2014.

7.3 Methodology

Study area

7.3.1 For marine sediment and water quality, the study area comprises the likely maximum extent over which potentially significant environmental impacts of the proposed scheme may occur. This was informed by the hydrodynamic and sediment dispersion modelling and was based on the maximum extent over which effects are predicted to occur (e.g. sediment plumes generated during capital dredging and effects on tidal currents during operation). The study area for marine sediment and water quality is shown in **Figure 5-1**.

Site-specific survey

7.3.2 In order to define the sediment quality baseline, a site-specific survey was commissioned and undertaken in July 2014. As discussed in **Section 7.2**, the sediment quality sampling and analysis strategy was agreed with Natural England, the Environment Agency and the MMO (**Appendix 7.1**).

7.3.3 A total of six vibrocores were taken within the footprint of the proposed berth pocket and port terminal and two vibrocores were taken from the adjacent approach channel that would be deepened as part of the proposed scheme.

7.3.4 The sediment samples were analysed by Cefas for the following parameters:

- Total organic carbon (TOC);
- PSA;
- Metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc);
- Polychlorinated biphenyls (25 congeners including ICES 7) (PCB);
- Polycyclic aromatic hydrocarbons (PAH);
- Total hydrocarbon content (THC);
- Organotins (TBT) and dibutyl tin (DBT)); and,
- Organochlorine pesticides.

Methodology for assessment of potential impacts

7.3.5 The methodology used to assess the significance of the potential environmental impacts associated with the proposed scheme is described in Section 4.

7.3.6 The assessment of potential water quality impacts has been based on the EQSs outlined in the WFD and Dangerous Substances Directive, and comparison of concentrations to the baseline environment where ESQs do not exist (for example, for the assessment of suspended solid concentrations).

7.3.7 The assessment of potential impact has been undertaken with regard to recognised guidelines and action levels, namely:

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

7.3.8 The Cefas Action Levels are used as part of a 'weight of evidence' approach to assessing the suitability of dredged material for disposal at sea, but are not themselves statutory standards. Selected Action Levels are set out in **Table 7-6.**

Table 7-6 Selected Cefas Action Levels

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

Table 7-5 Summary of consultation responses on the scope of the sediment quality survey

Comment	Royal HaskoningDHV response	Consultee follow up response (reflected in revised specification where appropriate)
Natural England		
Ensure that the reason for excluding Bran Sands from sediment sampling is explained in the ES.	No sediment deposition is predicted to occur over intertidal areas at Bran Sands and, therefore, there is no significant risk of impact at this location. For this reason, this area was excluded from the sediment sampling.	Natural England confirmed that it was satisfied with the rationale for the survey design.
Post dredging monitoring of Seal Sands should be taken from the same location as the baseline samples so to identify new deposits as a result of dredging activities. If dredging is found to be detrimental, additional mitigation may be required.	Noted.	Not applicable.
MMO		
Additional sampling than that described may be required to determine the extent of any contamination should some of the material exceed Cefas Action Level 2.	Noted.	Not applicable.
The laboratory and methods used to analyse samples need to meet criteria as set out by the MMO.	Requested Cefas approved list of laboratories.	Criteria provided on the MMO's website. Sediment quality samples were analysed by Cefas (with duplicate samples analysed by Fugro).
The berth pocket samples should be taken at surface and at depths ranging from 1m to 6m. Five sample locations, as opposed to 4 should be adopted. Moving sample locations 2 and 4 will also give a more representative view of the dredged area.	Proposed change has been noted; however there is no existing berth pocket. Required clarification from Cefas as to the whether this will alter the advice given regarding the additional sampling and relocation of sampling locations 2 and 4.	The 'corners' of the proposed berth are adjacent to a jetty and a natural area of sedimentation, backed by a seawall. Sediment would be expected to settle out as the flow slows in these areas, therefore, Cefas still recommend the changes.

Comment	Royal HaskoningDHV response	Consultee follow up response (reflected in revised specification where appropriate)
The particle size analysis (PSA) of the samples will follow the guidelines of DLTR (2002), however, a more detailed methodology should be provided.	Requested confirmation as to whether Cefas require further detail in the PER or in the ES.	This is not an immediate requirement and can be dealt with by reporting in the ES. The applicant may wish to consult Cefas (through the MMO) further prior to the final submission of the ES to ensure that the methodologies are appropriate and follow standard and best practise procedures. [Note that PSA was undertaken by Cefas as part of the sediment quality analysis].
It is unclear what the sample size for the PSA will be, depending on the size, it may compromise the faunal sample.	The PSA sub-sample will be taken in accordance with advice from Cefas. A small core (cut-off 100ml) syringe will be used to remove sediment from undisturbed surface for PSA analysis.	Noted.
The results of the PSA should be reported using full particle size distribution, as opposed to only reporting percentage of gravel, sand and silt/clay.	Noted.	Not applicable. [Note that PSA was undertaken by Cefas as part of the sediment quality analysis].
The MMO welcomes the applicant's use of the OSPAR guidelines.	Noted.	Not applicable.
The MMO recommend that the applicant take samples at the surface and every 0.5m down to the maximum depth to be dredged at each sample location.	Noted.	Not applicable. The MMO confirmed, during subsequent consultation with Cefas, that sample recovery at every 1m down to the maximum depth would be acceptable.
Environment Agency		
The proposed sampling strategy is acceptable.	Noted.	None.

7.3.9 Cefas guidance indicates that, in general, concentrations of contaminants within sediment which are below Action Level 1 are not considered to be of concern and are, therefore, likely to be approved for disposal at sea. Material with concentrations of contaminants above Action Level 2 is generally considered to be unsuitable for disposal at sea. Dredged material with contaminant concentrations between Action Levels 1 and 2 requires further consideration and testing before a decision can be made. Comparison of results from sediment quality analysis with Cefas Action Levels therefore provides a good indication regarding the risk of the material to the environment.

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

7.3.11 Selected Canadian guidelines are presented in **Table 7-7** and comprise two assessment levels. The lower level is referred to as the TEL and represents the concentration below which adverse biological effects are expected to occur only rarely (in some sensitive species for example). The higher level, the PEL, defines a concentration above which adverse effects may be expected in a wider range of organisms.

Table 7-7 Selected CSQG values (taken from CCME, 2002)

Contaminant	Units	TEL	PEL
Arsenic	mg/kg	7.24	41.6
Cadmium	mg/kg	0.7	4.2
Chromium	mg/kg	52.3	160
Copper	mg/kg	18.7	108
Mercury	mg/kg	0.13	0.7
Lead	mg/kg	30.2	112
Zinc	mg/kg	124	247
Acenaphthene	µg/kg	6.71	88.9
Acenaphthylene	µg/kg	5.87	128
Anthracene	µg/kg	46.9	245
Benz(a)anthracene	µg/kg	74.8	693
Benzo(a)pyrene	µg/kg	88.8	763
Chrysene	µg/kg	108	846

Contaminant	Units	TEL	PEL
Dibenz(a,h)anthracene	µg/kg	6.22	135
Fluoranthene	µg/kg	113	1,494
Fluorene	µg/kg	21.2	144
Napthalene	µg/kg	34.6	391
Phenanthrene	µg/kg	86.7	544
Pyrene	µg/kg	153	1,398

7.4 Existing environment

Existing sediment quality data from the Tees estuary

7.4.1 Data from previous surveys and data obtained from a more recent site-specific survey for the proposed scheme have both been used to inform the existing baseline conditions for sediment quality.

Sediment quality

7.4.2 The Tees estuary has historically received a considerable amount of waste discharges. Significant improvements have been made to waste management and waste water discharges within the estuary; however, this legacy of contamination remains in estuarine sediments that have not been disturbed or removed since the period when significant inputs of pollutants to the estuary declined.

NGCT

7.4.3 Sediment samples were collected as part of the EIA for the NGCT during 2006 (Royal Haskoning, 2006) along the approach channel (downstream of the Tees Dock area) and within the area proposed for the container terminal. The sampling locations are shown in **Figure 7-1**. Overall, the chemical data from the NGCT study indicated some level of contamination within the samples, particularly heavy metals. However, levels were not deemed high enough to prohibit the material from being disposed of to sea.

QEII berth

7.4.4 An additional sediment quality survey was carried out within the Tees estuary in December 2008, in order to characterise the area that was proposed to be dredged as part of the QEII berth redevelopment project. Two vibrocores (VC004 and VC001B) sampled sediments to a depth of 4m below Ordnance Datum (OD), or as deep as the core reached (**Figure 7-1**).

7.4.5 The results from the vibrocores identified that all metals analysed within the sediments exceeded Action Level 1. Concentrations of DBT and TBT were present below Action Level 1. Concentrations of mercury, cadmium, chromium, copper, lead and zinc exceeded Cefas Action Level 2. Exceedance of the TEL by acenaphthene was also recorded in VC001B.

7.4.6 As well as identifying contaminated sediments, the sediment quality survey also indicated a pattern of increasing contamination with depth. As a result of the contamination levels, the fine material was not accepted for disposal to sea and only the Mercia mudstone constituent of the proposed dredge was licensed for offshore disposal.

Site-specific sediment survey

7.4.7 In order to define the baseline for sediment quality at the site of the proposed scheme, a site-specific survey was carried out by Fugro in July 2014.

7.4.8 During the survey, the position of vibrocore VC05 and VC07 (which had been agreed with Natural England, the Environment Agency and the MMO) had to be modified due to insufficient water depth for the survey vessel. In addition, the precise locations of five of the proposed vibrocore locations had to be slightly modified from the agreed position (within 10m) due to poor sample recovery during the initial vibrocore attempt (the revised positions are marked within an 'A' in **Table 7-9**). The actual location of each vibrocore is illustrated on **Figure 7-2**.

7.4.9 Sub-samples were taken from the surface at 1m depth intervals and from the bottom of each vibrocore. Where recovery of sediment within the vibrocore was low (i.e. due to the vibrocore being unable to significantly penetrate into the sediment), samples were recovered at 0.5m intervals. A summary of the samples collected and the ground conditions encountered during the survey (based on visual inspection) is presented in **Table 7-8.**

7.4.10 Contaminant data from the laboratory analyses have been compared to the Cefas Action Levels and CSQG to provide an indication of contamination levels. A summary of results is provided here, with the full set of results included in **Appendix 7.2**.

7.4.11 A comparison of the sediment quality data obtained with the sediment quality guidelines indicates that the sediments contain relatively high levels of contaminants. Particularly elevated concentrations of metals and PAHs were recorded.

7.4.12 Concentrations of metals in the sediments exceed Cefas Action Level 1 at the majority of sampling stations and sampling depths. Exceedance of Cefas Action Level 2 was also recorded at a number of sampling stations (VC04, VC05A, VC06, VC07 and VC08A), most notably for chromium, copper and mercury. Similarly, the TEL for all metals was exceeded at the majority of the sampling stations, with the PEL also exceeded for at least one metal at all stations, most notably for copper, mercury, lead and zinc. The survey data also indicates that concentrations of metals in the sediments of the approach channel (VC01A and VC02A) are generally lower than those in the berth pocket, with no exceedances of Cefas Action Level 1 recorded and considerably fewer exceedances of the PEL.

7.4.13 The PAH and total PCB concentrations have also been compared to Cefas Action Levels (PAHs have been compared to the indicative PAH Action Levels). This data indicates that the majority of the sampling stations exceed Cefas Action Level 1 for concentrations of PAHs at varying depths. There are considerably less exceedances of the Cefas Action Levels for PCBs; however, exceedance of both Action Level 1 and 2 was recorded at sampling stations VC04 and VC08A and exceedance of Action Level 1 at VC06, VC05 and VC03. When compared to the CSQG, only a small number of PAH concentrations exceed the TEL, with no exceedances of the PEL recorded; this was also the case for total PCB concentrations.

7.4.14 The data also indicate that concentrations of contaminants within the surface sediments are lower than those in the deeper sediments. This reflects the historical industrialised nature of the Tees estuary which once received considerable amounts of waste discharge and is consistent with the results of previous sediment quality surveys.

Table 7-8 Summary of samples collected and ground conditions encountered during the sediment quality survey

Vibrocore (see location on Figure 7-2)	Date	Depth of sub-sample taken from the vibrocore	Composition of sediment recovered
VC01	31 July 2014	No samples recovered	-
VC01A	31 July 2014	0m, 1m, 1.6m	Sandy mud in all samples
VC02	27 July 2014	No samples recovered	-
VC02A	27 July 2014	0m, 0.86m	Sandy mud in all samples
VC03	24 July 2014	No samples recovered	-
VC03A	24 July 2014	0m, 0.7m 1.24m, 1.79m	Sandy mud at 0m and 0.7m Muddy sandy gravel at 1.24m Sandy clay at 1.79m
VC04	26 July 2014	0m, 1m, 2m, 3m, 4m, 4.53m	Sandy mud in all samples from 0m to 4m Muddy sand at 4.53m
VC05	30 July 2014	0m, 1m, 2m, 3m, 3.48m	Sandy mud in all samples
VC05A	31 July 2014	3.78m	Sandy mud
VC06	26 July 2014	0m, 1m, 2m, 3m, 4.18m	Sandy mud in all samples
VC07	31 July 2014	0m, 1m, 2m, 3m, 4m, 4.87m	Sandy mud in all samples
VC08	26 July 2014	0m, 1m, 2m, 2.8m	Sandy mud in all samples
VC08A	27 July 2014	0m, 1m, 2m, 3m, 4m, 4.68m	Sandy mud at 0m to 3m Muddy sand at 4m and 4.68m

7.4.15 Based on the results of the historic sediment quality surveys undertaken for the proposed NGCT and QEII schemes, in addition to the results of the sediment quality survey and analysis undertaken in 2014 for the proposed scheme, sediment (as an environmental receptor) is considered to be of low sensitivity.

Water quality

7.4.16 Improvements in water quality in the Tees estuary in the last 30 years are primarily due to a reduction in the amount of discharged effluent with a high biochemical oxygen demand (BOD), from over 500 tonnes per day in 1970, to around 25 tonnes per day in 2003 (Environment Agency, 2005). A decrease in the inputs of ammonia, organic chemicals and metals was also achieved over a similar period.

Water Framework Directive

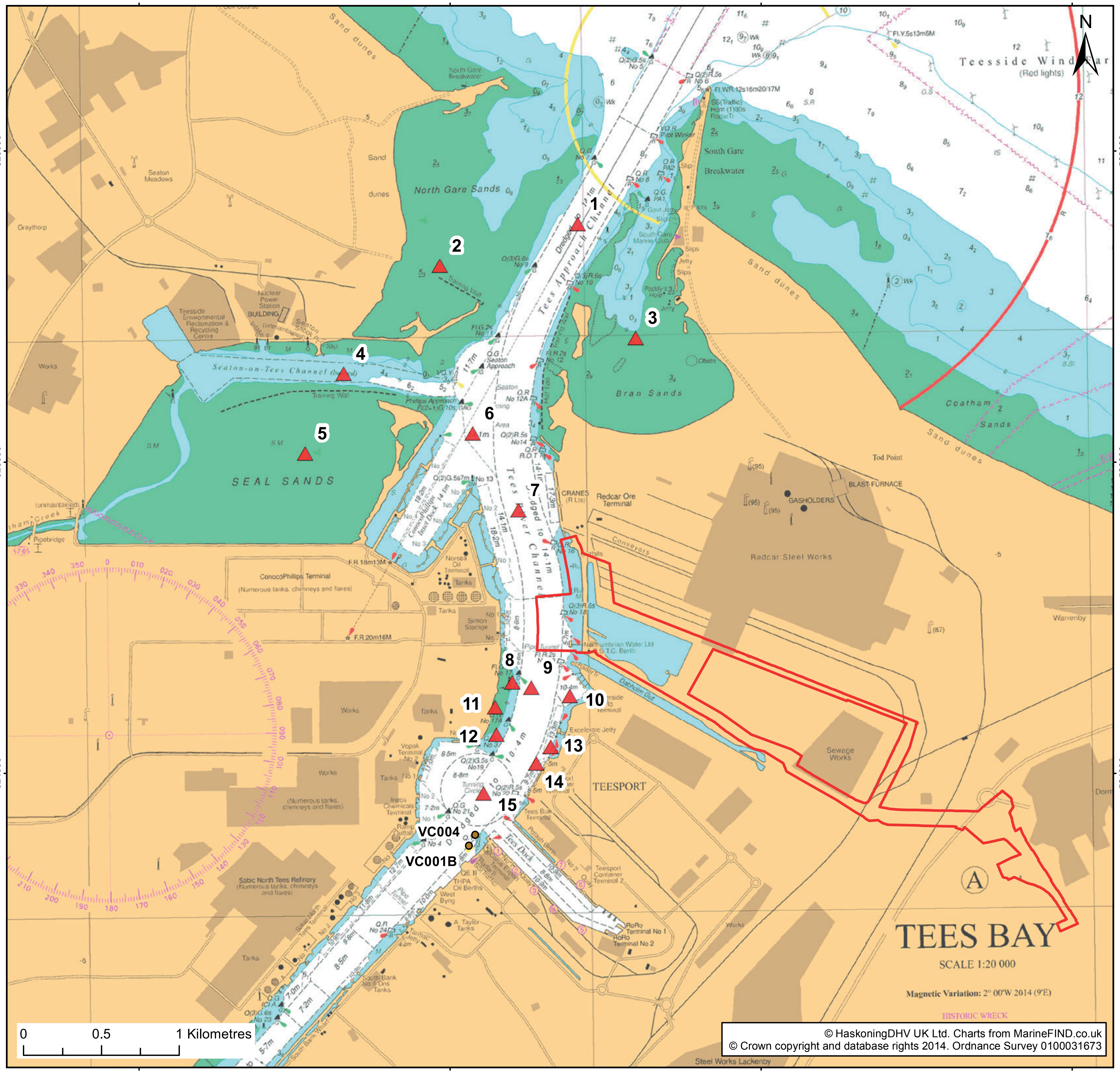
7.4.17 Two coastal/transitional water bodies, as defined under the Directive, lie within the vicinity of the study area of the proposed scheme; the Tees transitional water body (GB10302509900) and the Yorkshire North coastal water body (GB650301500003).

7.4.18 The Tees transitional water body is currently designated as a heavily modified water body due to flood protection, navigation and quay line works that are present within it and is currently classified as having 'moderate potential'. This classification relates to the status of phytoplankton and the presence of dissolved inorganic nitrogen and phenol. However, general improvements to water quality throughout the Tees estuary are reflected in the high status dissolved oxygen classification associated with the Tees water body. Dissolved inorganic nitrogen and phenol levels are, however, identified as being at moderate status and therefore the overall classification for physico-chemical supporting elements is moderate. In terms of chemical contaminants, this water body is classified as failing due to TBT concentrations. The aim for this water body is to achieve 'good ecological potential' by 2027 and 'good chemical status' by 2027.

7.4.19 The Yorkshire North coastal water body (GB650301500003) is currently designated as a heavily modified water body due to coastal protection works. The water body is currently classified as having 'good' overall potential, with a status objective of achieving 'good ecological potential' by 2015. The biological and physico-chemical quality elements of the water body are currently classified as either good or high, with this status predicted to remain by 2015.

Urban Waste Water Treatment Directive

7.4.20 The UWWTD serves to promote high water quality standards in areas particularly sensitive to pollution. Seal Sands was designated as Sensitive (Eutrophic) under this Directive in June 2002. As a consequence, Billingham sewage treatment works and Bran Sands sewage treatment works were selected to receive further treatment in order to reduce the levels of nitrogen and phosphorus in the final effluent. The nutrient removal scheme also involved the diversion of the effluent to Seaton Carew long sea outfall.



Legend:

- DCO Order Limits
- QEII Vibro Cores
- NGCT Sediment Sample Sites

DCO Order Limits as of 24/02/15

Client:	Project:
York Potash Limited	York Potash Project Harbour Facilities

Title: Environmental Statement: Sediment Sample Locations for the NGCT and QEII Berth near Harbour Facilities

Part:	Figure:	Drawing No:
HF	7.1	9Y0989-HF-7-001

Rev:	Date:	Drawn:	Checked:	Size:	Scale:
1	04/03/2015	JE	SR	A3	1:25,000
0	10/12/2014	JE	SR	A3	1:25,000

Co-ordinate system: British National Grid

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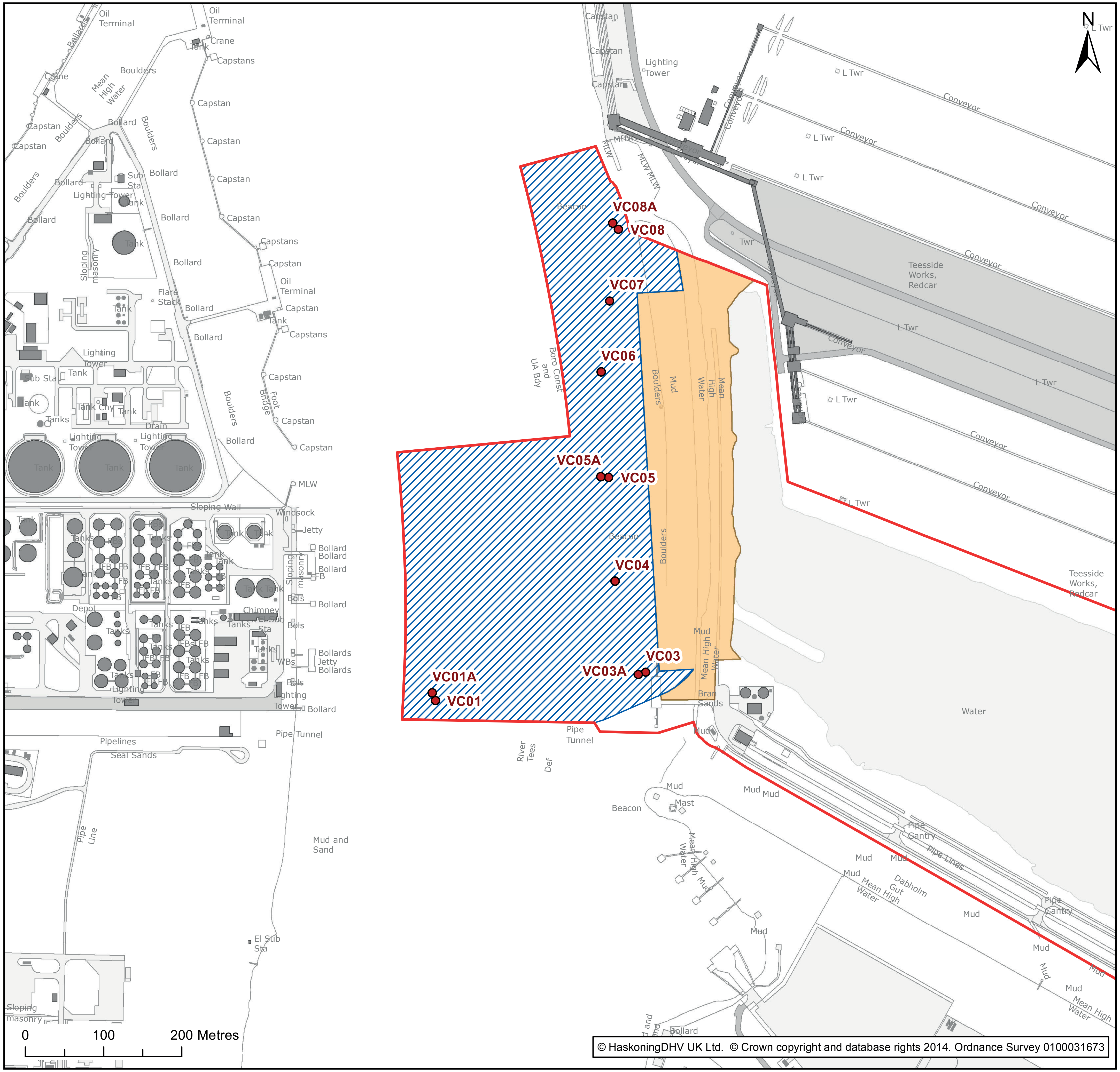

Legend:

- DCO Order Limits
- Dredge Area Envelope
- Quay Area Envelope
- Vibrocore locations

DCO Order Limits as of 24/02/15

Client:	Project:
York Potash Limited	York Potash Project Harbour Facilities

Title:

Environmental Statement: Vibrocore Locations Within and Adjacent to the Proposed Berthing Pocket and in Adjacent Areas

Part:	Figure:	Drawing No:
HF	7.2	9Y0989-HF-7-002

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

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Bathing Waters Directive

7.4.21 There are six designated bathing waters within the study area (Seaton Carew North, Seaton Carew Centre, Seaton Carew North Gare, Redcar Coatham, Redcar Lifeboat Station and Redcar Granville). However, they are all located on the coastline outside of the Tees estuary.

Water quality monitoring

7.4.22 As part of the Clean Seas Environmental Monitoring Programme (CSEMP) (previously known as the National Marine Monitoring Programme (NMMP)), the Environment Agency collects water quality data annually at various sites within the Tees estuary and tributaries. This programme aims to detect long term trends in physical, biological and chemical variables at selected estuarine and coastal sites.

7.4.23 Water quality monitoring data collected between 2012 and 2013 for dissolved metal concentrations has been summarised as mean values in **Table 7-9** for five sites located along the estuary from the mouth at The Gares to the Tees Barrage.

Table 7-9 Average concentration of metals recorded in water samples from the Tees estuary between 2012 and 2013 (Environment Agency, 2013)

Substance (dissolved)	Priority substance directive EQS (annual average µg/l)	Dangerous substance directive EQS (annual average µg/l)	Concentration at sampling site (µg/l)				
			The Gares	Redcar Jetty	Smiths Dock	Transporter Bridge	Tees Barrage
Arsenic	-	25	1.18	1.23	1.00	-	1.00
Chromium	-	15	0.5	0.5	0.56	0.52	0.5
Copper	-	5	0.66	1.11	1.02	1.16	1.46
Lead	7.2	25	0.42	0.87	1.28	1.24	2.55
Nickel	20	30	1.04	1.70	1.57	1.98	1.66
Tributyl tin	0.002	0.002	0.0005	0.0005	0.0005	0.0005	0.0005
Zinc	-	40	3.16	4.90	4.78	4.16	5.29

7.4.24 The information in **Table 7-9** indicates low levels of metal contamination within the water of the Tees estuary between the period of 2012 and 2013. No exceedances of the EQS have been recorded.

7.4.25 Additional water quality data for the years 2006 to 2011 was provided by the Environment Agency for other contaminants which have been averaged for the period in **Table 7-10.** During this period, concentrations of Lindane and total concentration of Drins exceeded the EQS at all three stations, with concentrations of ppDDT and TBT matching the EQS.

Table 7-10 Average dangerous substances data recorded in water samples recovered from the Tees estuary between 2006 and 2011 (Environment Agency, 2011)

Substance	EQS under Priority Substances Directive (annual average, µg/l)	EQS under Dangerous Substances Directive (annual average, µg/l)	Concentration at sampling site (µg/l)		
			The Gares	Redcar Jetty	Smiths Dock
Lindane		0.002	0.003	0.003	0.003
ppDDT	0.01	0.001	0.001	0.001	0.001
Drins: total	-	0.003	0.006	0.006	0.006
Pentachlorophenol	0.4	2	0.971	0.135	0.091
Chloroform	-	12	0.109	0.259	0.148
Carbon tetrachloride	-	12	0.100	0.101	0.100
TBT	0.0002	0.002	0.002	0.002	0.002
Hexachlorobenzene	0.01	0.03	0.001	0.001	0.001
Hexachlorobutadiene	0.1	0.1	0.003	0.003	0.003

7.4.26 It is considered that the water quality within the Tees estuary has a moderate capacity to accommodate change, as the tidal exchange within the estuary would remain unrestricted during all phases of the proposed scheme; this tidal exchange is considered likely to allow rapid recovery of the water quality if affected by the proposed scheme. Based on the information presented above, marine water (as an environmental receptor) is considered to be of low sensitivity.

7.5 Assessment of potential impacts during construction

Re-suspension of sediment during dredging and piling

7.5.1 As described within **Section 3.1,** the construction phase of the proposed scheme involves capital dredging to deepen a section the approach channel and to create a berthing pocket adjacent to the proposed port terminal. For the open quay option, dredging of the intertidal area would also be required to create a stable slope (this would not be required for the solid (reclamation) option).

7.5.2 The construction of the port terminal would require the installation of piles (for both options), and up to three driven piles would be required in the upstream (inland) reach of Dabholm Gut to support the overland conveyor within the southern conveyor envelope.

7.5.3 The above construction phase activities have the potential to cause disturbance and re-suspension of sediments and release them into the water column as a plume. This would increase the suspended sediment concentrations within the estuary, thus increasing the turbidity of the water column. Additionally, increases in suspended sediment concentrations could give rise to high oxygen demands, thus reducing the levels of dissolved oxygen within the water.

7.5.4 As discussed in **Section 3**, an enclosed grab is proposed for dredging of the contaminated sediment present above geological deposits. This method has been proposed as mitigation due to the negligible sediment release from this method of dredging.

7.5.5 The dredging of the geological deposits underlying the contaminated sediment would be undertaken using a backhoe, CSD or TSHD (or a combination of all three types of dredging plant). Sediment plume modelling was undertaken to predict the effect of dredging due to all potential dredge methods on suspended sediment concentrations (with the exception of an enclosed grab due to the negligible sediment release from this method). The predicted implications on water quality arising from the use of method backhoe dredger, CSD and TSHD are summarised below.

Backhoe dredging

7.5.6 A backhoe dredger is suitable for dredging cohesive and non-cohesive sediment in confined seabed areas, such as quays and berths. A backhoe dredger is similar to a land-based excavator and dredges the material in consolidated lumps as opposed to creating a more fluid slurry of dredged material (which would be generated by a CSD or TSHD). Backhoe dredging therefore typically releases less sediment into the water column than other methods (e.g. CSD) as it works at a slower rate and does not require water as a medium to transport the dredged sediments (CIRIA, 2000).

7.5.7 The sediment plume simulations for the backhoe dredger predict that an area of elevated suspended sediment in the range of 10mg/l to 50mg/l above background is confined to the immediate vicinity of the dredger, with no wider effects within the estuary. The predicted sediment plume for the backhoe dredger is illustrated on **Figure 7-3**.

CSD

7.5.8 CSDs are commonly used where stiffer cohesive sediments and weak rocks need to be dredged. The greater production rate of the CSD compared with the backhoe, combined with overflow from the hopper in order to increase the density of material taken to the disposal site and the fact that the cutter head is not enclosed, results is a significantly higher rate of sediment release in comparison with the backhoe and enclosed grab. Material arising from the backhoe remains close to its in situ density.

7.5.9 The sediment plume simulation undertaken for the CSD (see **Figure 7-4**) indicates an area of elevated total suspended solids in the range of 10mg/l to 50mg/l above background in the channel, 500m either side of the dredging works. Larger excess concentrations are predicted in the immediate area of the dredger, at up to 500mg/l of suspended sediment.

7.5.10 Based on this information, it can be concluded that the CSD would lead to temporary increases in suspended sediment concentrations above those normally experienced in the estuary, albeit within a relatively localised area of the estuary.

Figure 7-3 Simulated average increase in suspended sediment concentration from backhoe dredging in spring tide, low river flow conditions

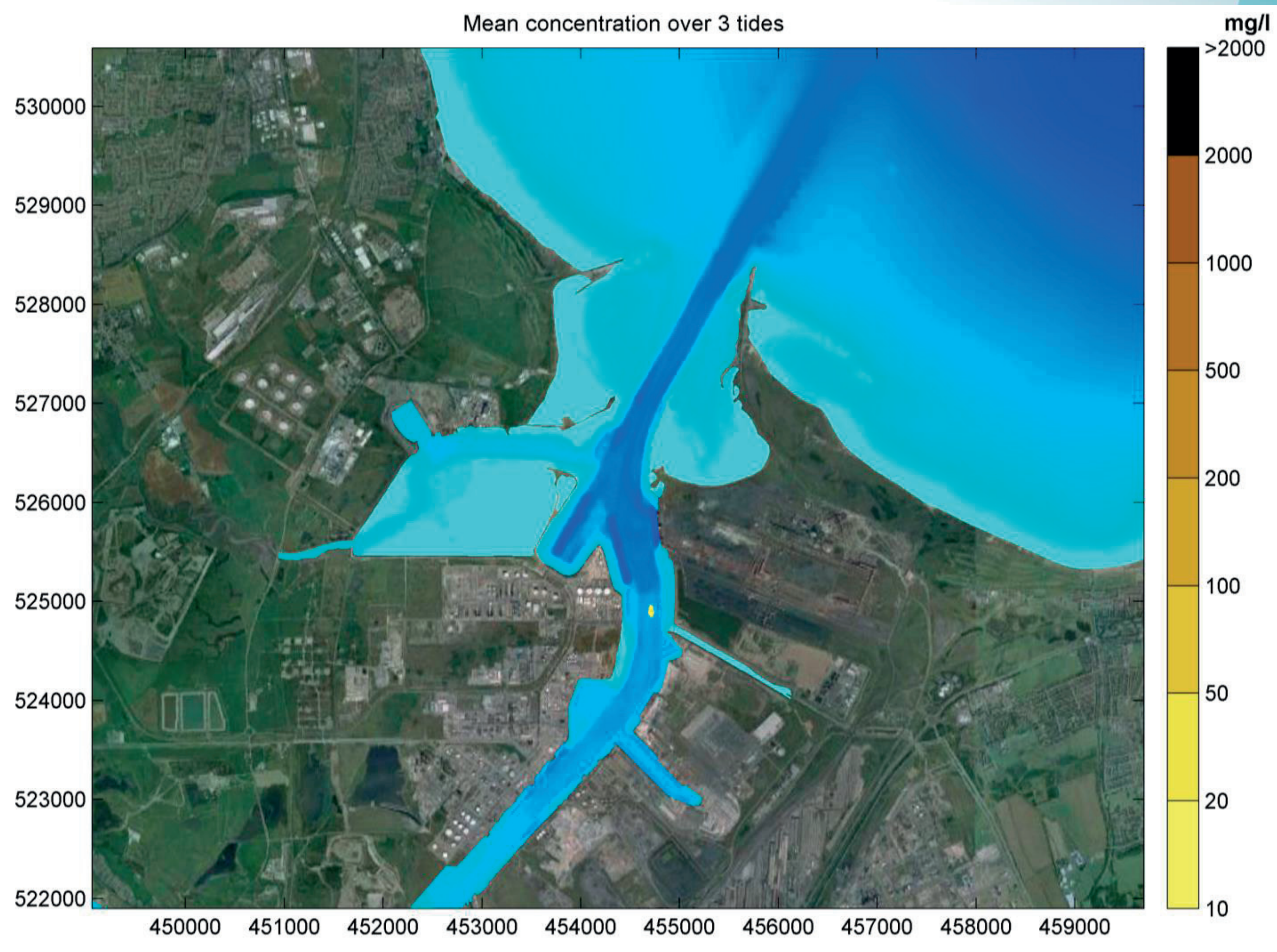
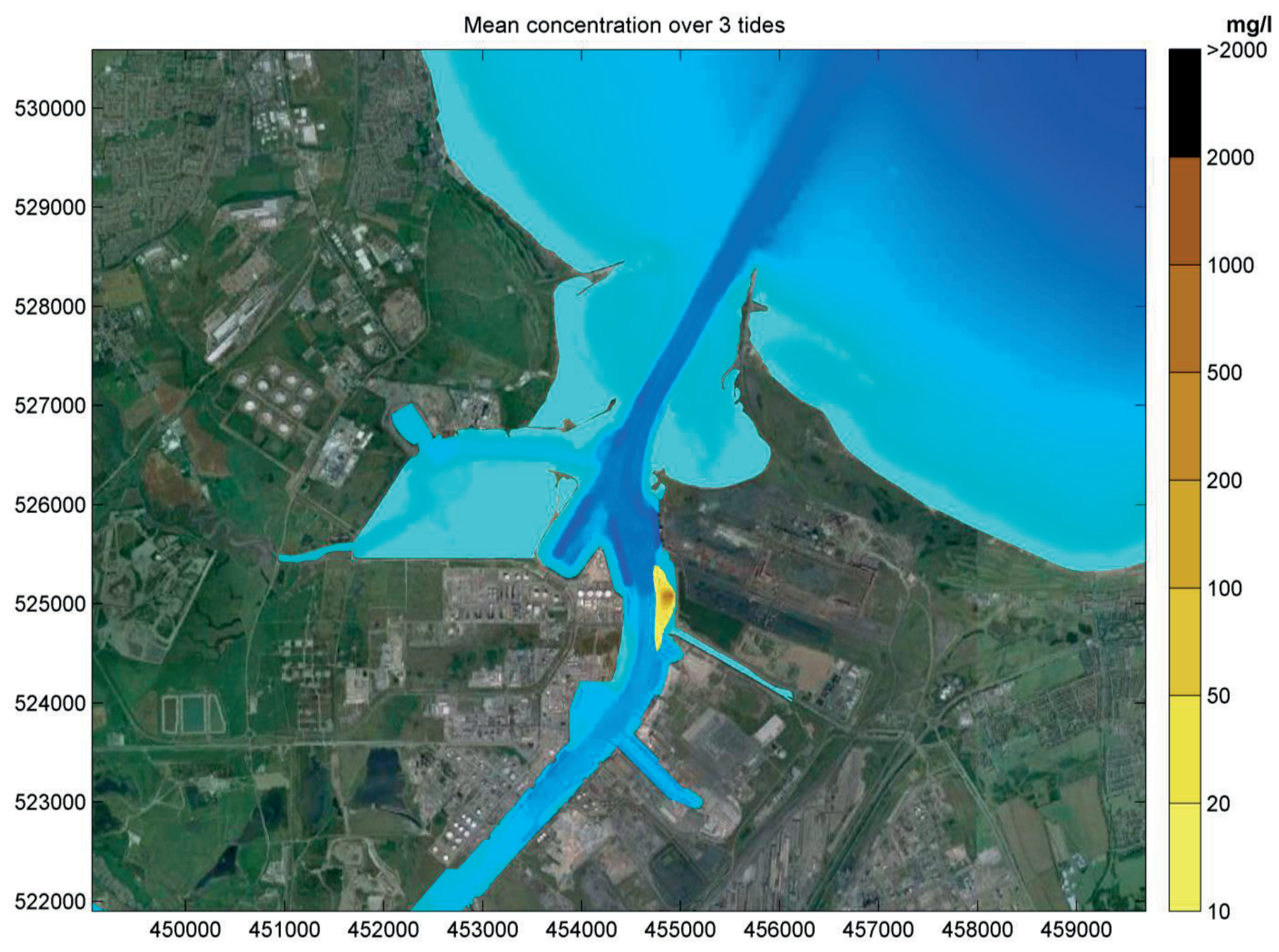


Figure 7-4 Simulated average increase in suspended sediment concentration from CSD dredging in spring tide, low river flow conditions



TSHD

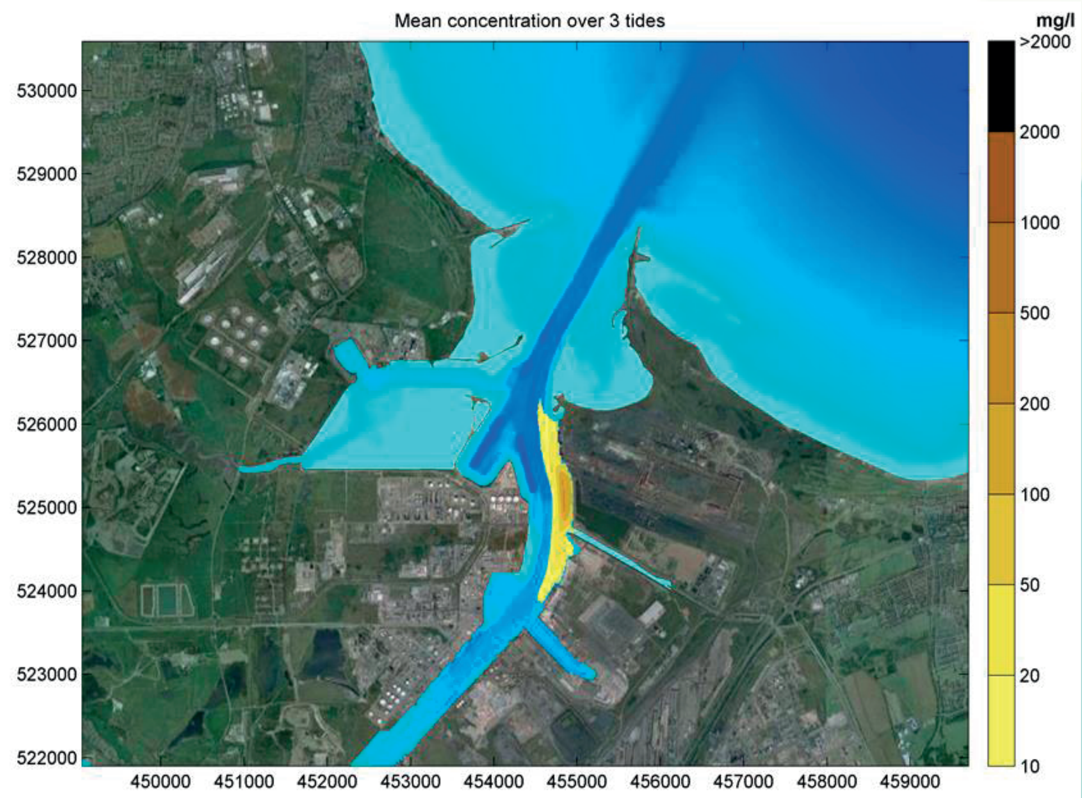
7.5.11 The sediment plume simulations for the TSHD (see **Figure 7-5**) predict that an area of elevated suspended sediment in the range of 10mg/l to 50mg/l above background may be anticipated in the channel, approximately 1km either side of the dredging works. Larger excess concentrations are predicted in the immediate area of the dredger, at up to 200mg/l of suspended sediment.

Summary of impact to water quality due to sediment disturbance during dredging

7.5.12 The dredging required for the proposed scheme has potential to impact upon water quality through the re-suspension of sediment into the water column. The proposed use of an enclosed grab for the contaminated sediments above geological deposits would ensure that the generation of a contaminated sediment plume is minimised as far as practicable.

7.5.13 The sediment plume modelling simulations (presented and discussed within **Section 5**) have shown that the effects of the backhoe dredger are much reduced in comparison with the TSHD and CSD. On average, the predicted mean concentration increases outside of the proposed dredge area are a few tens of mg/l above background at most. Larger excess concentrations are predicted within the immediate vicinity of the dredger, at up to 500mg/l (for the CSD).

Figure 7-5 Simulated average increase in suspended sediment concentrations from TSHD dredging in spring tide, low river flow conditions



7.5.14 In general, sediment plumes induced by dredging are considered to pose only a limited risk to water quality since the affected water usually has capacity to accommodate an increased oxygen demand, particularly when dredging takes place in open seas or estuaries (CIRIA, 2000). The tidal exchange within the Tees estuary would remain unrestricted during the construction phase, and peaks in total suspended solids are only expected on a short term basis. No increase in suspended sediment is predicted at the designated bathing water on the coast.

7.5.15 Installation of up to three piled supports (each with two foundations) in Dabholm Gut for the construction of the conveyor in the southern conveyor envelope and one conveyor support (with two foundations) within the finger of Bran Sands lagoon (northern conveyor), along with piling for the construction of the port terminal, would result in re-suspension of bed sediments. This effect, however, would be localised to the location of the piling and disturbance is unlikely to be significant.

7.5.16 The sensitivity of the water in terms of the potential for water and sediment quality impacts is assessed as low, as it is considered that the receptor possesses the capacity to accommodate such change. The magnitude of the effect is also considered to be low given its short term, localised and reversible nature. Consequently, the potential impact on water quality associated with the increase in suspended solids in the water column from any of the potential dredge methods is predicted to be of **negligible** significance.

7.5.17 The implications of changes in water quality for marine ecology and fish populations are discussed in **Sections 8.5 and 11.5** respectively.

Mitigation and residual impact

7.5.18 There are a number of controls that would be implemented to ensure that the suspended sediment load is minimised during dredging. The main mitigation measure to limit sediment plume is selection of the dredging method. As noted above, dredging of geological deposits may be undertaken by a TSHD, CSD or backhoe, or a combination of these methods. There is no further mitigation that can be applied for the proposed dredge of contaminated sediment, above the use of an enclosed grab. Controls which would be implemented during TSHD, CSD and backhoe dredging are presented below.

7.5.19 Limiting re-suspension of sediment during TSHD can be achieved through the following good practice measures:

- Trailing velocity, position of the suction mouth and the discharge of the pump can be optimised with respect to each other.
- Any reduction in the intake of water by the suction head means a more dense pay load, thus reducing or avoiding the need for overflowing. This can be achieved by directing the flow lines of the suction stream to the actual point of excavation, thus making better use of the erosive capacities of the flow of water into the suction head.

7.5.20 Backhoe dredging is the most environmentally acceptable approach, as this would result in a significantly lower release rate of sediment to the water column compared with, for example, typical CSD or TSHD. The main measure that can be adopted to minimise losses of sediment to the water column during dredging activities with a backhoe dredger is to use an experienced operator, as control over the dredging equipment is one of the main factors affecting sediment disturbance during backhoe dredging. Other measures that limit plume generation comprise limiting the swing of the backhoe over water, thereby reducing the time when sediment can leak out of the bucket. In addition, the practice of smoothing the excavated area by dragging the backhoe bucket along the bottom should be avoided (CIRIA, 2000).

7.5.21 The re-suspension of sediment caused by CSD can be reduced through optimising the cutter speed, swing velocity and suction discharge, shielding the cutter head or suction head and optimising the design of the cutter head.

7.5.22 The residual impact is predicted to be of **negligible** significance.

Impact from accidental spillage of oils, fuels and chemicals from vessels and plant during construction

7.5.23 During construction, a wide range of construction plant and machinery would be required on site, ranging from ready mix wagons, barges, low loaders, articulated flat bed, articulated bulk materials, private vehicles, earth moving equipment, lorries and cranes and dredging vessels (see **Section 3.1**) As is the case for most construction works that take place in and near the marine environment, there is, therefore, potential for accidental spillages or leakages of substances (e.g. fuels, oils, etc.) to occur from such machinery, which has the potential to adversely affect water and sediment quality through direct input to the estuary or via runoff.

7.5.24 One of the main contamination sources to surface waters during the construction phase comprises run-off from the site compounds. It is proposed that the site compounds will be situated in the locations shown on **Drawings PB1586-SK56 and SK57**. The site compounds would be underlain by crushed rock / stone and rain water would percolate into the ground. A mobile bowser is likely to be used for refuelling.

7.5.25 To minimise the risk of spillage or leakages from occurring, best practise techniques and due diligence would be executed throughout all construction activities. All working practises would adhere to the Environment Agency's Pollution Prevention Advice and Guideline (PPG) 5: Works and maintenance in or near water (Environment Agency, 2007) and all vessels would adhere to the requirements of the MARPOL Convention Regulations.

7.5.26 In addition, appropriate preventative and control measures would be adopted, such as the placement of drip trays under all parked vehicles and bunded areas to store the substances as well as ensuring that a spill kit is kept on site. PD Teesport is also a spill responder for the Tees estuary and, as such, there are plans in place to ensure spillages or leakages can be rapidly and effectively managed.

7.5.27 It is not possible to assess the significance of a particular pollution incident as this is dependent on the nature of the incident (e.g. location, scale, type of pollutant). In this instance the assessment is considered in terms of the risk of a spill or other pollution event occurring. The implementation of control measures and adoption of good practice however means that the potential for accidental pollution occurring is minimal, therefore the risk is considered to be low.

Mitigation measures

7.5.28 The risk of a significant pollution event occurring is low, particularly given the implementation of the control measures and guidance recommended above. No further control measures are expected to be necessary in this context.

Reduced water quality due to placement of dredged material within Bran Sands lagoon

7.5.29 As discussed within **Section 3.1**, the proposed scheme involves the placement of capital and maintenance dredged material within Bran Sands lagoon, in order to enhance waterbird feeding, roosting and nesting opportunities. The placement of dredged material within Bran Sands lagoon therefore has potential to cause a reduction in water quality within the lagoon due to increased suspended sediment concentrations from runoff.

7.5.30 As discussed within **Section 7.4**, the sediments present above geological deposits within the footprint of the proposed dredge area are contaminated with a range of chemicals. These contaminated sediments would not be used as part of the habitat enhancement proposals, and therefore, the potential reduction in water quality within Bran Sands lagoon would be due to increased suspended sediment concentrations only during deposition. The reduction in water quality from increased suspended sediment would arise during the construction phase only (i.e. no operational phase impact).

7.5.31 The proposed scheme involves the placement of clay / mudstone within the lagoon to create a bund; the bund would be formed prior to placement of sands, gravels and maintenance dredged materials. This clay bund would effectively segregate a proportion of the lagoon, limiting the spatial extent of the reduction in water quality due to infilling of the bunded area with the sands, gravels and maintenance dredged material. However, material would be deposited within the lagoon in slurry form, and as such, it is inevitable that water within the lagoon would experience a temporary increase in suspended sediment concentration.

7.5.32 Surface water runoff from industrial land immediately adjacent to Bran Sands lagoon (including the coal storage area to the immediate north) flows directly into the lagoon and the lagoon receives sediments in suspension due to tidal exchange with the Tees. Based on the above, it is considered that the lagoon is of low sensitivity with respect to changes in suspended sediment concentration.

7.5.33 The proposed scheme involves the placement of approximately 20,000m^3 to 25,000m^3 of material within the lagoon. The clay bund would confine the spatial extent of the effect; however, increases in suspended sediment are likely to be experienced across the full width of the lagoon. It is considered that the reduction in water quality would be temporary, with material likely to settle out on the bed of the lagoon relatively rapidly following placement (due to the shallow water depth within the lagoon). Based on the above, the magnitude of the effect is considered to be medium. Based on the impact assessment matrix presented in **Section 4**, an impact of **minor adverse** significance is anticipated.

Mitigation and residual impact

7.5.34 In order to minimise the spatial extent of the reduction in water quality during sediment placement, a silt screen / curtain would be utilised during the placement activity and a silt box would be installed through which placed dredged material would dewater into the Tees; this would minimise the concentration of fine sediment entering the Tees as the material dewaters.

7.5.35 The silt screen would be installed across the full width of the lagoon (around the location of placement of dredged material) prior to placement of material and would be maintained in position during the activity. Given the shallow depth of water within the lagoon in addition to the limited flows within the lagoon, it is considered that the silt screen would form an effective barrier. With the implementation of the above mitigation measures, it is considered that the residual impact would be of **negligible** significance.

7.6 Assessment of potential impacts during operation

Increased suspended sediment concentration due to maintenance dredging

7.6.1 During the operational phase, maintenance dredging within the berth pocket and approach channel would be required to maintain the dredged depth. Such maintenance dredging would likely lead to an increase in TSS concentrations within the water column.

7.6.2 At present, there is an existing requirement for maintenance dredging of the approach channel and various berth pockets in the Tees estuary. The existing maintenance dredging regime is implemented and managed by PD Teesport and the locations, volumes and frequency of dredging are well recorded.

7.6.3 As a result of the proposed scheme it is envisaged that the newly deepened sections of berth pocket and channel would be incorporated into the existing maintenance dredging strategy. The material from the maintenance dredging would be disposed of at the existing disposal sites in Tees Bay (as currently occurs).

7.6.4 As discussed in **Section 5**, the proposed scheme does not have the potential for a significant effect on the amount of sediment imported to the Tees from offshore (given that the proposed scheme does not include any changes to the outer sections of the approach channel). Furthermore, no changes to sediment transport in the predominantly sandy areas around Teesmouth are expected and so no effect on sand transport is expected.

7.6.5 Sediment transport modelling was undertaken for the operational phase of the proposed scheme, to determine any changes to the local sediment regime. The results for the post-development cases show a negligible effect on the overall import of fine sediment into the estuary (less than 0.5%). The effect of the scheme is to result in a localised redistribution of locations of sediment deposition in response to predicted changes in current speeds as a result of the proposed works. It is predicted that this very small change in the overall fine sediment regime would not alter the present frequency of, or methodology used for maintenance dredging. On this basis, it is anticipated that maintenance dredging would not represent a significant impact to water quality.

7.6.6 Based on the information presented above and given the low sensitivity of the water and sediment quality receptors (as discussed within **Section 7.5**), the magnitude of the effect is considered to be low. Therefore, it is predicted that there would be an impact of **negligible** significance on water quality due to increased suspended sediment concentrations from maintenance dredging.

Mitigation and residual impact

7.6.7 Mitigation is not required and, therefore, the residual impact would be of **negligible** significance.

Accidental spillage of oils, fuels, chemicals and polyhalite from vessels

7.6.8 During operation of the Harbour facilities, there is the potential for accidental spillages of oils and fuels from vessels using the port as well as from land based activities to enter the marine environment.

7.6.9 Vessels anticipated to use the port terminal are bulk carriers up to 85,000DWT. **Table 7-11** summarises the anticipated vessel numbers required to achieve the Phase 1 and Phase 2 product throughput. It can be seen that there would be approximately 191 vessels calls per year at the port terminal. Whilst vessels are docked at the harbour facility, no re-fuelling activities are planned; similarly there are no planned discharges of sewage or other waste water from the vessels.

Table 7-11 Vessel numbers required to transport the anticipated volumes of product from the port terminal during Phase 1 and Phase 2 of the proposed scheme

Vessel size (DWT)	Vessel numbers anticipated in Phase 1 (per year)	Vessel numbers anticipated in Phase 2 (per year)
55,000	30	59
65,000	25	50
75,000	22	44
85,000	19	38

7.6.10 In addition to the risk of spills and leaks of oils and fuels from vessels, there is also the risk of accidental release of the product (polyhalite) into the marine environment during ship loading operations. Polyhalite is a naturally occurring evaporate mineral comprising hydrated sulphates of potassium, calcium and magnesium which will be used as a fertilizer.

7.6.11 The polyhalite would be transported from the MHF at Wilton to the port terminal via a conveyor system. The polyhalite would be transported in a pellet form with a wax coating. During transfer of pellets from the ship loaders onto the vessels, there is potential for an accidental release of the wax pellets into the marine environment, which could potentially release polyhalite into the Tees estuary.

7.6.12 The information provided above suggests that there is only one area of the harbour facility where an accidental release of polyhalite into the marine environment could occur. In the event of a spill, the wax pellets are likely to be dispersed rapidly by a combination of the currents and the tides, the components of the polyhalite product pose no significant threat to the marine environment.

7.6.13 It is not possible to assess the significance of a pollution event, therefore the impact is considered in terms of risk of a spill or pollution event occurring. Based on the information above, a **low risk** is predicted.

Mitigation and residual impact

7.6.14 To minimise the risk of such spillages/leakages from occurring, the control measures described in **Section 7.5** (with regard to minimising the risk of spillages or leakages from occurring), would also be applicable to this impact. In addition, a spill kit (including booms) would be kept on site at all times during operation and any major spills or leakages will be reported to the Environment Agency and Harbour Master. The impact of accidental spills and leaks is assessed in terms of risk, which is considered to be **low** in this case.

Potential impacts on existing land drainage and surface water during operation

7.6.15 Surface run off from the port terminal has the potential to contain oils and fuels which could cause pollution if they are discharged into the marine environment.

7.6.16 Surface water from the port terminal would be discharged from the quay to the Tees estuary through outfalls. For the solid reclamation option, drainage would be via outfalls through the quay face. It is proposed that interceptors would be included within the drainage system to enable surface water to drain without impacting on surface water quality.

7.6.17 It is proposed that waste water generated from the welfare facilities would be stored in a tank under the car park and would be tankered away for treatment.

7.6.18 Given the above and the low sensitivity of the water and sediment quality receptors, the magnitude of the effect is predicted be low. Hence the impact of land drainage and surface water runoff on water quality is predicted to be of **negligible** significance.

Mitigation and residual impact

7.6.19 As stated above, interceptors would be included within the drainage system. Storage areas would also be bunded and drip trays used where appropriate.

7.7 Assessment of potential impacts during decommissioning

Increased suspended sediment concentrations during removal of conveyor system

7.7.1 During the decommissioning phase, it is proposed that the site infrastructure of the conveyor system from the MHF at Wilton to the port terminal would be removed.

7.7.2 As described in **Section 3**, there are currently two options being considered for the conveyor route. The southern route includes supports for the conveyor bridge in the upstream section of the Dabholm Gut. It is envisaged that the piled supports would be cut off rather than removed and, therefore, there would be no impact on suspended sediment concentration during decommissioning.

Mitigation measures and residual impact

7.7.3 No mitigation measures are required and there would be **no residual impact**.

Accidental spillage of polluting substances

7.7.4 During the decommissioning phase system, various plant and machinery would be utilised to undertake the removal of the conveyor system. Therefore, there is the potential for accidental spills/leaks of oil and fuel from such machinery, which has the potential to adversely affect water and sediment quality.

7.7.5 To minimise the risk of spillages or leakages from occurring, the same mitigation measures described in **Section 7.5** (with regard to reducing the risk of spillages from occurring) are applicable to the decommissioning phase. Through the implementation of control measures and adoption of good practise, the potential for accidental pollution occurring during decommissioning is minimal, therefore the risk is considered to be **low**.

7.8 Summary

7.8.1 This section has discussed the existing marine water and sediment quality within the study area for the proposed scheme. The impact assessment has taken into account the requirements of European and national legislation and policy concerning Environmental Quality Standards for chemical contaminants and guideline values to determine water and sediment quality.

7.8.2 Previous sediment quality surveys undertaken in the Tees estuary have identified elevated concentrations of both heavy metals and PAHs in the study area. The results from the survey undertaken for the proposed scheme are consistent with this data and have identified metal and PAH concentrations in estuarine sediments which exceed Cefas Action Level 1 and 2 and the TEL and PEL. The results also identified that contamination increases with depth through the vibrocore (within the silts), demonstrating the influence of historical industry which once dominated the area. In comparison, water quality has shown improvements over the last 30 years; and this is reflected by data obtained from the CSEMP, where samples from very few sites exceeded the EQS for contaminants.

7.8.3 The impact assessment identified a number of impacts that could arise with regard to marine and sediment quality during the construction, operation and decommissioning of the Harbour facilities. These impacts include re-suspension of suspended sediment as a result of capital and maintenance dredging and piling, and deterioration of water quality as a result of surface-run off and accidental spills and leaks. The assessment concludes that, by following best practice guidance and implementing the mitigation measures presented in this section of the ES, the potential impacts of the proposed scheme on marine water and sediment quality are predicted to be of negligible significance at worst.

7.8.4 Uncertainty in the assessment of impacts on marine sediment and water quality is considered to be low for all stages of the proposed scheme, given the large volume of data (from previous and very recent site-specific sediment quality surveys and on-going water quality sampling and analysis throughout the estuary) used to assist in the determination of impact significance.

7.8.5 A summary of the impacts predicted with regard to marine sediment and water quality is presented in **Table 7-12.**

Table 7-12 Summary of impacts with regard to marine sediment and water quality

Impact	Sensitivity of receptor	Magnitude of effect	Significance of impact	Mitigation	Residual impact
Construction					
Re-suspension of sediment during dredging and piling	Low	Low	Negligible	None required. However controls would be implemented during dredging as outlined below. Limiting re-suspension during TSHD can be achieved by optimising the trailing velocity, position of the suction mouth and discharge of the pump with respect to each other, and directing the flow lines of the suction stream to the actual point of excavation. Reduction of sediment plumes during backhoe dredging can be achieved by using an experienced operator and limiting the swing of the backhoe over water. Re-suspension of sediment during CSD can be reduced through optimising the cutter speed, swing velocity and suction discharge, shielding the cutter head and optimising the design of the cutter head.	Negligible
Impact from accidental spillages	Low risk			None required.	Low risk
Reduced water quality due to placement of dredged material within Bran Sands lagoon	Low	Medium	Minor adverse	Use of a silt box through which the placed material would dewater and a silt curtain within the lagoon to minimise dispersion of sediment within the lagoon.	Negligible
Operation					
Increased suspended sediment due to maintenance dredging	Low	Low	Negligible	None required	Negligible
Impact from accidental spillages	Low risk			None required.	Low risk
Impacts on existing land drainage and surface water	Low	Low	Negligible	None required	Negligible

Impact	Sensitivity of receptor	Magnitude of effect	Significance of impact	Mitigation	Residual impact
Decommissioning					
Increased suspended sediment during conveyor removal	No impact			None required	No impact
Impact from accidental spillages	Low risk			None required	Low risk

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