# Dudgeon and Sheringham Shoal Offshore Wind Farm Extensions

## Preliminary Environmental Information Report

**Volume 1**

## Chapter 9 - Marine Water and Sediment Quality

April 2021

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## Glossary of Acronyms

| | |
|---|---|
| AfL | Agreement for Lease |
| Cefas | Centre for Environment, Fisheries and Aquaculture Science |
| CIA | Cumulative Impact Assessment |
| CSQG | Canadian Sediment Quality Guidelines |
| CSEMP | Clean Seas Environmental Monitoring Programme |
| DBT | Dibutyltin |
| DCO | Development Consent Order |
| DECC | Department for Energy and Climate Change |
| DEFRA | Department for the Environment and Rural Affairs |
| DEP | Dudgeon Extension Project |
| EIA | Environmental Impact Assessment |
| EPP | Evidence Plan Process |
| EQS | Environmental Quality Standards |
| EA | Environment Agency |
| ES | Environmental Statement |
| ETG | Expert Topic Group |
| EU | European Union |
| HDD | Horizontal directional drilling |
| EIFCA | Eastern Inshore Fisheries Conservation Authority |
| IPC | Infrastructure Planning Commission |
| km | Kilometre |
| MCZ | Marine Conservation Zone |
| MMO | Marine Management Organisation |
| MW | Megawatts |
| MSFD | Marine Strategy Framework Directive |
| NPS | National Policy Statement |
| NSIP | Nationally Significant Infrastructure Project |
| OSP | Offshore Substation Platform |
| OSPAR | Oslo Paris Agreement |
| OWF | Offshore Wind Farm |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PCB | Polychlorinated biphenyl |

| | |
|---|---|
| PEIR | Preliminary Environmental Information Report |
| PEL | Probable Effects Level |
| PEMP | Project Environmental Management Plan |
| PSA | Particle Size Analysis |
| SEP | Sheringham Shoal Extension Project |
| SSC | Suspended Sediment Concentration |
| TBT | Tributyltin |
| TEL | Threshold Effects Level |
| TEU | Treaty of the European Union |
| UK | United Kingdom |
| UN | United Nations |
| WFD | Water Framework Directive |

## Glossary of Terms

| | |
|---|---|
| The Applicant | Equinor New Energy Limited |
| Dudgeon Offshore Wind Farm Extension site | The Dudgeon Offshore Wind Farm Extension offshore wind farm boundary. |
| The Dudgeon Offshore Wind Farm Extension Project (DEP) | The Dudgeon Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure. |
| Canadian Sediment Quality Guidelines | Guideline contaminant concentration levels which can be used to provide a basic indication on the degree of contamination and likely impact on ecology. |
| Cefas Action Levels | Guideline contaminant concentration levels used as part of a weight of evidence approach for decision-making on the suitability of dredged material for disposal to sea. |
| Evidence Plan Process (EPP) | A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics. |
| Grid option | Mechanism by which DEP and SEP will connect to the existing electricity network. This may either be an integrated grid option providing transmission infrastructure which serves both of the wind farms, or a separated grid option, which allows DEP and SEP to transmit electricity entirely separately. |
| Horizontal directional drilling (HDD) zones | The areas within the onshore cable route which would house HDD entry or exit points. |
| Infield cables | Cables which link the wind turbine generators to the offshore substation platforms. |
| Interlink cables | Buried offshore cables which link offshore substation platforms. |
| Landfall | The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables |
| Offshore cable corridor | An area that will contain cables outside of a wind farm site, either interlink cables or offshore export cables. |
| Offshore export cables | The cables which would bring electricity from the offshore substation platform(s) to the landfall. |
| Offshore substation platform | A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore. |

| | |
|---|---|
| PEIR boundary | The area subject to survey and preliminary impact assessment to inform the PEIR, including all permanent and temporary works for DEP and SEP. The PEIR boundary will be refined down to the final DCO boundary ahead of the application for development consent. |
| Study area | Area where potential impacts from the project could occur, as defined for each individual EIA topic. |
| Sheringham Shoal Offshore Wind Farm Extension site | Sheringham Shoal Offshore Wind Farm Extension offshore wind farm boundary. |
| The Sheringham Shoal Offshore Wind Farm Extension Project (SEP) | The Sheringham Shoal Offshore Wind Farm Extension site as well as all onshore and offshore infrastructure. |

# 9 MARINE WATER AND SEDIMENT QUALITY

## 9.1 Introduction

1. This chapter of the Preliminary Environmental Information Report (PEIR) considers the potential impacts of the proposed Dudgeon Extension Offshore Wind Farm Project (DEP) and Sheringham Shoal Extension Offshore Wind Farm Project (SEP) on marine sediment and water quality. The chapter provides an overview of the existing environment for the proposed offshore development area and export cable corridor, followed by an assessment of the potential impacts and if required, identifies mitigation for the construction, operation, and decommissioning phases of the projects.

2. This chapter has been written based on expert-based assessment and judgement by Royal HaskoningDHV, with the assessment undertaken with specific reference to the relevant legislation and guidance, of which the primary sources are the National Policy Statements (NPS). Details of these and the methodology used for the Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) are presented in **Section 9.3.4**.

3. The assessment should be read in conjunction with following linked chapters and assessments:
    - **Chapter 8 Marine Geology, Oceanography and Physical Processes**;
    - **Chapter 10 Benthic Ecology**;
    - **Chapter 11 Fish and Shellfish Ecology**;
    - **Chapter 14 Commercial Fisheries**; and
    - **Appendix 20.1 Water Framework Directive (WFD) Compliance Assessment**.

4. Information to support the marine water and sediment quality assessment includes:
    - survey data specifically collected for the DEP and SEP including environmental (sediment particle size) and chemical (sediment contaminant concentration) data;
    - the existing evidence base of the effects of offshore wind farm (OWF) developments on the environment; and
    - discussion of main effects with key stakeholders.

## 9.2 Consultation

5. Consultation with regard to marine sediment and water quality has been undertaken in line with **Chapter 6 EIA Methodology**. The key elements to date have included scoping and the ongoing Evidence Plan Process (EPP) via the Seabed Expert Topic Group (ETG) which includes Natural England, the Marine Management Organisation (MMO), the Centre for Environment, Fisheries and Aquaculture Science (Cefas), The Wildlife Trusts, and the Eastern Inshore Fisheries and Conservation Authority (EIFCA). **Table 9-1** provides a summary of how the consultation responses received to date have influenced the approach that has been taken in preparing the PEIR.

6. This chapter will be updated following the consultation on the PEIR to produce the final assessment that will be submitted with the Development Consent Order (DCO) application. Full details of the consultation process will also be presented in the Consultation Report alongside the DCO application.

*Table 9-1: Consultation responses.*

| Consultee | Date/ Document | Comment | Project Response |
|---|---|---|---|
| PINS | Scoping Opinion (November 2019) | The Scoping Report acknowledges the potential for scour of the seabed to result in increased suspended sediments in the water column; however, it considers these would be localised and short lived (i.e. only during storm conditions). The proposal to scope out impacts from this aspect chapter is inconsistent with the proposal to scope in effects on suspended sediment concentrations during operation in the Marine Geology, Oceanography and Physical Processes chapter (paragraph 214). Given the acknowledgement within the Scoping Report that there is potential for the resuspension of sediment during the operational phase, the Inspectorate is unable to rule out potential significant effects to Marine Water and Sediment Quality and therefore does not agree this matter can be scoped out. | Potential effects relating to resuspension of sediment during operation is discussed in **Section 9.6.2**. |
| | | The Scoping Report states that any sediment contamination within suspended sediment resulting from scour of the seabed is unlikely to give rise to changes in marine water quality. The Scoping Report does not justify this statement. It states that contamination in the existing Sheringham Shoal and Dudgeon wind farm sites are considered to be low, however no site-specific data for SEP/DEP has been provided at this stage.<br>The Inspectorate acknowledges that the majority of contaminant disturbance would likely be during the construction phase.<br>However, in the absence of site-specific data on contaminant levels, the Inspectorate does not consider it has sufficient information to rule out a likely significant effect resulting from re- suspension of contaminants from scouring effects. As such, the Inspectorate does not agree this can be scoped out of the ES. | Site specific contamination concentrations are presented in **Section 9.5.4**, and the potential impacts arising from the disturbance of this sediment during construction and operation are discussed in **Section 9.6.1** and **Section 9.6.2**, respectively. |

| Consultee | Date/ Document | Comment | Project Response |
|---|---|---|---|
| | | The Scoping Report states that all construction vessels would be required to comply with the International Convention for the Prevention of Pollution from Ships (MARPOL 73/38) and notes that a Project Environmental Management and Monitoring Plan (or similar) would be put in place to ensure works are undertaken in line with best practice for working in the marine environment. For operation, the Scoping Report states best practice measures would be put in place to reduce risks as far as possible.<br>The Inspectorate agrees that, with the implementation of such measures, any potential impacts on water and sediment quality are unlikely to result in significant effects and therefore further assessment is not required. However, the Inspectorate seeks assurances that such measures would be employed and therefore considers the matter should still be covered within the ES, along with details of the measures to be employed and how they are secured by the DCO (or through the Marine Licence or other suitable mechanism). The ES should include a draft version (with sufficient detail) of any plans containing such measures. | An Outline Offshore Project Environmental Management Plan (PEMP) will be submitted alongside the DCO application. |
| | | The Scoping Report states that effects on Marine Water and Sediment Quality are likely to be restricted to the project boundary and the immediate surrounding area. As with the Marine Geology, Oceanography and Physical Processes chapter, the Applicant has not provided references to studies to back up this claim, nor has it identified a study area for this aspect chapter within which it considers effects are likely.<br>Nevertheless, having regard to the location of the Proposed Development (a minimum of 100km from any international territory boundary), the nature of potential impacts to water and sediment quality, the Inspectorate considers that transboundary impacts associated with this matter are unlikely to result in significant effects and can therefore can be scoped out of the ES. | A study area for this topic is presented in **Section 9.3.1** and modelling results illustrating the extent of any sediment plumes are presented in **Chapter 8**. |

| Consultee | Date/ Document | Comment | Project Response |
|---|---|---|---|
| | | Table 2-5 of the Scoping Report refers to information in the Marine Geology, Oceanography and Physical Processes chapter to be collected in 2020. It states that this will provide baseline information on sediment type and suspended solid concentrations. As noted in Table 4.1 of this Opinion, it is currently unclear how suspended baseline sediment concentrations will be established.<br>The ES should clearly identify the data sources used to inform the suspended sediment baseline. | Data sources for the baseline information that has been collected are presented and discussed within **Chapter 8**. |
| | | It is unclear at this stage what site-specific information will be obtained to inform the baseline. The Scoping Report states that the analysis of the grab samples proposed in Table 2-5 (which would be conducted as part of the Benthic Ecology survey) will be agreed with stakeholders including the MMO, Cefas and Natural England.<br>For the avoidance of doubt, the Inspectorate expects the contaminant levels from grab samples to be analysed to inform the baseline contaminant levels across the site. | Contaminant levels present within the grab samples collected are presented in **Section 9.5.4**. |
| | | The Scoping Report states that where high levels of contamination are identified (i.e. close to or above Cefas Action Level 2), consideration against Water Framework Directive Environmental Quality Standards will be undertaken. The Inspectorate understands that Cefas Action Levels between Level 1 and 2 generally trigger further investigation of the material proposed for disposal at sea, and contaminants in dredged material above chemical Action Level 2 (cAL2) are generally considered unsuitable for sea disposal. The ES should explain the approach taken in order to characterise the receiving environment for cALs, including how they relate to the assessment of likely significant effects and any measures necessary to mitigate any such effects. | The approach taken to characterise and assess any contamination present in the sediment is discussed in **Section 9.5.4**. The impact assessment is presented in **Section 9.6**. |

| Consultee | Date/ Document | Comment | Project Response |
|---|---|---|---|
| | | Overall, the proposed approach seems appropriate. Please see the following two comments, and otherwise, Natural England defers to the expert advice at the Environment Agency and CEFAS with regards to the need for surveys or additional assessment work for water and sediment quality. | Noted. |
| Natural England | Scoping Opinion (November 2019) | There is currently no reference to specific impacts of suspended sediment concentrations from disposal of dredged material at specific disposal grounds offshore. This needs to be considered further and scoped into the assessment. | Seabed levelling may be carried out for interlink cable installation (between SEP and DEP North) and seabed preparation may be required for gravity base structure (GBS) foundations. Excavated sediment would be disposed of within the PEIR boundary, the worst-case scenario assumes that sediment would be dredged and returned to the water column at the sea surface from the dredger vessel (see Chapter 5 Project Description). An assessment of the potential effects associated with the seabed preparation and sediment release is presented in **Section 9.6.1.1**. |
| | | Increased concentrations of suspended sediments and release of contaminants due to ongoing scour during operation should be scoped in. This has been recognised by the scoping in of increased suspended sediment concentrations during operation in regard to Benthic and intertidal ecology. | Potential impacts through the increased suspended sediments and release of contaminants during operation through scour effects is discussed in **Sections 9.6.2.3**. |

| Consultee | Date/ Document | Comment | Project Response |
|---|---|---|---|
| MMO | Dudgeon and Sheringham Extension Projects Seabed Expert Topic Group meeting response July 2020 | Tributyltin (TBT) contamination (mobilisation of contaminated sediments) has been screened out of assessment. In the ETG meeting there was a request to screen this pressure back in due to the potential presence of a whelk fishery within the MCZ. TBT has the potential to cause imposex in gastropod molluscs. If organotins (TBT/dibutyltin (DBT)) were present in the sediment and resuspended, they could become bioavailable to fauna and have detrimental impacts on the viability of the fishery. | See **Section 9.5.4** – Organotins were included within the sediment analysis suite. Concentrations of organotins were below Cefas Action Level 1. |
| Cefas | 2nd Seabed ETG Meeting Minutes (PB8164-RHD-ZZ-OF-MI-PM-0012) 2nd June 2020 | In the ETG meeting Cefas requested a Day grab be used at stations where there will be an analysis for sediment contaminants. As acknowledged by Cefas at the meeting, the success rate of the Day grab is lower than the Hamon grab in coarse sediment so it is possible that repeat attempt(s) with a Day grab could be required. We would appreciate clarification on this point against the comment that the type of grab used should enable a successful sample to be taken first time | Please refer to Fugro 2020a and 2020b. Seabed fauna and Particle Size Analysis (PSA) samples were taken using a Hamon grab. Chemistry samples were taken with a Day grab outside the Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) and with a Shipek grab inside the MCZ. |

## 9.3 Scope

### 9.3.1 Study Area

7. The study area for marine sediment and water quality has been defined on the basis of the following project elements:

- The area within the offshore PEIR boundary comprising:
  - The DEP and SEP wind farm sites (defined by Agreement for Lease (AfL) areas) including the wind turbine foundations, infield cables and offshore substation platform/s (OSP).
  - Offshore cable corridors outside of the wind farm sites (either interlink cable or offshore export cable corridors).
- The wider area that may be impacted by sediment plumes (this is informed by **Chapter 8 Marine Geology, Oceanography and Physical Processes** as this chapter considers the spatial extent of any potential sediment plumes).

### 9.3.2 Realistic Worst-Case Scenario

8. The detailed design of DEP and SEP (including numbers of wind turbines, layout configuration, requirement for scour protection etc.) has not yet been determined and may not be known until sometime after any DCO has been granted. Therefore, realistic worst-case scenarios in terms of potential impacts/effects on marine water and sediment quality are adopted to undertake a precautionary and robust impact assessment. Due to the inherent links between marine water and sediment quality, and the marine geology, oceanography and physical processes chapter, the worst-case scenario presented in both chapters is the same.

#### 9.3.2.1 General Approach

9. To provide a precautionary but robust impact assessment at this stage of the development process, realistic worst-case scenarios have been defined in terms of the potential effects that may arise. This approach to EIA, referred to as the Rochdale Envelope, is common practice for developments of this nature, as set out in Planning Inspectorate Advice Note Nine (2018). The Rochdale Envelope for a project outlines the realistic worst-case scenario for each individual impact, so that it can be safely assumed that all lesser options will have less impact. Further details are provided in **Chapter 6 EIA Methodology**.

10. The realistic worst-case scenarios for the marine sediment and water quality assessment are summarised in **Table 9-2**. These are based on the project parameters described in **Chapter 5 Project Description**, which provides further details regarding specific activities and their durations.

11. In addition to the design parameters set out in **Table 9-2**, consideration is also given to how DEP and SEP will be built out as described in **Section 9.3.2.2** to **Section 9.3.2.4** below. This accounts for the fact that whilst DEP and SEP are the subject of one DCO application, it is possible that either one or both of the projects will be developed, and if both are developed, that construction may be undertaken either concurrently or sequentially.

*Table 9-2: Realistic Worst Case Scenarios.*

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| **Construction** | | | | |
| Impact 1: Changes in suspended sediment concentrations due to seabed preparation for foundation installation | Seabed preparation for 32 conical GBS foundations for 14MW turbines.<br><br>Total worst case seabed preparation volume: **530,929m$^3$** | Seabed preparation for 24 conical GBS foundations for 14MW turbines.<br><br>Total worst case seabed preparation volume: **398,197m$^3$** | Seabed preparation for 56 conical GBS foundations for 14MW turbines.<br><br>Total worst case seabed preparation volume: **929,126m$^3$** | The worst-case scenario for a single GBS foundation is for the larger 18+ megawatt (MW) turbine with a 60m base plate diameter, however over the whole project, the worst case volumes are associated with sea bed preparation for the maximum number of 14MW GBS foundations, which has a 45m base plate diameter.<br><br>Sea bed preparation (dredging using a trailer suction hopper dredger and installation of a bedding and levelling layer) may be required up to a sediment depth of 5m. The worst-case scenario assumes that sediment would be dredged and returned to the water column at the sea surface during disposal from the dredger vessel. |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| | | | | The worst case scenario for DEP and SEP is the same for all DEP and SEP scenarios. |
| Impact 2: Changes in suspended sediment concentrations due to drill arisings for foundation installation of piled foundations for wind turbines and OSPs | Two drilled 14MW monopile foundations, and one OSP in DEP North.<br><br>Total worst-case drill arisings: **12,371m³** | Two drilled 14MW monopile foundations, and one OSP in SEP.<br><br>Total worst-case drill arisings: **12,371m³** | Four drilled 14MW monopile foundations, and two OSPs (one in DEP North and one in SEP)<br><br>Total worst-case drill arisings: **24,742m³** | The worst case for a release from an individual wind turbine assumes monopile foundation for the 14+ megawatt (MW) wind turbine (13m diameter drill drilling to 45m) releasing a maximum of 5,973m³ per foundation into the water column.<br><br>Equinor estimates that the maximum number of foundations requiring drilling would be 5% (1 in 20 foundations). Hence, for the total volume during the construction phase, the worst case scenario for drilling is associated with two 14MW monopiles (per site) and one of eight pin piles per OSP.<br><br>The worst case scenario for DEP and SEP together assumes DEP (North & South) and SEP are developed in a separated grid |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| | | | | option (each having their own OSP). |
| Impact 3: Changes in suspended sediment concentrations due to export cable installation | One HVAC export cable up to 62km in length.<br><br>Worst case volume of sediment that would be disturbed: **175,850m³** (**6,148m³** of which within the Cromer Shoal MCZ)<br>• **144,200m³** for sand wave levelling<br>• **31,000m³** for export cable trench<br>• **650m³** for HDD exit point | One HVAC export cable up to 40km in length.<br><br>Worst case volume of sediment that would be disturbed: **20,650m³** (**6,148m³** of which within the Cromer Shoal Chalk Beds MCZ)<br>• No sand wave levelling<br>• **20,000m³** for export cable trench<br>• **650m³** for HDD exit point | Two HVAC export cables, totalling up to 102km in length.<br><br>Worst case volume of sediment that would be disturbed: **195,900m³** (**11,697m³** of which within the Cromer Shoal Chalk Beds MCZ)<br>• **144,200m³** for sand wave levelling<br>• **51,000m³** for export cable trench<br>• **700m³** for HDD exit point | Trenching by jetting or ploughing would be required to bury the export cables. However, jetting is considered the worst case scenario due to the greater width of disturbance compared to ploughing. Therefore, the worst case assumes 100% jetting of a v-shaped trench, 1.0m in width and 1.0m depth.<br><br>The offshore HDD exit location will be approximately 1,000m offshore in the offshore export cable corridor. Sediment displacement assumes a box shaped dimension.<br><br>The worst case scenario for export cable installation for the DEP and SEP together scenario is where both DEP (North & South) and SEP are developed in in a separated grid option (each having their own OSP and export |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| | | | | cable). This is a realistic worst case scenario. |
| Impact 4: Changes in suspended sediment concentrations due to offshore cables installation (infield and interlink cables) | Worst case volume of sediment that would be disturbed: **458,325m³**<br>• Sand wave levelling in infield and interlink cable corridors: **232,200m³**<br>• 135km of infield cables (DEP North: 90km; DEP South: 45km): **151,875m³**<br>• Up to 3 parallel interlink cables between DEP South and OSP in DEP North: up to 66km in length | Worst case volume of sediment that would be disturbed: **101,250m³**<br>• 90km of infield cables: **101,250m³**<br>• No interlink cables<br>• No sand wave levelling | **Worst case scenario**[1]:<br>Worst case volume of sediment that would be disturbed:<br>• Sand wave levelling in infield and interlink cable corridors: **360,200m³**<br>• Up to 225km of infield cables: **253,125m³**<br>• Up to seven interlink cables (between DEP North to OSP in SEP) up to 154km total length: **173,250m³** | Sand wave levelling is required in particular areas prior to infield and interlink cable installation. Any excavated sediment due to sand wave levelling would be disposed of within the DEP and SEP wind farm sites, meaning there will be no net loss of sediment from the site(s).<br><br>The cable burial technique for infield and interlink cables is assumed to be 50% jetting and 50% mechanical cutting. The worst case cable laying technique is considered to be mechanical cutting due to the greater width of disturbance compared to jetting, therefore the assessment considers 100% of cables installed by mechanical cutting. |

[1] The individual worst case scenarios presented for interlink and infield cables would not represent a developable scenario if taken as a total, therefore a ‘realistic’ worst case scenario is presented for this and all other activities that vary depending on the development scenario in question. This includes sandwave clearance, number of OSPs and anchoring.

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
| --- | --- | --- | --- | --- |
| | (combined): **74,250m$^3$** | | **Realistic worst case scenario**<br>• The realistic worst case volume of sediment that would be disturbed: **774,200m$^3$** | A maximum width of a mechanically cut trench is 1.5m and maximum burial depth of 1.5m for a v-shaped trench is assumed.<br><br>**DEP and SEP together worst case scenario**<br>**Sand wave levelling:** Assumes DEP and SEP are developed in an integrated grid option, and DEP North & South and SEP are developed.<br>**Interlink cable:** Assumes DEP and SEP are developed in an integrated grid option, however only DEP North and SEP are developed.<br>**Infield cable:** Assumes DEP and SEP are developed in an integrated grid option, and DEP North & South and SEP are developed.<br><br>**DEP and SEP together realistic worst case scenario** |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| | | | | Assumes DEP and SEP are developed in an integrated grid option, and DEP North & South and SEP are developed. |
| Impact 5: Deterioration in water quality due to the release of contaminated sediment during construction activities | See Impacts 1 to 4 above. | See Impacts 1 to 4 above. | See Impacts 1 to 4 above. | Mobilisation of any sediment-bound contaminants. |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| **Operation** | | | | |
| Impact 1: Deterioration in water quality through an increase in suspended sediment due to scouring effects | Worst case obstruction: **459,706m²**<br>• 32 x 14MW GBS wind turbine foundations (45m base diameter plus scour protection of 135m diameter) with a minimum spacing of 990m: **458,044m²**<br>• One OSP with four-leg jacket and suction buckets (12m diameter per leg) and a maximum bucket spacing of 40m: **1,662m²** | Worst case obstruction: **345,195m²**<br>• 24 x 14MW GBS wind turbine foundations (45m base diameter plus scour protection of 135m diameter) with a minimum spacing of 990m: **343,533m²**<br>• One OSP with four-leg jacket and suction buckets (12m diameter per leg) and a maximum bucket spacing of 40m: **1,662m²** | Worst case obstruction: **804,901m²**<br>• 56 x 14MW GBS wind turbine foundations (45m base diameter plus scour protection of 135m diameter) with a minimum spacing of 990m: **801,577m²**<br>• Two OSPs with four-leg jackets and suction buckets (12m diameter per leg) and a maximum bucket spacing of 40m: **3,324m²** | GBS are the worst-case foundation types for effects on the sediment transport regime due to the height of the foundation above the seabed.<br><br>The quantities of suspended sediment associated with scour effects cannot be quantified, but scour will be localised around structures placed on the sea bed.<br><br>The DEP and SEP worst case scenario assumes DEP (North & South) and SEP are developed in a separated grid option (each having their own OSP). |
| | Total footprint of cable and crossing protection: **0.05km²** | Total footprint of cable and crossing protection: **0.015km²** | Total footprint of export cable and crossing protection: **0.059km²** | External cable protection for unburied cables will be rock berm protection up to 0.5m in height and 4m wide in a trapezoid |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| | • **4,000m²** for infield cables<br>• **9,000m²** for interlink cables<br>• **3,000m²** for export cables<br>• **35,700m²** for 17 crossings (six interlink crossings, seven infield crossings, four export)<br>• **300m²** for 100m of HDD exit point cable protection | • **4,000m²** for infield cables<br>• **3,000m²** for export cables<br>• **8,400m²** for four export cable crossings<br>• **300m²** for 100m of HDD exit point cable protection | • **4,000m²** for infield cables<br>• **9,000m²** for interlink cables<br>• **3,000m²** for export cables<br>• **44,100m²** for 21 crossings (six interlink crossings, seven infield crossings, eight export)<br>• **600m²** for 200m of HDD exit point cable protection | shape. External cable protection for crossings will be either mattressing or rock dumping.<br><br>The DEP and SEP worst case scenario is the same for all DEP and SEP together scenarios. |
| Impact 2: Deterioration in water quality through an increase in suspended sediment due to cable repairs / reburial and maintenance vessel footprints | See Operational Impact 7 of **Marine Geology, Oceanography and Physical Processes**.<br>The volume of sediment disturbed due to cable repairs / reburial and maintenance vessel footprints will be less than during cable installation and construction vessel activities. | | | |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| Impact 3: Deterioration in water quality through the release of contaminated sediment due to scouring effects and maintenance activities. | See Impacts 1 and 2. | See Impacts 1 and 2. | See Impacts 1 and 2. | As above. |
| **Decommissioning** | | | | |
| Impact 1: Changes in suspended sediment concentrations due to foundation removal | No final decision has yet been made regarding the final decommissioning policy for the offshore project infrastructure. It is also recognised that legislation and industry best practice change over time. However, the following infrastructure is likely be removed, reused or recycled where practicable:<br>• Turbines including monopile, steel jacket and GBS foundations;<br>• OSPs including topsides and steel jacket foundations; and<br>• Offshore cables may be removed or left *in situ* depending on available information at the time of decommissioning.<br>The following infrastructure is likely to be decommissioned *in situ* depending on available information at the time of decommissioning:<br>• Scour protection; | | | Decommissioning arrangements will be detailed in a Decommissioning Plan, which will be drawn up and agreed with the Department for Business, Energy and Industrial Strategy (BEIS) prior to construction. |
| Impact 2: Changes in suspended sediment concentrations due to removal of parts of the export cable | | | | |
| Impact 3: Changes in suspended | | | | |

| Impact | DEP in Isolation | SEP in Isolation | DEP & SEP Together | Notes and Rationale |
|---|---|---|---|---|
| sediment concentrations due to removal of parts of the infield and interlink cables | • Offshore cables may be removed or left *in situ*; and<br>• Crossings and cable protection<br><br>The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator. For the purposes of the worst case scenario, it is anticipated that the impacts will be no greater than those identified for the construction phase. | | | |
| Impact 4: Deterioration in water quality due to release of contaminated sediment during decommissioning activities | | | | |

#### 9.3.2.2 Construction Scenarios

12. The following principles set out the framework for how the projects may be constructed:
    - DEP and SEP may be constructed at the same time, or at different times;
    - If built at the same time both projects could be constructed in four years, with offshore construction being undertaken over two years (likely years 3 and 4) of the overall construction period;
    - If built at different times, either project could be built first;
    - If built at different times the first project would require a four-year period of construction including a two year offshore construction period, the second project a three-year period of construction including a two year offshore construction period;
    - If built at different times, the duration of the gap between the start of construction of the first project, and the start of construction of the second project may vary from two to four years;
        - If the gap between the projects is less than two years, the first project would wait for the second project in order to be constructed together;
    - Assuming a maximum construction periods, and taking the above into account, the period over which the construction of both projects could take place is seven years;
    - The earliest construction start date is 2024 and the latest is 2028.
13. To determine which construction scenario presents the realistic worst case for each receptor and impact, the assessment considers both maximum duration effects and maximum peak effects, in addition to each project being developed in isolation, drawing out any differences between each of the two projects.
14. The three construction scenarios considered by the marine sediment and water quality assessment are therefore:
    - Build DEP or build SEP in isolation;
    - Build DEP and SEP concurrently – reflecting the maximum peak effects; and
    - Build one project followed by the other with a gap of up to four years (sequential) – reflecting the maximum duration of effects. This would result in a maximum gap in offshore construction of one year.
15. Any differences between the two projects, or differences that could result from the manner in which the first and the second projects are built (concurrent or sequential and the length of any gap) are identified and discussed where relevant in the impact assessment section of this chapter (**Section 9.6**). For each potential impact only the worst-case construction scenario for two projects is presented, i.e. either concurrent or sequential. The justification for what constitutes the worst case is provided, where necessary, in **Section 9.6**.

#### 9.3.2.3 Operation Scenarios

16. Operation scenarios are described in detail in **Chapter 5 Project Description**. The assessment considers the following three scenarios:

- Only DEP in operation;
- Only SEP in operation; and
- The two projects operating at the same time, with a gap of up to three years between each project commencing operation.

17. The operational lifetime of each project is expected to be 35 years.

#### 9.3.2.4 Decommissioning Scenarios

18. Decommissioning scenarios are described in detail in **Chapter 5 Project Description**. Decommissioning arrangements will be agreed through the submission of a Decommissioning Plan prior to construction, however for the purpose of this assessment it is assumed that decommissioning of DEP and SEP could be conducted separately, or at the same time.

### 9.3.3 Summary of Mitigation Embedded in the Design

19. This section outlines the embedded mitigation relevant to the marine water and sediment quality assessment, which has been incorporated into the design of DEP and SEP (**Table 9-4**). Where other mitigation measures are proposed, these are detailed in the impact assessment (**Section 9.6**).

*Table 9-3: Embedded Mitigation Measures*

| Parameter | Mitigation Measures Embedded into the Design of DEP and SEP |
|---|---|
| **General** | |
| Foundations | For piled foundation types, such as monopiles and jackets with pin piles, pile-driving would be used in preference to drilling where it is practicable to do so (i.e. where ground conditions allow). This would minimise the quantity of sub-surface sediment that is released into the water column from the installation process. |
| | Micro-siting would be used where possible to minimise the requirements for seabed preparation prior to foundation installation. |
| Cables | Cables would be buried where possible, minimising the requirement for external cable protection measures and thus effects related to scour. Where burial is required, jetting, ploughing or cutting will be used depending on the ground conditions. Where possible sediment removed from the trench will be used as infill. Use of external cable protection would be minimised in all cases and in the nearshore is only included for potential use at the HDD exit point. |
| | Route selection and micro-siting of the cables will be used to avoid areas of seabed that pose a significant challenge to their installation, including for example areas of sand waves and megaripples. This will minimise the requirement for seabed |

| Parameter | Mitigation Measures Embedded into the Design of DEP and SEP |
|---|---|
| | preparation (levelling) and the associated seabed disturbance. This is reflected in the allowances that have been made for these works as described in **Table 9-2**, based on the information from the geophysical surveys conducted to date. |

### 9.3.4 Pollution prevention

20. Equinor is committed to the use of best practice techniques and due diligence regarding the potential for pollution throughout all construction, operation and maintenance, and decommissioning activities. An outline PEMP will be developed and submitted alongside the DCO application to set out the details of the measures that will be taken in relation to accidental pollution events. The final PEMP would be agreed with the MMO prior to construction.

21. In view of the above and the commitment to the PEMP this risk is not considered further in this chapter.

## 9.4 Impact Assessment Methodology

### 9.4.1 Policy, Legislation and Guidance

#### 9.4.1.1 National Policy Statements

22. The assessment of potential impacts upon marine sediment and water quality has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to DEP and SEP are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC) 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

23. The specific assessment requirements for marine sediment and water quality, as detailed in the NPS, are summarised in **Table 9-4** together with an indication of the section of the PEIR chapter where each is addressed.

*Table 9-4: NPS Assessment Requirements.*

| NPS Requirement | NPS Reference | Section Reference |
|---|---|---|
| **En-1 NPS for Energy (EN-1)** | | |
| Infrastructure development can have adverse effects on the water environment, including transitional waters and coastal waters. During the construction, operation and decommissioning phases, discharges would occur. There may also be an increased risk of spills and leaks of pollutants to the water environment. | Paragraph 5.15.1 | Potential impacts of the project on water quality are assessed in **Section 9.6** and in the WFD Compliance Assessment found in **Appendix 20.1**. |

| NPS Requirement | NPS Reference | Section Reference |
|---|---|---|
| These effects could lead to adverse impacts on health or on protected species and habitats and could, in particular, result in surface waters, ground waters of protected areas failing to meet environmental objectives established under the Water Framework Directive. | | Impacts to habitats and species are assessed in **Chapter 10 Benthic Ecology**, **Chapter 11 Fish and Shellfish Ecology and Chapter 14 Commercial Fisheries**. |
| Where the project is likely to have adverse effects on the water environment, the application 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 Environmental Statement or equivalent. | Paragraph 5.15.2 | The existing baseline and the baseline for relevant WFD marine bodies is presented in **Section 9.5**. |
| **En-3 NPS for Renewable Energy Infrastructure (EN-3)** | | |
| The construction, operation and decommissioning of offshore energy infrastructure can affect marine water quality through the disturbance of sea bed sediments or the release of contaminants with subsequent indirect effects on habitats, biodiversity and fish stocks. | Paragraph 2.6.189 | Potential impacts during construction are assessed in **Section 9.6**. Contaminant analysis of samples collected from the seabed indicate very low levels of contaminants. |
| The Environment Agency regulates emissions to land, air and water out to 3 nautical miles (nm). Where any element of the wind farm or any associated development included in the application to the Infrastructure Planning Commission (IPC) (now the Planning Inspectorate) is located within 3nm of the coast, the Environment Agency should be consulted at the pre-application stage on the assessment methodology for impacts on the physical environment. | Paragraph 2.6.191 | The Environment Agency has been consulted with through the Scoping process (see **Chapter 7 Technical Consultation** for further detail). |

| NPS Requirement | NPS Reference | Section Reference |
|---|---|---|
| Beyond 3nm, the Marine Management Organisation (MMO) is the regulator. The applicant should consult the MMO and Centre for Environment, Fisheries and Aquaculture Science (Cefas) on the assessment methodology for impacts on the physical environment at the pre-application stage. | Paragraph 2.6.192 | The MMO have been consulted with through the Evidence Plan Process (see **Chapter 7 Technical Consultation** for further detail). |

#### 9.4.1.2 Other

24. In addition to the NPS, there are a number of pieces of legislation, policy and guidance applicable to the assessment of marine sediment and water quality. These include:
    - 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 WFD);
    - Directive 2008/105/EC Priority Substances establishing Environmental Quality Standards for contaminants in water;
    - Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive (MSFD)); and;
    - Directive 2006/7/EC concerning the management of bathing water quality.
25. Following the UK's exit from the EU, these are written into UK law through the following regulations:
    - The Flood and Water (Amendments) (England and Wales) (EU Exit) Regulations 2019;
    - The Environment (Amendment etc.) (EU Exit) Regulations 2019; and
    - The Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019.
26. The International Convention for the Prevention of Marine Pollution by Ships (MARPOL Convention) 73/78 is also relevant to the protection of marine water and sediment quality.
27. Other UK policies and plans of relevance to this chapter are the Marine Policy Statement (MPS) (HM Government, 2011) and the East Inshore and East Offshore Marine Plans (HM Government, 2014). These documents guide decision making with regard to marine developments and signpost the relevant legislation to be followed. These are discussed further in **Chapter 3, Policy and Legislative Context**.
28. The MPS provides the high-level approach to marine planning and general principles for decision making. It also sets out the framework for environmental, social and economic considerations that need to be taken into account in marine planning. Section 2.6.4 of the MPS states that:

"*Developments and other activities at the coast and at sea can have adverse effects on transitional waters, coastal waters and marine waters. During the construction, operation and decommissioning phases of developments, there can be increased demand for water, discharges to water and adverse ecological effects resulting from physical modifications to the water environment. There may also be an increased risk of spills and leaks of pollutants into the water environment and the likelihood of transmission of invasive non-native species, for example through construction equipment, and their impacts on ecological water quality need to be considered*."

29. With regard to the East Inshore and East Offshore Marine Plans (HM Government 2014) Objective 6 "To have a healthy, resilient and adaptable marine ecosystem in the East Marine Plan areas" is of relevance to this chapter as this covers policies and commitments on the wider ecosystem, set out in the MPS including those to do with the MSFD and the WFD, as well as other environmental, social and economic considerations. Elements of the ecosystem considered by this objective include:

*"water quality characteristics critical to supporting a healthy ecosystem and pollutants that may affect these".*

30. Further detail is provided in **Chapter 3 Policy and Legislative Context**.

### 9.4.2 Data and Information Sources

#### 9.4.2.1 Site specific surveys

31. To provide site specific information on which to base the impact assessment, a site characterisation survey was conducted in the DEP and SEP wind farm sites and offshore cable corridors by Fugro between the 10$^{th}$ and 19$^{th}$ August 2020 (Fugro, 2020a and 2020b). The site characterisation reports are available in **Appendix 10.1 DEP Benthic Characterisation Report** (Fugro, 2020a) and **Appendix 10.2 SEP Benthic Characterisation Report** (Fugro, 2020b).

32. Grab samples were collected for particle size analysis (PSA) and chemical analysis for polycyclic aromatic hydrocarbons (PAHs), heavy metals and Tributyl Tins (TBT). The results of the chemical analysis are presented in **Section 9.5.4**.

#### 9.4.2.2 Other available sources

33. Other sources that have been used to inform the assessment are listed in **Table 9-5**.

*Table 9-5: Other available data and information sources.*

| Data set | Spatial coverage | Year | Notes |
|---|---|---|---|
| Clean Seas Environmental Monitoring Programme (CSEMP) – water quality | UK Seas – water quality | Various – latest report OSPAR, 2017 | The Interim Quality Status Report (QSR) 2017 describes the current status and trends in water quality for regional seas including the North Sea. |
| Environment Agency Catchment Data | Rivers, estuaries and | 2019 | Database for information related to river basin |

| Data set | Spatial coverage | Year | Notes |
|---|---|---|---|
| Explorer (Environment Agency, 2021a) | coastal water bodies around England | | management plans (RBMP) in England. Contains information on river basin districts and catchments and WFD compliance data. |
| Environment Agency Bathing Waters Information and classification (Environment Agency, 2021b) | Coastal water bodies designated as bathing waters | Up to 2019 | Data for designated bathing waters. Note there is no data available for 2020 due to Covid-19 and issues associated with sampling. |

### 9.4.3 Impact Assessment Methodology

34. **Chapter 6 EIA Methodology** provides a summary of the general impact assessment methodology applied to DEP and SEP. The following sections confirm the methodology used to assess the potential impacts on marine sediment and water quality.

35. The impact assessment methodology in this chapter generally follows that outlined in **Chapter 6 EIA Methodology** with topic specific definitions for sensitivity and magnitude provided below.

#### 9.4.3.1 Definitions

36. For each effect, the assessment identifies receptors sensitive to that effect and implements a systematic approach to understanding the impact pathways and the level of impacts on given receptors. The definitions of sensitivity and magnitude for the purpose of the marine sediment and water quality assessment are provided in **Table 9-6** and **Table 9-7**.

37. The sensitivity of a receptor, in this case marine water quality, is dependent upon its:

- Tolerance to an effect (i.e. the extent to which the receptor is adversely affected by a particular effect);
- Adaptability (i.e. the ability of the receptor to avoid adverse impacts that would otherwise arise from a particular effect); and
- Recoverability (i.e. a measure of a receptor's ability to return to a state at, or close to, that which existed before the effect caused a change).

38. Sensitivity is described using a standard semantic scale. Definitions for each term are provided in **Table 9-6**.

*Table 9-6: Definition of sensitivity for marine waters*

| Sensitivity | Definition |
|---|---|
| **High** | The water quality of the receptor supports or contributes towards the designation of an internationally or nationally important feature and/or has a very low capacity to accommodate any change to current water quality status, compared to baseline conditions. |
| **Medium** | The water quality of the receptor supports high biodiversity and/or has low capacity to accommodate change to water quality status. |
| **Low** | The water quality of the receptor has a high capacity to accommodate change to water quality status due, for example, to large relative size of the receiving water and capacity for dilution. Background concentrations of certain parameters already exist. |
| **Negligible** | Specific water quality conditions of the receptor are likely to be able to tolerate proposed change with very little or no impact upon the baseline conditions detectable. |

39. Water quality in the offshore area is considered to be of low sensitivity because it is not within a confined area and therefore has a high capacity to accommodate change due to its size and ability to dilute any alterations to water quality parameters. Similarly, it is also considered that the inshore project area (the export cable corridor) is of low sensitivity. The nearest designated bathing water is over 4km from the proposed export cable corridor and due to the exposed coastal nature of the area, there is a high capacity to accommodate change through dilution of any water quality effects.

40. The descriptions of magnitude are specific to the assessment of marine water quality impacts and are considered in addition to the generic descriptors of impact magnitude that are presented in **Chapter 6 EIA Methodology**. Potential impacts have been considered in terms of whether they are permanent or temporary and have resulting adverse or beneficial effects. The magnitude of an effect is dependent upon its:

- Scale (i.e. size, extent or intensity);
- Duration;
- Frequency of occurrence; and
- Reversibility (i.e. the capability of the environment to return to a condition equivalent to the baseline after the effect ceases).

41. The magnitude of effect is described using a standard semantic scale and definitions for each term are provided in **Table 9-7**.

*Table 9-7: Definition of magnitude*

| Magnitude | Definition |
|---|---|
| **High** | Large scale change to key characteristics of the water quality status of the receiving water feature. Water quality status degraded to the extent that a permanent or long term change occurs. Inability to meet (for example) Environmental Quality Standard (EQS) is likely. |
| **Medium** | Medium scale changes to key characteristics of the water quality status taking account of the receptor volume, mixing capacity, flow rate, etc. Water quality status likely to take considerable time to recover to baseline conditions. |
| **Low** | Noticeable but not considered to be substantial changes to the water quality status taking account of the receiving water features. Activity not likely to alter local status to the extent that water quality characteristics change considerably or EQSs are compromised. |
| **Negligible** | Although there may be some impact upon water quality status, activities predicted to occur over a short period. Any change to water quality status would be quickly reversed once activity ceases. |

#### 9.4.3.2 Impact Significance

42. In basic terms, the potential significance of an impact is a function of the sensitivity of the receptor and the magnitude of the effect (see **Chapter 6 EIA Methodology** for further details). The determination of significance is guided by the use of an impact significance matrix, as shown in **Table 9-8**. Definitions of each level of significance are provided in **Table 9-9**.

43. Potential impacts identified within the assessment as major or moderate are regarded as significant in terms of the EIA regulations (see **Chapter 6 EIA Methodology** for further detail). Where identified, appropriate mitigation must be described, and where possible, agreed in consultation with the regulatory authorities and relevant stakeholders in advance of submission. The aim of mitigation measures is to avoid or reduce the overall impact in order to determine a residual impact upon a given receptor.

*Table 9-8: Impact significance matrix*

| | | Adverse Magnitude | | | | Beneficial Magnitude | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | High | Medium | Low | Negligible | Negligible | Low | Medium | High |
| Sensitivity | High | *Major* | *Major* | *Moderate* | *Minor* | *Minor* | *Moderate* | *Major* | *Major* |
| | Medium | *Major* | *Moderate* | *Minor* | *Minor* | *Minor* | *Minor* | *Moderate* | *Major* |
| | Low | *Moderate* | *Minor* | *Minor* | *Negligible* | *Negligible* | *Minor* | *Minor* | *Moderate* |
| | Negligible | *Minor* | *Negligible* | *Negligible* | *Negligible* | *Negligible* | *Negligible* | *Negligible* | *Minor* |

*Table 9-9: Definition of impact significance*

| Significance | Definition |
|---|---|
| **Major** | Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and / or breaches of legislation. |
| **Moderate** | Intermediate change in receptor condition, which are likely to be important considerations at a local level. |
| **Minor** | Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process. |
| **Negligible** | No discernible change in receptor condition. |
| **No change** | No impact, therefore, no change in receptor condition. |

### 9.4.4 Cumulative Impact Assessment Methodology

44. The cumulative impact assessment (CIA) considers other plans, projects and activities that may impact cumulatively with DEP and SEP. As part of this process, the assessment considers which of the residual impacts assessed for DEP and/or SEP on their own have the potential to contribute to a cumulative impact, the data and information available to inform the cumulative assessment and the resulting confidence in any assessment that is undertaken. **Chapter 6 EIA Methodology** provides further details of the general framework and approach to the CIA.

45. For marine water and sediment quality, these activities include the construction of other OWFs, O&M activities at operational OWFs, construction and maintenance of coastal projects and other offshore projects.

### 9.4.5 Transboundary Impact Assessment Methodology

46. The transboundary assessment considers the potential for transboundary effects to occur on marine sediment and water quality receptors as a result of DEP and SEP; either those that might arise within the Exclusive Economic Zone (EEZ) of European Economic Area (EEA) states or arising on the interests of EEA states e.g. a non UK fishing vessel. **Chapter 6 EIA Methodology** provides further details of the general framework and approach to the assessment of transboundary effects.

47. The Scoping Report concluded that potential impacts on marine water and sediment quality are likely to be restricted to the project boundary and immediate surrounding area. In their Scoping Opinion, the Planning Inspectorate also considered that transboundary impacts associated with this topic are unlikely to result in significant effects (Planning Inspectorate, 2019). Therefore, transboundary effects are scoped out and are not considered further in this chapter.

### 9.4.6 Assumptions and Limitations

48. Given the limited data regarding site specific offshore water quality, information from more general monitoring programmes such as the Clean Seas Environmental Monitoring Programme and WFD water body status have been used to inform this assessment.

49. Information regarding coastal suspended sediments is not available, however the modelling informing **Chapter 8 Marine Geology, Oceanography and Physical Processes** predicts the potential change in concentrations, therefore allowing an assessment of the magnitude of change that is likely during the various construction activities.

50. The limitations identified above are not considered to significantly affect the certainty or reliability of the impact assessments presented in **Section 9.6**.

## 9.5 Existing Environment

### 9.5.1 Baseline Water Quality

51. The offshore cable corridor routes through WFD coastal water bodies, specifically the Norfolk East coastal water body (GB650503520000), and is also partly within the Norfolk North coastal water body (GB640503300000) in the western part of the offshore export cable corridor (see **Figure 9-1**). A WFD compliance assessment is presented in **Appendix 20.1** however the information available for these water bodies regarding water quality is also relevant to this chapter and is therefore summarised below.

52. Both water bodies are 'heavily modified'; Norfolk North due to flood protection and Norfolk East due to flood and coastal protection. Both water bodies are currently classified to have an overall status of 'moderate' (Environment Agency, 2021a).

53. Classification for physico-chemical parameters in both water bodies is considered moderate due to dissolved inorganic nitrogen concentrations in the water. In the River Basin Management Plan for the area (Environment Agency, 2021a), reasons for the elevated inorganic nitrogen concentrations are listed as diffuse pollution (field runoff from arable land), and point sources associated with sewage discharges. In terms of chemical contaminants, both water bodies are considered to have a status of 'fail' due to levels of polybrominated diphenyl ethers (PBDEs), and mercury and its compounds.

54. There are five designated bathing waters located along the coast from the cable corridor (see **Figure 9-2**). The WFD bathing waters in closest proximity to the offshore cable corridor are Sheringham, and West Runton, 4.6km and 7.7km from the proposed export cable corridor respectively. These bathing waters have been classified as having excellent bathing water quality since 2016 (Environment Agency, 2021b).

55. In terms of the offshore area, the Interim QSR 2017 (OSPAR, 2017) states that overall in the OSPAR region, including the North Sea, contaminant concentrations have continued to decrease in the majority of areas assessed. Although concentrations are generally below levels likely to harm marine species in the areas assessed, in most cases they have not yet reduced to background levels (where these are specified). Concerns remain in some localised areas with respect to high levels of mercury, lead, and CB118 (one of the most toxic polychlorinated biphenyl (PCB) congeners), and locally increasing concentrations of PAHs and cadmium.

### 9.5.2 Suspended Sediment Concentrations

56. As set out in **Chapter 8 Marine Geology, Oceanography and Physical Processes**, typical mean summer suspended sediment concentrations across the study area are less than 10mg/l whereas mean winter concentrations are 30mg/l, although concentrations may increase significantly during storm events (HR Wallingford et al., 2002). These ambient concentrations mean that the transient impact of sediment plumes arising from DEP and SEP activities that interact with the seabed may be significant (although temporally limited) under specific circumstances.

### 9.5.3 Baseline Sediment Characteristics

57. PSA data from seabed samples taken within the study area are described in full in **Chapter 8 Marine Geology, Oceanography and Physical Processes**.

58. The results of the sediment sampling campaign are summarised in **Table 9-10** for ease of reference.

*Table 9-10: Summary of sediment PSA collected during the site specific sampling campaign*

| Area | Description |
|---|---|
| DEP North | The dominant sediment type is medium sand. The mud content is less than 10% in all samples. |
| DEP South | The dominant sediment type is medium sand. Samples have a particularly high sand content, with 82% of samples containing greater than 75% sand. Mud content is less than 10% in all samples. |

| Area | Description |
|---|---|
| Interlink Cable Corridors | The majority of samples in the DEP North to SEP interlink cable corridor are composed primarily of medium to coarse sand. Three samples contain a high percentage of gravel. Mud content is low - less than 10% in all samples. In the DEP South to SEP interlink cable corridor, sediment is dominated by medium sand and low mud content (also less than 10% in all samples). |
| SEP (wind farm site) | The predominant sediment type is sandy gravel. Mud content is less than 10% in 88% of samples, with two samples in the northwest of the SEP wind farm site containing 16.9% and 13.1% mud. |
| Export Cable Corridor | The landward 500m of the export cable corridor (from the SEP wind farm site to landfall) is mainly outcropping chalk (N.B. the export cables at the landfall will be installed by HDD, exiting the seabed approximately 1000m from shore). From 500m to 4.5km offshore along the export cable corridor, the seabed is composed of alternating zones of coarse sediment comprising gravelly sand/gravel, and Holocene sand. From 4.5km from the coast to the SEP wind farm site the seabed is gravelly sand or gravel. 10km offshore, the seabed is composed of sand forming the eastern end of Sheringham Shoal sand bank. Sediment samples collected within the export cable corridor are predominantly composed of medium sand to coarse gravel. Many samples closer to the coast contain greater than 56% gravel and the majority of samples contain 0% mud. |

### 9.5.4 Baseline Sediment Quality

59. To inform the baseline for sediment quality, seven grab samples were taken for chemical analysis during benthic surveys of the DEP and SEP wind farm sites and offshore cable corridors (**Appendix 10.1 DEP Benthic Characterisation Report** (Fugro, 2020a) and **Appendix 10.2 SEP Benthic Characterisation Report** (Fugro, 2020b)). Sample locations are shown in **Figure 9-3**. Ten samples were originally planned, however, at three sites, sampling was unsuccessful because of repeated failure of the grab to take a sample due to rocks in the grab jaws and insufficient sediment recovered.

60. On completion of the survey, all samples were frozen and stored on the survey vessel until demobilisation, following which they were transferred to Fugro for analysis. Analysis was undertaken for the following contaminants:

- Heavy metals (arsenic, mercury, cadmium, chromium, copper, lead, nickel and zinc);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Organotins (Monobutyltin (MBT), Dibutyltin (DBT) and Tributyltin (TBT)); and
- Total hydrocarbons (THC).

#### 9.5.4.1 Comparison with Cefas Action Levels

61. The context of the contaminants found within sediments is established through the use of recognised guidelines and action levels, in this case Cefas Action Levels have been applied because they provide good coverage of contaminants, across a broad range of contaminant types (MMO, 2018). These levels are used to indicate general contaminant levels in the sediments. If, overall, levels do not generally exceed the lower threshold values of these guideline standards, then contamination levels are not considered to be of significant concern and are low risk in terms of potential impacts on the marine environment.

62. The majority of the material assessed against these standards arises from dredging activities, but they are considered an acceptable way of assessing the risks to the environment from other marine activities as part of the EIA process. Selected Action Levels are set out in **Table 9-11**.

*Table 9-11: 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 (MBT, TBT, DBT) | 0.1 | 1 |
| Polycyclic aromatic Hydrocarbons (PAH) | 0.1 (exception dibenz[a,h]anthracene which is 0.01) | None |
| Total Hydrocarbons (THC) | 100 | None |

63. Data from the project sites is presented in **Table 9-12**. It can be seen that no samples exceed the lower Cefas Action Level 1. The sediment is therefore deemed to be very low in terms of risk to the water environment.

*Table 9-12: Data from site specific survey compared to Cefas Action Levels (if an exceedance of Action Level 1 is noted, the cell would be coloured yellow, if an exceedance of Action Level 2 is noted the cell would be coloured red)*

| Contaminant | Sample site (all in mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| | CC-06 | D-17 | D-26 | EC-04 | EC-05 | EC-15 | SS-03 |
| Arsenic | 5.90 | 8.73 | 11.3 | 10.5 | 14.3 | 9.42 | 9.41 |
| Cadmium | <0.0800 | <0.0800 | <0.0800 | <0.0800 | <0.0800 | <0.0800 | <0.0800 |
| Chromium | 4.53 | 3.94 | 10.2 | 8.67 | 10.2 | 5.03 | 10.0 |
| Copper | 1.44 | <0.0800 | 1.10 | 1.80 | 2.06 | 0.915 | 1.75 |
| Nickel | 3.27 | 1.86 | 4.70 | 4.82 | 5.04 | 3.24 | 5.13 |
| Mercury | <0.0400 | <0.0400 | <0.0400 | <0.0400 | <0.0400 | <0.0400 | <0.0400 |
| Lead | 7.28 | 4.59 | 7.53 | 6.34 | 9.93 | 5.34 | 8.34 |
| Zinc | 9.12 | 6.43 | 14.7 | 16.2 | 18.7 | 11.6 | 17.7 |
| TBT | 0.00105 | 0.00126 | <0.0004 | <0.0004 | <0.0004 | <0.0004 | <0.0004 |
| DBT | 0.00167 | <0.0004 | <0.0004 | <0.0004 | 0.000568 | <0.0004 | <0.0004 |
| MTB | <0.0004 | <0.0004 | 0.0399 | 0.00042 | <0.0004 | <0.0004 | <0.0004 |
| Naphthalene | 0.0007 | 0.0005 | 0.0021 | 0.0042 | 0.0037 | 0.0002 | 0.0035 |
| Acenaphthylene | <0.0001 | <0.0001 | <0.0001 | 0.0001 | 0.0001 | <0.0001 | <0.0001 |
| Acenaphthene | 0.0001 | 0.0001 | 0.0001 | 0.0004 | 0.0003 | <0.0001 | 0.0003 |
| Fluorene | 0.0002 | 0.0002 | 0.0004 | 0.0011 | 0.0009 | 0.0001 | 0.0008 |

| Contaminant | Sample site (all in mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| | CC-06 | D-17 | D-26 | EC-04 | EC-05 | EC-15 | SS-03 |
| Phenanthrene | 0.0027 | 0.0028 | 0.0061 | 0.0086 | 0.0089 | 0.0005 | 0.0073 |
| Anthracene | 0.0001 | 0.0001 | 0.0004 | 0.0008 | 0.0009 | 0.0001 | 0.0005 |
| Fluoranthene | 0.0013 | 0.0015 | 0.0048 | 0.0058 | 0.0053 | 0.0005 | 0.0041 |
| Pyrene | 0.0012 | 0.0012 | 0.0041 | 0.0054 | 0.0049 | 0.0004 | 0.0038 |
| Benzo(a)anthracene | 0.0007 | 0.0006 | 0.0019 | 0.0028 | 0.0026 | 0.0002 | 0.0022 |
| Chrysene | 0.0011 | 0.0008 | 0.0026 | 0.0032 | 0.0028 | 0.0003 | 0.0027 |
| Benzo(b)fluoranthene | 0.0019 | 0.0020 | 0.0047 | 0.0066 | 0.0059 | 0.0012 | 0.0056 |
| Benzo(k)fluoranthene | 0.0005 | 0.0005 | 0.001 | 0.0017 | 0.0015 | 0.0003 | 0.0014 |
| Benzo(a)pyrene | 0.0006 | 0.0006 | 0.0017 | 0.0030 | 0.0028 | 0.0002 | 0.0022 |
| Indeno(1,2,3-cd)pyrene | 0.0008 | 0.0008 | 0.0017 | 0.0031 | 0.0030 | 0.0004 | 0.0024 |
| Benzo(ghi)perylene | 0.0014 | 0.0015 | 0.0031 | 0.0046 | 0.0045 | 0.0004 | 0.0038 |
| Dibenzo(a,h)anthracene | 0.0002 | 0.0002 | 0.0005 | 0.0008 | 0.0008 | <0.0001 | 0.0007 |
| THC | 1.4 | 1.4 | 3.3 | 4.0 | 3.6 | 1.2 | 2.4 |

### 9.5.4.2 Comparison with Canadian Sediment Quality Guidelines

64. For completeness, the data has also been compared to the Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CSQG) (Canadian Council of Ministers of the Environment (CCME), 2002). These guidelines involved the derivation of Interim Marine Sediment Quality Guidelines (ISQGs) or Threshold Effect Levels (TEL) and Probable Effect Levels (PEL) 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).

65. These values are not statutory standards. They were designed specifically for Canada and are based on the protection of pristine environments. The findings should, therefore, be treated with caution. In the absence of suitable alternatives, however, is 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. The use of these standards within impact assessments for OWF projects is also widely accepted.

66. Selected Canadian guidelines are presented in **Table 9-13** and comprise two assessment levels. The lower level is referred to as the TEL and represents a 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.

67. Sediment contamination data (Fugro, 2020a and 2020b) is presented in **Table 9-14** and shows that only marginal exceedances of TEL for arsenic concentrations are present.

*Table 9-13: Selected CSQG values (taken from CCME, 2002)*

| Contaminant | TEL (mg/kg) | PEL (mg/kg) |
|---|---|---|
| Arsenic | 7.24 | 41.6 |
| Cadmium | 0.7 | 4.2 |
| Chromium | 52.3 | 160 |
| Copper | 18.7 | 108 |
| Mercury | 0.13 | 0.7 |
| Lead | 30.2 | 112 |
| Zinc | 124 | 247 |
| Acenaphthene | 0.00671 | 0.0889 |
| Acenaphthlyene | 0.00587 | 0.128 |
| Anthracene | 0.0469 | 0.245 |
| Benzo(a)anthracene | 0.0748 | 0.693 |

| Contaminant | TEL (mg/kg) | PEL (mg/kg) |
|---|---|---|
| Benzo(a)pyrene | 0.0888 | 0.763 |
| Chrysene | 0.108 | 0.846 |
| Dibenzo(a,h)anthracene | 0.00622 | 0.135 |
| Fluoranthene | 0.113 | 1.494 |
| Fluorene | 0.0212 | 0.144 |
| Naphthalene | 0.0346 | 0.391 |
| Phenanthrene | 0.0867 | 0.544 |
| Pyrene | 0.153 | 1.398 |

*Table 9-14 Data from site specific survey compared to Canadian Interim Sediment Quality Guideline (yellow indicates exceedance of TEL)*

| Contaminant | Sample site (all in mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| | CC-06 | D-17 | D-26 | EC-04 | EC-05 | EC-15 | SS-03 |
| Arsenic | 5.90 | 8.73 | 11.3 | 10.5 | 14.3 | 9.42 | 9.41 |
| Cadmium | <0.0800 | <0.0800 | <0.0800 | <0.0800 | <0.0800 | <0.0800 | <0.0800 |
| Chromium | 4.53 | 3.94 | 10.2 | 8.67 | 10.2 | 5.03 | 10.0 |
| Copper | 1.44 | <0.0800 | 1.10 | 1.80 | 2.06 | 0.915 | 1.75 |
| Nickel | 3.27 | 1.86 | 4.70 | 4.82 | 5.04 | 3.24 | 5.13 |
| Mercury | <0.0400 | <0.0400 | <0.0400 | <0.0400 | <0.0400 | <0.0400 | <0.0400 |
| Lead | 7.28 | 4.59 | 7.53 | 6.34 | 9.93 | 5.34 | 8.34 |
| Zinc | 9.12 | 6.43 | 14.7 | 16.2 | 18.7 | 11.6 | 17.7 |
| TBT | 0.00105 | 0.00126 | <0.0004 | <0.0004 | <0.0004 | <0.0004 | <0.0004 |
| DBT | 0.00167 | <0.0004 | <0.0004 | <0.0004 | 0.000568 | <0.0004 | <0.0004 |
| MTB | <0.0004 | <0.0004 | 0.0399 | 0.00042 | <0.0004 | <0.0004 | <0.0004 |
| Naphthalene | 0.0007 | 0.0005 | 0.0021 | 0.0042 | 0.0037 | 0.0002 | 0.0035 |
| Acenaphthylene | <0.0001 | <0.0001 | <0.0001 | 0.0001 | 0.0001 | <0.0001 | <0.0001 |
| Acenaphthene | 0.0001 | 0.0001 | 0.0001 | 0.0004 | 0.0003 | <0.0001 | 0.0003 |
| Fluorene | 0.0002 | 0.0002 | 0.0004 | 0.0011 | 0.0009 | 0.0001 | 0.0008 |

| Contaminant | Sample site (all in mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|
| | CC-06 | D-17 | D-26 | EC-04 | EC-05 | EC-15 | SS-03 |
| Phenanthrene | 0.0027 | 0.0028 | 0.0061 | 0.0086 | 0.0089 | 0.0005 | 0.0073 |
| Anthracene | 0.0001 | 0.0001 | 0.0004 | 0.0008 | 0.0009 | 0.0001 | 0.0005 |
| Fluoranthene | 0.0013 | 0.0015 | 0.0048 | 0.0058 | 0.0053 | 0.0005 | 0.0041 |
| Pyrene | 0.0012 | 0.0012 | 0.0041 | 0.0054 | 0.0049 | 0.0004 | 0.0038 |
| Benzo(a)anthracene | 0.0007 | 0.0006 | 0.0019 | 0.0028 | 0.0026 | 0.0002 | 0.0022 |
| Chrysene | 0.0011 | 0.0008 | 0.0026 | 0.0032 | 0.0028 | 0.0003 | 0.0027 |
| Benzo(b)fluoranthene | 0.0019 | 0.0020 | 0.0047 | 0.0066 | 0.0059 | 0.0012 | 0.0056 |
| Benzo(k)fluoranthene | 0.0005 | 0.0005 | 0.001 | 0.0017 | 0.0015 | 0.0003 | 0.0014 |
| Benzo(a)pyrene | 0.0006 | 0.0006 | 0.0017 | 0.0030 | 0.0028 | 0.0002 | 0.0022 |
| Indeno(1,2,3-cd)pyrene | 0.0008 | 0.0008 | 0.0017 | 0.0031 | 0.0030 | 0.0004 | 0.0024 |
| Benzo(ghi)perylene | 0.0014 | 0.0015 | 0.0031 | 0.0046 | 0.0045 | 0.0004 | 0.0038 |
| Dibenzo(a,h)anthracene | 0.0002 | 0.0002 | 0.0005 | 0.0008 | 0.0008 | <0.0001 | 0.0007 |
| THC | 1.4 | 1.4 | 3.3 | 4.0 | 3.6 | 1.2 | 2.4 |

### 9.5.5 Baseline Summary

68. From the data presented above it can be concluded that the baseline water quality for the offshore and coastal waters surrounding the wind farm areas and cable corridors is good and site specific information in relation to the sediment contaminant concentrations do not contain elevated levels of concern. For the area of export cable corridor within the WFD 1nm boundary, WFD water quality data indicates some issues with specific water quality parameters (**Section 9.5.1**) but sediment quality reflects that of the offshore area i.e. very low levels. These findings are supported by historic data gathered for the existing Dudgeon OWF and Sheringham Shoal OWF, which also showed that contamination levels throughout the study area were below Cefas Action Level 1 (Dudgeon Offshore Wind Farm, 2009; and Scira Offshore Energy Ltd, 2006).

69. The predominantly coarse seabed sediments (sand and gravel) indicated in the site specific information collected significantly reduces both the potential for any contaminants to accumulate, and for sediments to be re-suspended into the water column and transported over long distances, thus reducing the potential for far-field effects.

### 9.5.6 Climate Change and Natural Trends

70. The existing environment within the study area has been largely shaped by a combination of the physical processes which exist within the southern North Sea (**Chapter 8 Marine Geology Oceanography and Physical Processes**) and anthropogenic inputs (which influence pollutant levels). These processes will continue to influence the area in the future although any release of pollutants should continue to reduce due to better regulation and diffuse pollution control initiatives. As such, climate change and natural trends are not considered to have a material bearing on the outcome of the assessment presented in this chapter.

## 9.6 Potential Impacts

71. There is the potential for DEP and SEP construction, operation and decommissioning activities to suspend sediment and if present, sediment-bound contamination, which may have a detrimental effect on water quality.

72. The worst-case layout scenario (discussed in **Section 9.3.2)** is assessed for construction of DEP or SEP in isolation, and for DEP and SEP together.

73. Conceptual analysis undertaken within **Chapter 8 Marine Geology, Oceanography and Physical Processes** has been used to inform the assessment of the potential impact from the release of suspended sediment on water quality. This is based on the previous numerical modelling and theoretical work undertaken specifically for the existing Dudgeon OWF and the Sheringham Shoal OWF located in close proximity to DEP and SEP. The basis for using the previous modelling and theoretical results is that the designs of both of these wind farms and the prevailing marine geology, oceanography and physical processes at the sites are similar to DEP and SEP and therefore provide suitable analogues to support the assessment of effects.

### 9.6.1 Potential Impacts during Construction

#### 9.6.1.1 Impact 1: Deterioration in water quality due to an increase in suspended sediment through seabed preparation

##### *9.6.1.1.1 DEP or SEP in Isolation*

74. Seabed sediments and shallow near-bed sediments within DEP or SEP would be disturbed during seabed preparation to create a suitable base prior to GBS foundation installation and to level seabed prior to cable installation. The worst-case scenario assumes that sediment would be dredged and returned to the water column at the sea surface as overflow from a dredger vessel. This process would cause localised and short-term increases in suspended sediment concentrations both at the point of dredging at the seabed and at the point of its discharge back into the water column. The release of any sediment that would be removed during seabed preparation would therefore occur within the DEP and SEP wind farm sites.

75. **Chapter 8**, **Section 8.6.4.1** concludes that, due to the predominance of medium and coarse grained sand across the study area, the sediment disturbed by the drag head of the dredger at the seabed would remain close to the bed and settle back to the bed rapidly. Most of the sediment released at the water surface from the dredger vessel would fall rapidly (minutes or tens of minutes) to the seabed upon its discharge, within a few tens of metres.

76. Some of the finer sand fraction and the very small proportion of mud that is present are likely to stay in suspension for longer and form a passive plume which would become advected by tidal currents. Due to the sediment sizes present, this is likely to exist as a measurable but modest concentration plume (tens of mg/l) for around half a tidal cycle (i.e. up to six hours). Sediment would eventually settle to the seabed within a few hundred metres up to approximately a kilometre from the source. Whilst lower suspended sediment concentrations are likely to extend further, the magnitudes would be indistinguishable from background levels.

77. The magnitude of effect is therefore predicted to be negligible. Since the receptor is considered to be of low sensitivity, an increase in suspended sediment from dredging activities is expected to have a **negligible adverse** impact on water quality.

##### *9.6.1.1.2 DEP and SEP Together*

78. The worst-case scenario and impacts associated with foundation installation at DEP and SEP together will be comparable to those outlined in **Section 9.6.1.1.1**. The larger release volume due to constructing both projects concurrently may combine to result in higher concentrations for a limited period, but they are likely to still be less than 10mg/l above background levels (see **Chapter 8, Section 8.6.4.1**).

79. Therefore, a **negligible adverse** impact to water quality is expected to arise from sediment suspended during foundation installation during the construction of DEP and SEP together.

#### 9.6.1.2 Impact 2: Deterioration in water quality due to an increase in suspended sediment associated with drill arisings for foundation installation of piled foundations

##### *9.6.1.2.1 DEP or SEP in Isolation*

80. It is estimated that only 5% of turbine foundations will require drilling (i.e. two foundations each for DEP and SEP). The results of the conceptual analysis presented in **Chapter 8** show that due to the small quantities of fine sediment released, any plume is likely to be widely and rapidly dispersed, resulting in low suspended sediment concentrations and net movement of fine-grained sediment to the northwest or southeast, depending on state of the tide at the time of release.

81. Away from the immediate release locations, elevations in suspended sediment concentration above background levels would be very low (less than 10mg/l) and within the range of natural variability (**Chapter 8**, **Section 8.6.4.2.1**). Given the above, sediment concentrations arising from one foundation installation are unlikely to persist for sufficiently long to interact with subsequent operations, and therefore no cumulative effect is predicted from multiple installations.

82. The magnitude of effect is therefore predicted to be negligible. Since the receptor is considered to be of low sensitivity, the increase in suspended sediment from drilling activities is expected to have a **negligible adverse** impact on water quality.

##### *9.6.1.2.2 DEP and SEP Together*

83. The worst-case scenario and impacts associated with foundation installation at DEP and SEP together will be comparable to those outlined in **Section 9.6.1.2.1**. The larger release volume (**Table 9-2**) due to constructing both projects concurrently may combine to result in higher concentrations for a limited period but these are still likely to be less than 10mg/l above background levels. As above, due to the relatively small quantities which will be released it is unlikely that plumes arising from one foundation will interact with plumes from another.

84. Therefore, a **negligible adverse** impact to water quality is expected to arise from sediment suspended during drilling activities during the construction of DEP and SEP together.

#### 9.6.1.3 Impact 3: Deterioration in water quality due to an increase in suspended sediment during export cable installation

##### *9.6.1.3.1 DEP or SEP in Isolation*

85. Resuspension of sediments during the installation of the offshore export cable is discussed in **Chapter 8, Section 8.6.4.5.1** and summarised here.

86. The assessment is based on the overall sediment release volumes being low and confined to near the seabed (rather than higher in the water column) along the alignment of the offshore export cable corridor, and the rate at which the sediment is released into the water column from the installation process being relatively slow.

87. It is anticipated that suspended sediment concentrations will be elevated above prevailing conditions, but are likely to remain within the range of background nearshore levels (which will be high close to the coast because of increased wave activity) and lower than those concentrations that would develop during storm conditions (**Chapter 8**, **Section 8.6.4.5.1**).

88. Furthermore, it is predicted that the majority of disturbed sediment (sand) will resettle within 100m of the cable route. Any mobilised chalk fines would be transported a greater distance (up to 10km) to the west, and less to the east and would dissipate within one tidal cycle. The plume created by the chalk sediment may therefore be visible at the Sheringham and West Runton designated bathing waters, however as set out in **Chapter 8**, this plume is anticipated to dissipate within a single tidal cycle, i.e. will disperse within a day.

89. During the excavation process at the HDD exit point, in the subtidal zone approximately 1000m offshore, suspended sediment concentrations will be elevated above prevailing conditions, but are likely to remain within the range of background nearshore levels (which will be high close to the coast because of increased wave activity) and lower than those concentrations that would develop during storm conditions. Also, once completed, the high energy nearshore zone is likely to rapidly disperse the suspended sediment (i.e. over a period of a few hours) in the absence of any further sediment input.

90. The magnitude of effect is therefore predicted to be negligible. Since the receptor is considered to be of low sensitivity, the resuspension of sediment from the installation of the export cable is expected to have a **negligible adverse** impact on water quality.

##### *9.6.1.3.2 DEP and SEP Together*

91. In a DEP and SEP together scenario there will be two export cables installed at different times, parallel to each other through the export cable corridor south of the SEP wind farm site. Although more sediment would be resuspended under the projects together scenario, installation of each export cable would be at different times and therefore no in-combination effects on water quality are anticipated. Although suspended sediment concentrations will be elevated, they are likely to be lower than concentrations that would develop in the water column during storm conditions. Tidal currents are likely to rapidly disperse the suspended sediment (i.e. over a period of a few hours) in the absence of any further sediment input. Therefore potential deterioration in water quality due to sediment resuspended during export cable installation is the same for DEP and SEP together as it is for DEP and SEP in isolation and the overall impact on water quality under a worst-case scenario for export cable installation activities is considered to be of **negligible adverse** significance.

#### 9.6.1.4 Impact 4: Deterioration in water quality due to an increase in suspended sediment during offshore cable installation (infield and interlink cables)

##### *9.6.1.4.1 DEP or SEP in Isolation*

92. The conceptual assessment undertaken to inform **Chapter 8 Marine Geology, Oceanography and Physical Processes** indicates that the changes in suspended sediment concentration due to infield and interlink cable installation would be similar to those arising from the disturbance of near-surface sediments during foundation installation activities including seabed preparation (**Table 9-2** and **Chapter 8, Section 8.6.4.7.1**).

93. The installation of the cabling by jetting or mechanical cutting has the potential to disturb the seabed sediments down to a depth of up to 1.5m and suspended them in the water column. The assessment is based on a worst case scenario where all the displaced sediment is suspended, although due to the general composition of seabed sediments in the area and the low proportion of mud/fines, only a small proportion of disturbed sediments will be suspended for any length of time, if at all.

94. Sand wave levelling may be required in DEP North, DEP South and adjacent sections of offshore cable corridors prior to infield and interlink cable installation. No requirement for sand wave levelling is expected for a SEP in isolation scenario. Any sediment excavated during sand wave levelling would be disposed of within the DEP wind farm sites and cable corridors, meaning there will be no net loss of sand from the site. The worst-case scenario assumes that sediment would be dredged and returned to the water column at the sea surface as overflow from a dredger vessel. This process would cause localised and short-term increases in suspended sediment concentrations both at the point of dredging at the seabed and, more importantly, at the point of its discharge back into the water column.

95. As described in **Section 9.6.1.1**, some of the finer sand fraction and the very small proportion of mud that is present are likely to stay in suspension for longer and form a passive plume which would become advected by tidal currents. Due to the sediment sizes present, this is likely to exist as a measurable but modest concentration plume (tens of mg/l) for around half a tidal cycle (i.e. up to six hours). Sediment would eventually settle to the seabed within a few hundred metres up to approximately a kilometre from the source within hours. Whilst lower suspended sediment concentrations are likely to extend further, the magnitudes would be indistinguishable from background levels.

96. The magnitude of effect is therefore predicted to be negligible. Since the receptor is considered to be of low sensitivity, an increase in suspended sediment from the installation of the offshore cables is expected to have a **negligible adverse** impact on water quality.

*9.6.1.4.2 DEP and SEP Together*

97. The details of the infield and interlink cabling are dependent upon the final project design (**Table 9-2**).

98. Sand wave levelling may be required prior to interlink and infield cable installation at the north end of the corridor between SEP and DEP North, between DEP North and DEP South, and within DEP South wind farm site. As with the DEP in isolation scenario, material generated by sand wave levelling would be disposed of within the DEP wind farm sites and cable corridors, meaning there will be no net loss of sand from the sites.

99. It is anticipated that the changes in suspended sediment concentration due to infield and interlink cable installation would be similar those arising from the disturbance of near-surface sediments during foundation installation activities including seabed preparation (**Table 9-2**, and **Chapter 8**, **Section 8.6.4.7.3**).

100. The magnitude of effect is therefore predicted to be negligible. Since the receptor is considered to be of low sensitivity, an increase in suspended sediment from the installation of the infield and interlink cables is expected to have a **negligible adverse** impact on water quality.

#### 9.6.1.5 Impact 5: Deterioration in water quality due to the release of contaminated sediment during construction activities

101. The re-suspension of sediment during the construction activities discussed above could lead to the release of sediment-bound contaminants which may in turn affect compliance with water quality standards. **Table 9-14** shows that the levels of contaminants within the DEP and SEP PEIR boundary are not of concern, i.e. all contaminants in all the samples are below the Cefas Action Level 1 and levels of arsenic only marginally exceed CSQG TEL levels in six sampled locations.

102. Uncontaminated nearshore marine sediments contain from about 5 to about 15mg/kg, present primarily as arsenate associated with iron (Neff, 1997). Elevated arsenic concentrations in sediments have been identified from the outer Thames and off north east Norfolk (Whalley et al., 1999). However, the highest concentration of arsenic recorded by the DEP and SEP benthic surveys is 14.3mg/kg (Fugro, 2020a and 2020b) suggesting that, although levels marginally exceed CSQG TEL levels, there is no arsenic contamination of concern in the project areas. Furthermore, the effect of sediment resuspension and any associated release of contaminants during construction activities is small in terms of the quantity of sediment disturbed and far smaller in magnitude than natural processes such as the effects of storms.

103. The magnitude of effect for DEP and SEP in isolation, and DEP and SEP together is therefore considered to be negligible. Since the receptor is considered to be of low sensitivity the resuspension of contaminated sediment during construction activities is expected to have a **negligible** adverse impact on water quality.

### 9.6.2 Potential Impacts during Operation

#### 9.6.2.1 Impact 1: Deterioration in water quality through an increase in suspended sediment due to scouring effects

##### *9.6.2.1.1 DEP or SEP in Isolation*

104. As a result of possible alterations to physical processes in the location of the foundations and along sections of offshore cables which require external cable protection, sediment could be resuspended into the water column during the operational lifetime of the wind farm, through scouring effects. An assessment of the potential impacts on the tidal regime, wave climate and sediment transport caused by the presence of the foundations has been undertaken in **Chapter 8**, **Sections 8.6.5.1**, **8.6.5.2** and **8.6.5.3** respectively and morphology and sediment transport effects due to the presence of external cable protection measures are discussed in **Sections 8.6.5.5** and **8.6.5.6**.

105. The assessments conclude that these changes would be both low in magnitude and largely confined to local wake or wave shadow effects and, therefore, would be small in geographical extent

106. Since it is expected that the changes in tidal flow and wave heights during the operational phase of DEP and SEP would have no significant far-field effects, changes in sediment resuspension would be of a similar magnitude and would only occur in the immediate vicinity of each GBS base. Effects are not predicted to extend to adjacent foundations.

107. Scour effects may also occur along any section of external cable protection as the protrusion above seabed level may interrupt sediment transport. However, gross patterns of sediment movement are not anticipated to be significantly affected as sediment would build up over the cable protection and eventually overtop and bypass the obstruction. It is unlikely that this will cause an increase in suspended sediment concentrations as this disturbance will take place relatively low above seabed level (a maximum of 0.5m).

108. The magnitude of effect is therefore predicted to be negligible. Since the receptor is considered to be of low sensitivity, an increase in suspended sediment through scouring effects is expected to have a **negligible adverse** impact on water quality.

##### *9.6.2.1.2 DEP and SEP Together*

109. **Chapter 8**, **Figure 8.14** and **Figure 8.15** show that the tidal current and wave zones of potential influence for DEP and SEP do not overlap, and therefore the combined effect on suspended sediment would be the same as the two sites individually. As such the resuspension of sediment through scouring effects at DEP and SEP together is considered to have a **negligible adverse** impact on water quality.

#### 9.6.2.2 Impact 2: Deterioration in water quality through an increase in suspended sediment due to cable repairs / reburial and maintenance vessel footprints

110. Disturbance of seabed sediments by jack up and anchored vessels and maintenance activities that impact the seabed (e.g. cable reburial) and has the potential to re-suspend sediment and increase suspended sediment concentrations. The scale of these effects will be small, infrequent and of short-term duration; and of a lower magnitude than during the construction phase.

111. Therefore, the magnitude of effect for both DEP and SEP in isolation, and DEP and SEP together, is therefore considered to be negligible. Since the receptor is considered to be of low sensitivity the resuspension of sediment due to cable repairs / reburial and maintenance vessel activities is expected to have a **negligible adverse** impact on water quality.

#### 9.6.2.3 Impact 3: Deterioration in water quality through the resuspension of contaminated sediment due to scouring effects and maintenance activities

112. The re-suspension of sediment could lead to the release of any sediment-bound contaminants, which may in turn affect compliance with water quality standards. However, **Table 9-14** shows that the levels of contaminants within study area are not of concern, i.e. concentrations of all contaminants in all samples were below Cefas Action Level 1, and only levels of arsenic marginally exceeded the CSQG TEL in six sampled locations.

113. The magnitude of effect for both DEP and SEP in isolation, and DEP and SEP together, is therefore considered to be negligible. Since the receptor is considered to be of low sensitivity the resuspension of contaminated sediment through scouring effects is expected to have a **negligible adverse** impact on water quality.

### 9.6.3 Potential Impacts during Decommissioning

114. The scope of the decommissioning works would most likely involve removal of the accessible installed components. This is outlined in **Section 5.4.12** of **Chapter 5 Project Description** and the detail would be agreed with the relevant authorities at the time of decommissioning. Offshore, this is likely to include removal of all the wind turbine components, part of the foundations (those above seabed level), removal of some or all of the infield cables, interlink cables, and export cables. Scour and external cable protection would likely be left *in situ.*

115. During the decommissioning phase, there is potential for wind turbine foundation and cable removal activities to cause changes in suspended sediment concentrations and disturb contaminated sediments. The types of effect would be comparable to those identified for the construction phase:

- Impact 1: Deterioration in water quality due to an increase in suspended sediment during foundation removal
- Impact 2: Deterioration in water quality due to an increase in suspended sediment during removal of parts of the export cable
- Impact 3: Deterioration in water quality due to an increase in suspended sediment during removal of parts of the infield and interlink cables
- Impact 4: Deterioration in water quality due to release of contaminated sediment during decommissioning activities.

116. The magnitude of effects would be comparable to or less than those identified for the construction phase. Accordingly, given the construction phase assessments concluded impacts of **negligible adverse** significance for marine water and sediment quality, it is anticipated that the same would be valid for the decommissioning phase. The magnitude of effects will be the same for DEP or SEP in isolation and for DEP and SEP together.

117. The significance of effects on other receptors is addressed within relevant chapters of this PEIR (**Chapter 8 Marine Geology, Oceanography and Physical Processes**, **Chapter 10 Benthic Ecology**, **Chapter 11 Fish and Shellfish Ecology and Chapter 14 Commercial Fisheries**).

## 9.7 Cumulative Impacts

### 9.7.1 Identification of Potential Cumulative Impacts

118. The first step in the cumulative assessment is the identification of which residual impacts assessed for DEP and/or SEP on their own have the potential for a cumulative impact with other plans, projects and activities (described as 'impact screening'). This information is set out in **Table 9-15** below, together with a consideration of the confidence in the data that is available to inform a detailed assessment and the associated rationale. Only potential impacts assessed in **Section 9.6** as negligible or above are included in the CIA (i.e. those assessed as 'no impact' are not taken forward as there is no potential for them to contribute to a cumulative impact).

119. **Table 9-15** concludes that in relation to marine sediment and water quality, no cumulative impacts are anticipated during the construction, operation or decommissioning phases and therefore cumulative impacts are screened out of further assessment.

*Table 9-15: Potential Cumulative Impacts (impact screening)*

| Impact | Potential for Cumulative Impact | Data Confidence | Rationale |
|---|---|---|---|
| **Construction** | | | |
| Impact 1: Deterioration in water quality due to an increase in suspended sediment through seabed preparation for foundation installation | No | High | Majority of impacts occur at discrete locations, are temporary in nature and are negligible in magnitude. Modest increases in suspended sediment concentration (tens of mg/l) would extend up to approximately one kilometre from source and persist for up to six hours, with concentrations further afield being indistinguishable from background levels. This applies to DEP or SEP in isolation, and DEP and SEP together. |
| Impact 2: Deterioration in water quality due to an increase in suspended sediment associated with drill arisings for foundation installation of piled foundations | No | High | |
| Impact 3: Deterioration in water quality due to an increase in suspended sediment during export cable installation | No | High | |
| Impact 4: Deterioration in water quality due to an increase in suspended sediment during offshore | No | High | |

| Impact | Potential for Cumulative Impact | Data Confidence | Rationale |
|---|---|---|---|
| cable installation (infield and interlink cables) | | | |
| Impact 5: Deterioration in water quality due to the release of contaminated sediment during construction activities | No | High | Contaminant concentrations within the sediment are present at levels below Cefas Action Level 1 and are therefore not of concern. |
| **Operation** | | | |
| Impact 1: Deterioration in water quality through an increase in suspended sediment due to scouring effects | No | High | Impacts occur at discrete locations, are temporary in nature and are negligible in magnitude. This applies to DEP or SEP in isolation, and DEP and SEP together. |
| Impact 2: Deterioration in water quality through an increase in suspended sediment due to cable repairs / reburial and maintenance vessel footprints | No | High | Impacts occur at discrete locations, are temporary in nature and are negligible in magnitude. This applies to DEP or SEP in isolation, and DEP and SEP together. |
| Impact 3: Deterioration in water quality through re-suspension of contaminated sediment due to scouring effects | No | High | Contaminant concentrations within the sediment are present at levels below Cefas Action Level 1 and are therefore not of concern. |
| **Decommissioning** | | | |
| Impact 1: Deterioration in water quality due to an increase in suspended sediment during foundation removal | No | High | Impacts occur at discrete locations, are temporary in nature and are negligible in magnitude. This applies to DEP or SEP in isolation, and DEP and SEP together. |
| Impact 2: Deterioration in water quality due to an increase in suspended | No | High | |

| Impact | Potential for Cumulative Impact | Data Confidence | Rationale |
|---|---|---|---|
| sediment during removal of parts of the export cable | | | |
| Impact 3: Deterioration in water quality due to an increase in suspended sediment during removal of parts of the infield and interlink cables | No | High | |
| Impact 4: Deterioration in water quality due to release of contaminated sediment during decommissioning activities. | No | High | Contaminant concentrations within the sediment are present at levels below Cefas Action Level 1 and are therefore not of concern. |

## 9.8 Inter-relationships

120. There are clear inter-relationships between the marine water and sediment quality topic and several other topics that have been considered within this PEIR. **Table 9-16** provides a summary of the principal inter-relationships and signposts where those issues have been addressed in relevant chapters.

*Table 9-16: Marine water and sediment quality inter-relationships*

| Topic and description | Related chapter | Where addressed in this chapter | Rationale |
|---|---|---|---|
| **Construction** | | | |
| Effects on water quality (increase in suspended sediment concentrations and suspension of contaminated sediments) | **Chapter 10: Benthic Ecology**<br><br>**Chapter 11: Fish and Shellfish Ecology**<br><br>**Chapter 14: Commercial Fisheries** | **Section 9.6.1.1** and **9.6.1.1** (foundation installation)<br><br>**Section 9.6.1.3** (export cable installation) | Increased suspended sediment concentrations and potential contaminant concentrations within suspended sediment or as a result of a pollution event |

| Topic and description | Related chapter | Where addressed in this chapter | Rationale |
|---|---|---|---|
| | | **Section 9.6.1.4** (infield and interlink cable installation)<br><br>**Section 9.6.1.5** (contaminated sediments) | could adversely impact benthic communities and fish species |
| **Operation** | | | |
| Effects on water quality (increase in suspended sediment concentrations and suspension of contaminated sediments) | **Chapter 10: Benthic Ecology**<br><br>**Chapter 11: Fish and Shellfish Ecology**<br><br>**Chapter 14: Commercial Fisheries** | **Section 9.6.2.1** (suspended sediment concentrations)<br><br>**Section 9.6.2.3** (contaminated sediments) | Increased suspended sediment concentrations and potential contaminant concentrations within suspended sediment could adversely impact benthic communities and fish species |
| **Decommissioning** | | | |
| Inter-relationships for impacts during the decommissioning phase will be the same as those outlined above for the construction phase. | | | |

## 9.9 Interactions

121. The impacts identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between impacts are presented in **Table 9-16**. This provides a screening tool for which impacts have the potential to interact.

122. Within **Table 9-17** the impacts are assessed relative to each development phase (Phase assessment, i.e. construction, operation or decommissioning) to see if (for example) multiple construction impacts affecting the same receptor could increase the level of impact upon that receptor. Where an interaction may occur, 'Yes' is entered into the table. Where an interaction cannot occur, due to the impossibility of the activities happening at the same time, or due to the distance between the two impacts 'No' is indicated. Following this, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across all development phases (**Table 9-18**).

*Table 9-17: Interaction between impacts - screening [does impact 1 affect the same receptor as impact 2, impact 3 etc y/n]*

| **Potential Interaction between Impacts** | | | | | |
|---|---|---|---|---|---|
| **Construction** | | | | | |
| | Impact 1: Deterioration in water quality due to an increase in suspended sediment through seabed preparation for foundation installation | Impact 2: Deterioration in water quality due to an increase in suspended sediment within drill arisings for foundation installation of piled foundations | Impact 3: Deterioration in water quality due to an increase in suspended sediment during export cable installation | Impact 4: Deterioration in water quality due to an increase in suspended sediment during offshore cable installation (infield and interlink cables) | Impact 5: Deterioration in water quality due to the release of contaminated sediment during construction activities |
| Impact 1: Deterioration in water quality due to an increase in suspended sediment through seabed preparation for foundation installation | | No | Yes | Yes | Yes |
| Impact 2: Deterioration in water quality due to an increase in suspended | No | | Yes | Yes | Yes |

| Potential Interaction between Impacts | | | | | |
|---|---|---|---|---|---|
| sediment within drill arisings for foundation installation of piled foundations | | | | | |
| Impact 3: Deterioration in water quality due to an increase in suspended sediment during export cable installation | Yes | Yes | | Yes | Yes |
| Impact 4: Deterioration in water quality due to an increase in suspended sediment during offshore cable installation (infield and interlink cables | Yes | Yes | Yes | | Yes |
| Impact 5: Deterioration in water quality due to the release of contaminated | Yes | Yes | Yes | Yes | |

| **Potential Interaction between Impacts** | | | | | |
|---|---|---|---|---|---|
| sediment during construction activities | | | | | |
| **Operation** | | | | | |
| | Impact 1: Deterioration in water quality through an increase in suspended sediment due to scouring effects | Impact 2: Deterioration in water quality through re-suspension of contaminated sediment due to scouring effects | Impact 3: Deterioration in water quality through re-suspension of contaminated sediment due to scouring effects | | |
| Impact 1: Deterioration in water quality through an increase in suspended sediment due to scouring effects | | Yes | Yes | | |
| Impact 2: Deterioration in water quality through re-suspension of contaminated sediment due to scouring effects | Yes | | Yes | | |

| **Potential Interaction between Impacts** | | | | | |
|---|---|---|---|---|---|
| Impact 3: Deterioration in water quality through re-suspension of contaminated sediment due to scouring effects | Yes | Yes | | | |
| **Decommissioning** | | | | | |
| Interactions between impacts during the decommissioning phase will be the same as those outlined above for the construction phase. | | | | | |

*Table 9-18: Interaction between impacts – phase and lifetime assessment*

| **Receptor** | **Highest significance level** | | | | |
|---|---|---|---|---|---|
| | Construction | Operation | Decommissioning | Phase assessment | Lifetime assessment |
| Water quality | Negligible | Negligible | Negligible | **No greater than individually assessed impact**<br><br>The impacts are considered to have a negligible magnitude of effect on the receptor. Given that the magnitudes are negligible and that each impact will be managed with standard and best practice methodologies it is considered that there would either be no interactions or that these would not result in greater impact than that assessed individually. | **No greater than individually assessed impact** |

## 9.10 Potential Monitoring Requirements

123. Monitoring requirements will be described in the in-principle monitoring plan (IPMP) submitted alongside the DCO application and further developed and agreed with stakeholders prior to construction based on the IPMP and taking account of the final detailed design of DEP and SEP. However, given the outcomes of the assessment, no monitoring specifically targeting marine sediment and water quality parameters is proposed.

## 9.11 Assessment Summary

124. This chapter has provided a characterisation of the existing environment for marine water and sediment quality based on both existing and site specific survey data which has established that the potential impacts during construction, operation and decommissioning phases of DEP and SEP (in isolation and together) are considered to be negligible.

125. A summary of impacts on marine water and sediment quality is provided in **Table 9-19**.

*Table 9-19: Summary of potential impacts on marine water and sediment quality*

| Potential impact | Receptor | Sensitivity | Magnitude | Pre-mitigation impact | Mitigation measures proposed | Residual impact |
|---|---|---|---|---|---|---|
| **Construction** | | | | | | |
| Impact 1: Deterioration in water quality due an increase in suspended sediment through seabed preparation for foundation installation | Water quality | Low | Low | Negligible | N/A | Negligible |
| Impact 2: Deterioration in water quality due an increase in suspended sediment within drill arisings for foundation installation of piled foundations | Water quality | Low | Low | Negligible | N/A | Negligible |
| Impact 3: Deterioration in water quality due to an increase in suspended sediment during export cable installation | Water quality | Low | Low | Negligible | N/A | Negligible |
| Impact 4: Deterioration in water quality due to an increase in suspended sediment during offshore cable installation (infield and interlink cables | Water quality | Low | Low | Negligible | N/A | Negligible |
| Impact 5: Deterioration in water quality due to the release of contaminated sediment during construction activities | Water quality | Low | Low | Negligible | N/A | Negligible |

| Potential impact | Receptor | Sensitivity | Magnitude | Pre-mitigation impact | Mitigation measures proposed | Residual impact |
|---|---|---|---|---|---|---|
| **Operation** | | | | | | |
| Impact 1: Deterioration in water quality through an increase in suspended sediment due to scouring effects | Water quality | Low | Low | Negligible | N/A | Negligible |
| Impact 2: Deterioration in water quality through an increase in suspended sediment due to cable repairs / reburial and maintenance vessel footprints | Water quality | Low | Low | Negligible | N/A | Negligible |
| Impact 3: Deterioration in water quality through re-suspension of contaminated sediment due to scouring effects | Water quality | Low | Low | Negligible | N/A | Negligible |
| **Decommissioning** | | | | | | |
| The impacts during the decommissioning phase would be comparable to those identified for the construction phase. Accordingly, given that no significant impact was assessed for marine water and sediment quality during the construction phase, it is anticipated that the same applies to the decommissioning phase. | | | | | | |

## 9.12 References


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