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White Cross Offshore Windfarm Environmental Statement

Chapter 9: Marine Water and Sediment Quality

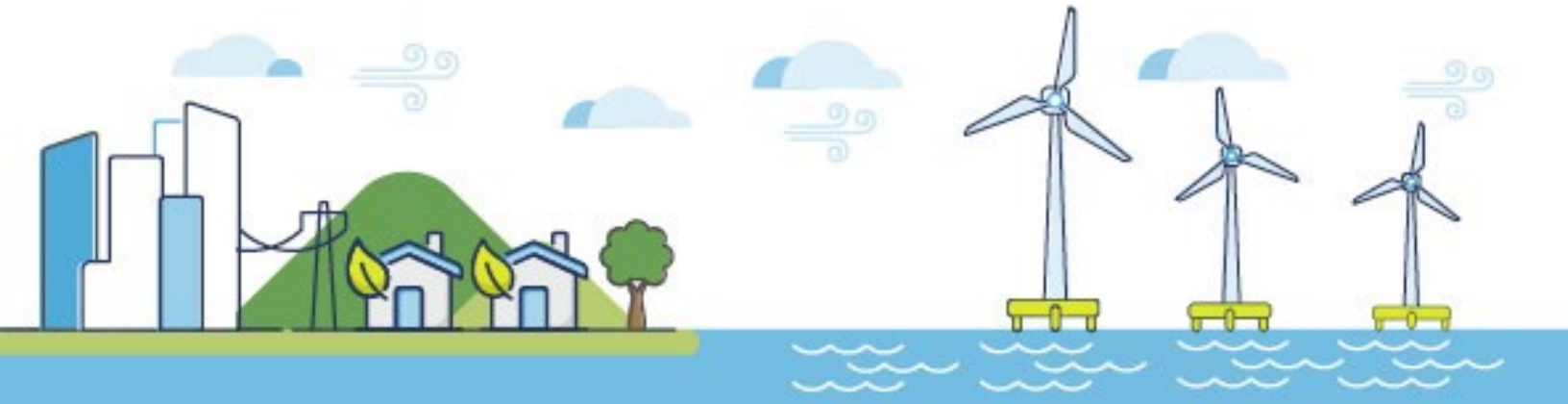

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Table of Contents

9. Marine Water and Sediment Quality 1
9.1 Introduction 1
9.2 Policy, Legislation and Guidance 2
9.2.1 National Planning Policy Framework 2
9.2.2 National Policy Statement 3
9.2.3 Guidance 6
9.3 Assessment Methodology 8
9.3.1 Study Area 8
9.3.2 Approach to Assessment 8
9.3.3 Worst-Case Scenario 11
9.3.4 Summary of Mitigation 13
9.3.5 Baseline Data Sources 13
9.3.6 Data Limitations 14
9.3.7 Scope 14
9.3.8 Consultation 18
9.4 Existing Environment 23
9.4.1 Current Baseline 23
9.4.2 Do Nothing Scenario 30
9.5 Potential Impacts During Construction 30
9.5.1 Impact 1: Localised temporary increases in suspended sediments due to cable installation 30
9.5.2 Impact 2: Remobilisation of existing contaminated sediments 31
9.6 Potential Impacts During Operation and Maintenance 32
9.7 Potential Impacts During Decommissioning 33
9.8 Potential Cumulative Effects 33
9.9 Potential Transboundary Impacts 35
9.10 Inter-relationships 35
9.11 Interactions 36
9.12 Summary 37
9.13 References 40

Table of Figures

Figure 9.1 Marine Water and Sediment Quality Study Area 9

Figure 9.2 Grab Sample Locations Analysed for Chemical Contamination.....17

Table of Tables

Table 9.1 Summary of NPPF Policy relevant to Marine Water and Sediment Quality 2
Table 9.2 Summary of NPS EN-1 and EN-3 provisions relevant to Marine Water and Sediment Quality 3
Table 9.3 Sediment quality guidelines used in this assessment..... 7
Table 9.4 Definition of terms relating to receptor sensitivity.....10
Table 9.5 Definition of terms relating to magnitude of an impact.....10
Table 9.6 Significance of an impact - resulting from each combination of receptor sensitivity and the magnitude of the effect upon it 11
Table 9.7 Definition of realistic worst-case scenario details relevant to the assessment of impacts in relation to marine water and sediment quality.....12
Table 9.8 Embedded mitigation measures relevant to the marine water and sediment quality assessment 13
Table 9.9 Data sources used to inform the marine water and sediment quality assessment 14
Table 9.10 Summary of site-specific survey data.....15
Table 9.11 Summary of impacts relating to Marine Water and Sediment Quality that are scoped out of the assessment 15
Table 9.12 Summary of impacts relating to Marine Water and Sediment Quality that are scoped into the assessments.....18
Table 9.13 Consultation responses 19
Table 9.14 Site specific data for metals (yellow indicates an exceedance of Cefas AL1 or BAC. There were no exceedances of ERL or AL2) [All data in mg/kg. Sample locations closest to MLWS are indicated in bold] 27
Table 9.15 Site specific data for PAHs (yellow indicates an exceedance of Cefas AL1 or BAC. There were no exceedances of ERL.) [All data in µg/kg. Sample locations closest to MLWS are indicated in bold] 28
Table 9.16 Site specific data for PAHs (yellow indicates an exceedance of Cefas AL1 or BAC. There were no exceedances of ERL.) [All data in µg/kg. Sample locations closest to MLWS are indicated in bold] 29
Table 9.17 Potential cumulative effects considered for Marine Water and Sediment Quality 34
Table 9.18 Projects considered in the cumulative effect assessment on Marine Water and Sediment Quality 35
Table 9.19 Marine Water and Sediment Quality Inter-relationships 36
Table 9.20 Interaction between impacts during construction.....38
Table 9.21 Interaction between impacts during decommissioning.....38
Table 9.22 Summary of potential impacts for marine water and sediment quality during construction and decommissioning of the Onshore Project.....39

Table of Plates

Plate 9.1 Average SSCs in the Celtic Sea for the period 1998-2015 (Cefas, 2016) 25

Glossary of Acronyms

Acronym	Definition
AfL	Agreement for Lease
AL	Action Level
BAC	Background Assessment Concentration
BEIS	Department for Business, Energy and Industrial Strategy
CEA	Cumulative Effect Assessment
Cefas	Centre for the Environment and Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CEMP	Coordinated Environmental Monitoring Programme
DBT	Dibutyltin
DECC	Department for Energy and Climate Change
EEA	European Economic Area
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
ERL	Effects Range-Low
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
HRA	Habitats Regulation Assessment
IEMA	Institute of Environmental Management and Assessment
IPC	Infrastructure Planning Commission
km	Kilometre
Km^2	Square kilometre
LPA	Local Planning Authority
m	Metre
MLWS	Mean Low Water Springs
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MW	Megawatts
NDC	North Devon Council
nm	Nautical Mile
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
WCOWL	White Cross Offshore Windfarm Limited
PAH	Polycyclic Aromatic Hydrocarbon

Acronym	Definition
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PDE	Project Design Envelope
PPG	Pollution Prevention Guidelines
PSA	Particle Size Analysis
PSD	Particle Size Distribution
QSR	Quality Status Report
RBMP	River Basin Management Plan
SSC	Suspended Sediment Concentration
SSSI	Site of Special Scientific Interest
TBT	Tributyltin
THC	Total Hydrocarbons
UK	United Kingdom
WER	Water Environment Regulation
WFD	Water Framework Directive

Glossary of Terminology

Defined Term	Description
Agreement for Lease	An Agreement for Lease (AfL) is a non-binding agreement between a landlord and prospective tenant to grant and/or to accept a lease in the future. The AfL only gives the option to investigate a site for potential development. There is no obligation on the developer to execute a lease if they do not wish to.
Applicant	White Cross Offshore Windfarm Limited
Cumulative effects	The effect of the Project taken together with similar effects from a number of different projects, on the same single receptor/resource. Cumulative Effects are those that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
Department for Business, Energy and Industrial Strategy (BEIS)	Government department that is responsible for business, industrial strategy, science and innovation and energy and climate change policy and consent under Section 36 of the Electricity Act. BEIS existed until 2023 when it was split to form the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ) and the Department for Science, Innovation and Technology (DSIT).
Engineer, Procure, Construct and Install	A common form of contracting for offshore construction. The contractor takes responsibility for a wide scope and delivers via own and subcontract resources.
Environmental Impact Assessment (EIA)	Assessment of the potential impact of the proposed Project on the physical, biological and human environment during construction, operation and decommissioning.
Export Cable Corridor	The area in which the export cables will be laid, either from the Offshore Substation or the inter-array cable junction box (if no offshore substation), to the NG Onshore Substation comprising both the Offshore Export Cable Corridor and Onshore Export Cable Corridor.
Front end engineering and design	Front-end engineering and design (FEED) studies address areas of windfarm system design and develop the concept of the windfarm in advance of procurement, contracting and construction.
Generation Assets	The infrastructure of the Project related to the generation of electricity within the windfarm site, including wind turbine generators, substructures, mooring lines, seabed anchors and inter-array cables.
High Voltage Alternating Current	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
High Voltage Direct Current	High voltage direct current is the bulk transmission of electricity by direct current (DC), whereby the flow of electric charge is in one direction.
In-combination effects	In-combination effects are those effects that may arise from the development proposed in combination with other plans and projects proposed/consented but not yet built and operational.

Defined Term	Description
Jointing bay	Underground structures constructed at regular intervals along the Onshore Export Cable Corridor to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	Where the offshore export cables come ashore.
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links.
Mean high water springs	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean low water springs	The average tidal height throughout a year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean sea level	The average tidal height over a long period of time.
Mitigation	Mitigation measures have been proposed where the assessment identifies that an aspect of the development is likely to give rise to significant environmental impacts, and discussed with the relevant authorities and stakeholders in order to avoid, prevent or reduce impacts to acceptable levels. For the purposes of the EIA, two types of mitigation are defined: • Embedded mitigation: consisting of mitigation measures that are identified and adopted as part of the evolution of the project design, and form part of the project design that is assessed in the EIA • Additional mitigation: consisting of mitigation measures that are identified during the EIA process specifically to reduce or eliminate any predicted significant impacts. Additional mitigation is therefore subsequently adopted by OWL as the EIA process progresses.
National Grid Onshore Substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of the electrical transformers.
National Grid Connection Point	The point at which the White Cross Offshore Windfarm connects into the distribution network at East Yelland substation and the distributed electricity network. From East Yelland substation electricity is transmitted to Alverdiscott where it enters the national transmission network.
Offshore Development Area	The Windfarm Site (including wind turbine generators, substructures, mooring lines, seabed anchors, inter-array cables and Offshore Substation Platform (as applicable)) and Offshore Export Cable Corridor to MHWS at the Landfall. This encompasses the part of the project that is the focus of this application and Environmental Statement and the parts of the project consented under Section 36 of the Electricity Act and the Marine and Coastal Access Act 2009.
Offshore Export Cables	The cables which bring electricity from the Offshore Substation Platform or the inter-array cables junction box to the Landfall.

Defined Term	Description
Offshore Export Cable Corridor	The proposed offshore area in which the export cables will be laid, from Offshore Substation Platform or the inter-array cable junction box to the Landfall.
Offshore Infrastructure	All of the offshore infrastructure including wind turbine generators, substructures, mooring lines, seabed anchors, Offshore Substation Platform and all cable types (export and inter-array). This encompasses the infrastructure that is the focus of this application and Environmental Statement and the parts of the project consented under Section 36 of the Electricity Act and the Marine and Coastal Access Act 2009.
the Offshore Project	The Offshore Project for the offshore Section 36 and Marine Licence application includes all elements offshore of MHWS. This includes the infrastructure within the windfarm site (e.g. wind turbine generators, substructures, mooring lines, seabed anchors, inter-array cables and Offshore Substation Platform (as applicable)) and all infrastructure associated with the export cable route and landfall (up to MHWS) including the cables and associated cable protection (if required).
Offshore Substation Platform	A fixed structure located within the Windfarm Site, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore Transmission Assets	The aspects of the project related to the transmission of electricity from the generation assets including the Offshore Substation Platform (as applicable)) or offshore junction box, Offshore Cable Corridor to MHWS at the landfall.
Offshore Transmission Owner	An OFTO, appointed in UK by Ofgem (Office of Gas and Electricity Markets), has ownership and responsibility for the transmission assets of an offshore windfarm.
Onshore Development Area	The onshore area above MLWS including the underground onshore export cables connecting to the White Cross Onshore Substation and onward to the NG grid connection point at East Yelland. The onshore development area will form part of a separate Planning application to the Local Planning Authority (LPA) under the Town and Country Planning Act 1990.
Onshore Export Cables	The cables which bring electricity from MLWS at the Landfall to the White Cross Onshore Substation and onward to the NG grid connection point at East Yelland.
Onshore Export Cable Corridor	The proposed onshore area in which the export cables will be laid, from MLWS at the Landfall to the White Cross Onshore Substation and onward to the NG grid connection point at East Yelland.
Onshore Infrastructure	The combined name for all infrastructure associated with the Project from MLWS at the Landfall to the NG grid connection point at East Yelland. The onshore infrastructure will form part of a separate Planning application to the Local Planning Authority (LPA) under the Town and Country Planning Act 1990.
Onshore Transmission Assets	The aspects of the project related to the transmission of electricity from MLWS at the Landfall to the NG grid connection point at East Yelland including the Onshore Export Cable, the White Cross Onshore Substation and onward connection to the NG grid connection point at East Yelland.

Defined Term	Description
the Onshore Project	The Onshore Project for the onshore TCPA application includes all elements onshore of MLWS. This includes the infrastructure associated with the offshore export cable (from MLWS), landfall, onshore export cable and associated infrastructure and new onshore substation (if required).
White Cross Offshore Windfarm Ltd	White Cross Offshore Windfarm Ltd (WCOWL) is a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy Ltd.
the Project	the Project is a proposed floating offshore windfarm called White Cross located in the Celtic Sea with a capacity of up to 100MW. It encompasses the project as a whole, i.e. all onshore and offshore infrastructure and activities associated with the Project.
Project Design Envelope	A description of the range of possible elements that make up the Project design options under consideration. The Project Design Envelope, or 'Rochdale Envelope' is used to define the Project for Environmental Impact Assessment (EIA) purposes when the exact parameters are not yet known but a bounded range of parameters are known for each key project aspect.
Safety zones	A marine zone outlined for the purposes of safety around a possibly hazardous installation or works / construction area.
Service operation vessel	A vessel that provides accommodation, workshops and equipment for the transfer of personnel to turbine during OMS. Vessels in service today are typically up to 85m long with accommodation for about 60 people.
Transition joint bay	Underground structures at the Landfall that house the joints between the offshore export cables and the onshore export cables.
Transition piece	The transition piece includes various functionalities such as access for maintenance, cable connection for the energy of the turbine and the corrosion protection of the entire foundation.
White Cross Offshore Windfarm	Up to 100MW capacity offshore windfarm including associated onshore and offshore infrastructure.
White Cross Onshore Substation	A new substation built specifically for the White Cross project. It is required to ensure electrical power produced by the offshore windfarm is compliant with NG electrical requirements at the grid connection point at East Yelland.
Windfarm Site	The area within which the wind turbines, Offshore Substation Platform and inter-array cables will be present.
Works completion date	Date at which construction works are deemed to be complete and the windfarm is handed to the operations team. In reality, this may take place over a period of time.

9. Marine Water and Sediment Quality

9.1 Introduction

1. This chapter of the Environmental Statement (ES) presents the potential impacts of the White Cross Offshore Windfarm Project (the Onshore Project) on Marine Water and Sediment Quality. Specifically, it considers impacts above (landward of) Mean Low Water Springs (MLWS) during its construction, operation and maintenance, and decommissioning phases.

2. The ES has been finalised with due consideration of pre-application consultation to date (see **Chapter 7: Consultation**) and the ES will accompany the application to North Devon Council (NDC) for planning permission under the Town and Country Planning Act 1990.

3. The components of the White Cross Offshore Windfarm Project seaward of Mean High Water Springs (MHWS) ('the Offshore Project') are subject to a separate application for consent under Section 36 of the Electricity Act 1989, and for Marine Licences under the Marine and Coastal Access Act 2009. These applications are supported by a separate ES covering all potential impacts seaward of MHWS.

4. This assessment has been undertaken with specific reference to the relevant policy, legislation and guidance, which are summarised in **Section 9.2** of this chapter. Further information on the international, national and local planning policy and legislation relevant to the Onshore Project is provided in **Chapter 3: Policy and Legislative Context**.

5. Details of the methodology used for the Environmental Impact Assessment (EIA) and Cumulative Effect Assessment (CEA), are presented in **Section 9.3** of this chapter and **Chapter 6: EIA Methodology**.

6. This assessment has been informed by impacts assessed in **Chapter 8: Marine and Coastal Processes** and impacts assessed in this chapter informs the following linked ES chapters:

   - **Chapter 10: Benthic and Intertidal Ecology**.

7. Inter-relationships with these chapters are further described in **Section 9.10**.

8. This ES chapter:

   - Presents the existing environmental baseline established from desk studies, and consultation

- Presents the potential environmental effects on Marine Water and Sediment Quality arising from the Onshore Project, based on the information gathered and the analysis and assessments undertaken
- Identifies any assumptions and limitations encountered in compiling the environmental information
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

9.2 Policy, Legislation and Guidance

9. **Chapter 3: Policy and Legislative Context** describes the wider policy and legislative context for the Onshore Project. The principal policy and legislation used to inform the assessment of potential impacts on Marine Water and Sediment Quality for the Onshore Project are outlined in this section.

9.2.1 National Planning Policy Framework

10. The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, updated July 2021) is the primary source of national planning guidance in England. Sections relevant to this aspect of the ES are summarised below in **Table 9.1**.

Table 9.1 Summary of NPPF Policy relevant to Marine Water and Sediment Quality

Summary	How and where this is considered in the ES
"Planning policies and decisions should contribute to and enhance the natural and local environment by preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans" - NPPF, paragraph 174 (e)	Potential impacts on water quality during construction, operation and maintenance and decommissioning are introduced in **Section 9.3.3** and assessed in **Section 9.5** and in the Water Environment Regulations Compliance Assessment (**Appendix 14.B: Water Environment Regulations Compliance Assessment**) with respect to the river basin management plans.

9.2.2 National Policy Statement

11. The assessment of potential impacts upon marine water and sediment quality has been made with specific reference to the relevant National Policy Statement (NPS). NPSs are statutory documents which set out the government's policy on specific types of Nationally Significant Infrastructure Projects (NSIPs) and are published in accordance with the Planning Act 2008.

12. Although the Offshore Project is not an NSIP, it is recognised that due to its size of up to 100MW and its location in English waters, certain NPS are considered relevant to the Offshore Project. Therefore, to align with the approach to the assessment of the Offshore Project, certain NPS are will also be considered as part of the Onshore Project.

13. Those relevant to marine water and sediment quality are set out within the overarching NPS for Energy (EN-1), NPS for Renewable Energy Infrastructure (EN-3) and NPS for Electricity Networks Infrastructure (EN-5), which are summarised in **Table 9.2**.

14. It is noted that the NPS for Energy (EN-1), the NPS for Renewable Energy Infrastructure (EN-3) and the NPS for Electricity Networks Infrastructure (EN-5) are in the process of being revised. Draft versions were published for consultation in September 2021 (Department for Business Energy and Industrial Strategy (BEIS), (2021a), BEIS, (2021b) and BEIS (2021c) respectively). A review of these draft versions has been undertaken in the context of this ES chapter.

15. **Table 9.2** includes a section for the draft version of NPS (EN-1, EN-3 and EN-5) in which relevant additional NPS requirements not presented within the current NPS (EN-1, EN-3 and EN-5) have been included. A reference to the requirement's location within the draft NPS and to where within this ES chapter or wider ES it has been addressed has also been provided.

16. Minor wording changes within the draft version which do not materially influence the NPS (EN-1, EN-3, EN-5) requirements have not been reflected in **Table 9.2**.

Table 9.2 Summary of NPS EN-1 and EN-3 provisions relevant to Marine Water and Sediment Quality

Summary	How and where this is considered in the ES
"Infrastructure development can have adverse effects on the water environment, including transitional waters and coastal waters. During the construction, operation, maintenance and decommissioning phases, discharges could occur.	Potential impacts on water quality during construction, operation and maintenance and decommissioning are introduced in **Section 9.3.3** and assessed in **Section 9.5**, **Section 9.6** and **Section 9.7**, and

Summary	How and where this is considered in the ES
There may also be an increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health or on protected species and habitats and could, in particular, result in surface waters, ground waters of protected areas failing to meet environmental objectives established under the Water Framework Directive" - **EN-1, paragraph 5.15.1**	in the Water Environment Regulations Compliance Assessment found in **Appendix 14.B: Water Environment Regulations Compliance Assessment**. Impacts to habitats and species are assessed in **Chapter 10: Benthic and Intertidal Ecology**.
"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 ES or equivalent." **- EN-1, paragraph 5.15.2**	The existing baseline and the baseline for the marine water environment within the study area is presented in **Section 9.4**.
"The ES should in particular describe the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges" **- Draft EN-1, paragraph 5.16.5**	Potential impacts on water quality during construction, operation and maintenance and decommissioning are introduced in **Section 9.3.3** and assessed in **Section 9.5**, **Section 9.6** and **Section 9.7**, and in the Water Environment Regulations Compliance Assessment found in **Appendix 14.B: Water Environment Regulations Compliance Assessment**.
"The risk of impacts on the water environment can be reduced through careful design to facilitate adherence to good pollution control practice." - **Draft EN-1, paragraph 5.16.12**	A Construction Environment Management Plan (CEMP) will be produced which will set out the best practice measures required throughout construction.
The construction, operation, maintenance and decommissioning of offshore energy infrastructure can affect marine water quality through the disturbance of seabed sediments or the release of contaminants with subsequent indirect effects on habitats, biodiversity and fish stocks. - **EN-3, paragraph 2.6.189**	Potential impacts on water quality during construction, operation and maintenance and decommissioning are introduced in **Section 9.3.3** and assessed in **Section 9.5**, **9.6** and **9.7**. Contaminant analysis of samples collected from the seabed indicate very low levels of contaminants. Potential impacts on commercial fisheries receptors are assessed in the Offshore Project ES.

Summary	How and where this is considered in the ES
"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." - **EN-3, paragraph 2.6.191**	Consultation with the Environment Agency has been undertaken through the Expert Topic Group (ETG) process.
"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." - **EN-3, paragraph 2.6.192**	Consultation with the MMO has been undertaken through the ETG process.
"An assessment of the effects of installing cable across the intertidal zone should follow The Crown Estate's cable route protocol and include information, where relevant, about: • **disturbance during cable installation, maintenance/repairs and removal (decommissioning)** • **increased suspended sediment loads in the intertidal zone during installation and maintenance/repairs** • **Protected sites (e.g. Habitats Regulation Assessment (HRA) sites, MCZs and Site of Special Scientific Interest (SSSI))"** **Draft EN-3, Section 2.21, Paragraph 2.27.3**	A range of cable installation methods may be required, and these are detailed in **Chapter 5: Project Description**. The worst-case scenario for marine water and sediment quality is provided in **Section 9.3.3**. Assessment of the potential disturbance and increased suspended sediment concentrations in the intertidal zone due to cable installation is provided in **Section 9.5.1**.

Summary	How and where this is considered in the ES
"As climate change is likely to increase risks to the resilience of some of this infrastructure, from flooding for example, or in situations where it is located near the coast or an estuary or is underground, applicants should in particular set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it has been designed to be resilient to:" • **flooding, particularly for substations that are vital to the network; and especially in light of changes to groundwater levels resulting from climate change; and** • **coastal erosion - for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations respectively" – Draft EN-5, paragraph 2.6.1**	The Onshore Project is designed so it is not vulnerable to coastal change or climate change. Potential flood risk impacts are considered in **Chapter 14: Water Resources and Flood Risk**.

9.2.3 Guidance

17. There is no specific guidance available for the impact assessment of marine sediment and water quality. However, where the data available supports it, sediment quality guidelines used by The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) (OSPAR Commission, 2014), the US Environmental Protection Agency (EPA) and the MMO have been used in relation to the assessment of contaminant concentrations within sediments and the potential for biological effects.

18. With respect to OSPAR and the EPA, assessments are undertaken using OSPAR's Background Assessment Concentration (BAC) and the US EPA's Effects Range-Low (ERL). BACs are statistical tools defined in relation to the background concentrations which enable statistical testing of whether observed concentrations can be considered to be near background concentrations. The ERL value is defined as the lower tenth percentile of the data set of concentrations in sediments which were associated with biological effects. Adverse effects on organisms are rarely observed when concentrations fall below the ERL value. Relevant BACs and ERLs are provided in **Table 9.3**.

19. In the UK, licensing authorities for dredge material disposal to sea, regulate the activity using guidelines, part of which require characterisation of the sediments for disposal to enable the consideration of potential adverse environmental effects. To

undertake this assessment, regulating authorities apply action levels (sediment quality criteria) for contaminants on a primary list. These action levels are then used as part of a 'weight of evidence' approach to decision making on the disposal of dredged material. There are two levels – Action Level 1 (AL1) and Action Level 2 (AL2). Contaminant levels below AL1 are generally assumed to be of no concern and are unlikely to influence the licensing decision. Contaminant levels between Level 1 and 2 generally trigger further investigation of the material, and contaminants in dredged material above AL2 are generally considered unsuitable for sea disposal (MMO, 2015).

Table 9.3 Sediment quality guidelines used in this assessment

Contaminant	Units	OSPAR BAC	OSPAR ERL	Cefas AL1	Cefas AL2
Arsenic	mg/kg	25	8.2	20	100
Cadmium		0.31	1.2	0.4	5
Chromium		81	81	40	400
Copper		27	34	40	400
Mercury		0.07	0.15	0.3	3
Nickel		36	21	20	200
Lead		38	47	50	500
Zinc		122	150	130	800
Acenaphthene	µg/kg	-	-	100	-
Acenaphthylene		-	-	100	-
Anthracene		5	85	100	-
Benz(a)anthracene		16	261	100	-
Benzo(a)pyrene		30	430	100	-
Chrysene		20	-	100	-
Dibenzo(a,h)anthracene		-	-	10	-
Fluoranthene		39	600	100	-
Fluorene		-	-	100	-
Naphthalene		8	160	100	-
Phenanthrene		32	240	100	-
Pyrene		24	665	100	-
Benzo(ghi)perylene		80	-	100	-
Indeno[1,2,3-cd]pyrene		103	-	100	-

20. Although the majority of the material assessed against these standards arises from a specific activity i.e. dredging and disposal activities, they are also considered a good way of undertaking an initial risk assessment with respect to determining risks to marine waters from other marine activities as part of the EIA and associated Water Environment Regulation (WER) compliance assessments. If, overall, levels do not generally exceed AL1 then contamination levels are considered to be low risk in terms of the potential for impacts on water quality. This approach is recommended

by the Environment Agency in their Water Environment Regulations Compliance Assessment guidance 'Clearing the Waters for All' for example (Environment Agency, 2017). Relevant values are presented in **Table 9.3**.

9.3 Assessment Methodology

9.3.1 Study Area

21. Details of the location of the Onshore Project and the onshore components are set out within **Chapter 5: Project Description.**

22. The marine water and sediment quality study area is defined by the distance over which impacts on water quality from all the Onshore Project components (i.e. Landfall, Onshore Export Cable Corridor, Compounds, Access Routes and Onshore Substation) may occur and by the location of any receptors that may be affected by those potential impacts.

23. The study area therefore includes the direct footprint of the onshore infrastructure, and the wider area which may be impacted by sediment plumes. This area has been informed by **Chapter 8: Marine and Coastal Processes** which considers the spatial extent of any potential sediment plumes. The study area is shown in **Figure 9.1**.

9.3.2 Approach to Assessment

24. The assessment methodology for Marine Water and Sediment Quality differs to that presented in **Chapter 6: EIA Methodology**. The methodology to be followed is set out in the following sub-sections.

9.3.2.1 Impact assessment criteria

25. The terms used to define sensitivity and magnitude are outlined in **Table 9.4** and **Table 9.5**.

26. Water quality along the coast 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.

Figure 9.1 Marine Water and Sediment Quality Study Area

Table 9.4 Definition of terms relating to receptor sensitivity

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 of natural or anthropogenic origin are known to exist within the surrounding environment.
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.

Table 9.5 Definition of terms relating to magnitude of an impact

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.

27. 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

- Reversibility (i.e., the capability of the environment to return to a condition equivalent to the baseline after the effect ceases).

28. The magnitude of effect is described using a standard scale and definitions for each term are provided in **Table 9.5**.

29. The significance of the effect upon Marine Water and Sediment Quality is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The method employed for this assessment is presented in **Table 9.6**.

Table 9.6 Significance of an impact - resulting from each combination of receptor sensitivity and the magnitude of the effect upon it

		Negative 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

9.3.3 Worst-Case Scenario

30. In accordance with the assessment approach to the 'Rochdale Envelope' set out in **Chapter 6: EIA Methodology**, the impact assessment for marine water and sediment quality has been undertaken based on a realistic worst-case scenario of predicted impacts. The Project Design Envelope for the Onshore Project is detailed in **Chapter 5: Project Description**.

31. The realistic worst-case scenario (having the most impact) for each individual impact is derived from the Project Design Envelope (PDE) to ensure that all other design scenarios will have less or the same impact.

32. The realistic worst-case scenarios with regard to marine water and sediment quality within the study area are presented by impact in **Table 9.7**. These relate to activities which will cause the disturbance of large volumes of sediment into the water column.

Table 9.7 Definition of realistic worst-case scenario details relevant to the assessment of impacts in relation to marine water and sediment quality

Impact	Realistic worst-case scenario	Rationale
Construction		
Impact 1: Localised temporary increases in suspended sediment due to cable installation	Two export cables would be buried in a trench across the northern end of Saunton Sands and into the subtidal. The trench dimensions across the beach would be 0.5m wide and 270m long, = 270m^2 (total plan area for two cables). The cable trench would be at least 1.2m deep, = 324m^3 (volume for two cables).	The worst-case scenario for water quality would occur through the release of significant volumes of, potentially contaminated, sediment into the water column. Open cut trenching in the intertidal would disturb the largest volume of sediment and therefore potentially cause the largest suspended sediment concentrations.
Impact 2: Remobilisation of contaminated sediments		
Operation		
None		There are no operational impacts identified because the cable is buried above MLWS. Transition joint bays are located within the car park, therefore maintenance works would not take place within the intertidal zone.
Decommissioning		
To be determined	The decommissioning policy for the Onshore Project infrastructure is not yet defined however it is anticipated that some infrastructure would be removed, reused or recycled; other infrastructure could be left in situ. The following infrastructure is likely be removed, reused, or recycled where practicable: • Onshore substation • Export Cables. The following infrastructure is likely to be decommissioned and could be left in situ depending on available information at the time of decommissioning: • Transition joint bays • Cable joint bays • Cable ducting.	The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time. Decommissioning arrangements will be detailed in a Decommissioning Plan, which will be drawn up and agreed with the relevant consenting body / stakeholder prior to decommissioning. For the purposes of the worst-case scenario, it is anticipated that the impacts will be comparable to those identified for the construction phase.

9.3.4 Summary of Mitigation

9.3.4.1 Embedded Mitigation

33. The embedded mitigation measures are those defined in the Institute of Environmental Management and Assessment (IEMA) guidance as either primary or tertiary mitigation. Those measures relevant to the marine water and sediment quality assessment are summarised in **Table 9.8**.

34. As these measures have been embedded the assessment of effects is undertaken on the basis that these forms of mitigation will be delivered. Therefore, any effects that might have arisen without these forms of mitigation do not need to be identified as 'potential effects', as there should be no potential for them to arise.

Table 9.8 Embedded mitigation measures relevant to the marine water and sediment quality assessment

Component/Activity/Impact	Mitigation embedded into the design of the Onshore Project
Landfall cable corridor	Either open trenching or trenchless technique will be used to install the cables at the landfall (above MLWS). Cables will be buried at sufficient depth to have no effect on marine water or sediment quality.
Cable corridor crossing of the Taw-Torridge Estuary SSSI	A trenchless technique will be used to install the cables underneath the Taw-Torridge Estuary SSSI. Cables will be buried at sufficient depth to have no effect on estuarine water or sediment quality.

9.3.5 Baseline Data Sources

9.3.5.1 Desktop Study

35. Data were acquired within the study area through a detailed desktop review of existing studies and datasets. Agreement was reached with all consultees that the data collected, and the sources used to define the baseline characterisation for marine water and sediment quality are fit for the purpose of the EIA (Marine Ecology ETG Meeting 1, 5 May 2022).

36. The sources of information presented in **Table 9.9** were consulted to inform the marine water and sediment quality assessment.

Table 9.9 Data sources used to inform the marine water and sediment quality assessment

Source	Summary
OSPAR Assessments (OSPAR 2010 assessment (OSPAR 2010) OSPAR Intermediate Assessment 2017 (OSPAR 2017)	The Interim Assessment 2017 provides background information and assessments of human pressures on the marine environment and biological diversity of the OSPAR Maritime Area. The Quality Status Report 2010 evaluates the quality status of the marine environment and biological diversity of the OSPAR Maritime Area.
OSPAR Coordinated Environmental Monitoring Programme assessment reports (OSPAR Commission 2020)	The 2019-2020 report summarises the 2019-2020 annual Coordinated Environmental Monitoring Programme assessment of levels and trends of contaminants and their biological effects.
Environment Agency Catchment Data Explorer (Environment Agency, 2022a)	Database for information related to river basin management plans (RBMP) in England. Contains information on river basin districts and catchments and Water Framework Directive (WFD) compliance data.
Environment Agency Bathing Waters Information and classification (Environment Agency, 2022b)	Data for designated bathing waters.

9.3.5.2 Site Specific Survey

37. To inform the EIA, site-specific surveys were undertaken, as agreed with the statutory consultees during the Marine Ecology ETG Meeting 1 on the 5 May 2022. These surveys are outlined in **Table 9.10**. Chemical analysis sampling locations undertaken as part of the site-specific survey are shown in **Figure 9.2**.

9.3.6 Data Limitations

38. Given the limited data available regarding site specific offshore water quality, information from more general monitoring programmes such as those undertaken by OSPAR are used to inform the baseline for offshore water quality. This limitation is not considered to significantly affect the certainty or reliability of the impact assessments presented in **Section 9.5**.

9.3.7 Scope

39. During scoping (Case reference: EIA/2022/00002), several potential impacts upon Marine Water and Sediment Quality were agreed to be "scoped out". These impacts are outlined, together with a justification as to why they are not considered further,

in **Table 9.11** and **Table 9.12** outlines the potential impacts that are "scoped in" to this assessment.

Table 9.10 Summary of site-specific survey data

Survey name and year	Summary
Benthic Characterisation Survey, 2022	25 stations (22 offshore and 3 nearshore) sampled with a 0.1 m^2 grab sampler with prior investigation by drop-down camera. Single Particle Size Distribution (PSD) analysis and macrobenthic samples collected from each sampling station. Additional samples were collected at a subset of 14 of the 25 stations for subsequent chemical contaminant analysis. The samples were analysed for the following parameters: • Trace metals • Organotins • Polyaromatic Hydrocarbons (PAHs) and Total Hydrocarbons (THC) • Polychlorinated biphenyls (PCBs). Chemical analysis was undertaken in line with the MMO accreditation scheme regarding sediment sampling for disposal to sea licensing at SOCOTEC. A 0.1m^2 Day grab sampler was used to collect the samples.
Intertidal Report, 2022/ Appendix 10.B: Intertidal Survey Report	As part of an intertidal biotope survey, 19 sediment samples were collected for Particle Size Analysis (PSA)

Table 9.11 Summary of impacts relating to Marine Water and Sediment Quality that are scoped out of the assessment

Potential Impact	Justification
Pollution events resulting from the accidental release of pollutants	There is a risk that a pollution event could occur through the accidental release of pollutants into the water column which could have a detrimental effect on Marine Water and Sediment Quality. All construction plant involved with construction and operation of The Onshore Project will be required to comply with the Guidelines for Pollution Prevention[1]. A CEMP will also be put in place for the Onshore Project to ensure all works are undertaken in line with best practice for working in the intertidal environment. This mitigation will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event.
Transboundary impacts	The likely water quality impacts would be restricted to near-field effects only (within tens or hundreds of metres of the activity),

[1] https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/

Potential Impact	Justification
	transboundary impacts are unlikely to occur, or are unlikely to be significant.

Figure 9.2 Grab Sample Locations Analysed for Chemical Contamination

Table 9.12 Summary of impacts relating to Marine Water and Sediment Quality that are scoped into the assessments

Potential Impact	Justification
Localised temporary increases in suspended sediments due to cable installation	Installation activities may cause an increase in suspended sediment concentrations in the water column.
Remobilisation of existing contaminated sediments	Sediment suspended during installation activities may contain contaminants which (if present) may have a detrimental effect on water quality.

9.3.8 Consultation

40. Consultation has been a key part of the development of the Onshore Project. Consultation regarding Marine Water and Sediment Quality has been conducted throughout the EIA. An overview of the Onshore Project consultation process is presented within **Chapter 7: Consultation**.

41. A summary of the key issues raised during consultation specific to Marine Water and Sediment Quality and of relevance to the Onshore Project is provided below in **Table 9.13** together with how these issues have been considered in the production of this ES.

Table 9.13 Consultation responses

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
Scoping Opinion Response			
Cefas	25th March 2022, Scoping response	The onshore cable ducts are to be installed using a trenching machine/open-cut trench techniques and using trenchless methods, where necessary, to avoid surface disturbance at sensitive features. I acknowledge that the risk of suspended sediments and contamination is low using these methods.	Please see **Section 9.5** for an assessment of this potential impact.
		Paragraph 129 describes that installation of the offshore export cable is typically undertaken by ploughing, jetting, trenching or post-lay burial depending on the soil conditions along the cable route. Please note that these methods have the potential for contaminant release and therefore, the Applicant may need to take samples to inform the impact assessment. I recommend the applicant engage with the MMO and provide a map of where these methods are to be carried out, to allow sampling advice to be provided.	Sampling has been undertaken to inform this assessment, in line with recommendations of the MMO and Cefas (see **Table 9.10**). The analysis results of this sediment survey are presented in **Section 9.4.1**)
		The effect of construction activities on suspended sediment concentrations will be assessed using expert-based assessment and using a source-pathway-receptor conceptual model. Further, the EIA will consider any likely changes in suspended sediment concentrations in response to scouring effects. I welcome these inclusions.	Noted. Construction effects on SSCs are assessed in **Section 9.5.1**.
		Potential cumulative effects are yet to be assessed and will consider cumulative effects with the existing windfarms and any other projects and marine users within the zone of influence. This is appropriate for the scoping stage.	Please see **Section 9.8** for an assessment of cumulative effects.
		Transboundary effects have been scoped out as the Offshore Project is ~130km from any international territory boundary. I agree with this scoping decision.	Noted. This is justified within **Section 9.3.7**.
North Devon Council	5th April 2022, Scoping response	The Scoping Out of pollution events resulting from the accidental release of pollutants does not appear to be fully	A CEMP would be put in place for the Offshore

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
	(pre-application enquiry)	justified. Pollution events at the offshore development site, along the cable route, landfall (up to MHWS) site or from construction vessels in transit could have potentially significant effects on wide range of environmental and socio-economic receptors. All primary effects on the receiving environment and secondary effects on tourism, the fishing industry, etc should be assessed in full.	Project to ensure all works are undertaken in line with best practice for working in the marine environment. This mitigation will minimise the likelihood of an accidental release and put in place procedures for an effective response to any pollution event.
Environment Agency	6th April 2022, Scoping response (ref DC/2022/122540/01-L01)	With regard to the objectives of the WFD new development must not cause deterioration from the present status. We would expect the Environment Statement to demonstrate that the proposal will not cause deterioration in WFD waterbody status. When the proposal's detailed locations are decided, we can provide further advice. At this stage we require the Environment Statement to scope in how the proposed development would affect the River Taw (& wider estuary), River Torridge (& wider estuary), Sir Arthurs Pill (main river) and other minor watercourse along with any relevant bathing waters and shellfish waters.	Please refer to **Appendix 14.B: Water Environment Regulations Compliance Assessment** for the Water Environment Regulations Compliance Assessment.
		However, an assessment should be prepared into the potential impacts of sediment deposition in the Taw and Torridge estuary and associated designated bathing beaches during construction operations at the site of the cable landfall (up to MHWS) and any crossing of the River Taw / Torridge. The impact assessment should include the possible effects of the drilling works on dispersion of final effluent from any outfall for Sewage Treatment Works and also the Taw / Torridge Estuary Shellfish Waters. We would expect the development to submit a Water Quality Monitoring Strategy to set out the	An assessment of potential impacts on marine water quality during construction is presented in **Section 9.5**. **Chapter 8: Marine and Coastal Processes** finds that the Onshore Project will not have an effect on the Taw/Torridge estuary.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		pre- and post- development water quality sampling scheme, and any monitoring during the works which may be required.	Potential impacts on freshwater and transitional water bodies arising from the installation of the Onshore Project are assessed in **Appendix 14.B: Water Environment Regulations Compliance Assessment**.
		To help manage risks (i.e., any increased silt loads) to the water environment, we recommend that a CEMP is developed. The CEMP should pull together and manage the pollution control and waste management requirements during the construction phase. It should ensure that adequate pollution prevention measures are included to protect controlled waters during construction. We recommend that the CEMP is drafted using guidance in our Pollution Prevention Guidelines (PPGs), in particular PPG5 - Works and maintenance in or near water and PPG6 - Working at construction and demolition sites. These can be viewed via the following link: https://www.gov.uk/government/collections/pollution-prevention-guidance-ppg	A CEMP will be produced to ensure all works are undertaken in line with best practice for working in the marine environment. An Outline CEMP is provided in **Appendix 5.B: Outline Construction Environment Management Plan (CEMP)**.
		All fuel, hydraulic and lubricating oils associated with onshore and offshore works should be stored in suitable double skinned or integrally bunded storage systems with leakage control alarm mechanisms. A pollution contingency plan should be in place in the event of a leak or spill of oil from onshore or offshore operations. Our relevant Pollution Prevention Guidelines (PPGs) should be referred to. These are available on our website.	As above. The CEMP will contain guidance on the control of chemicals.

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		All temporary working methods including: piling, dredging, de-watering, pumping, and construction within any water course must all be considered in the context of timing and minimising disturbance to migratory fish species' movement and activity. Sediment and its movement is a natural part of aquatic systems, essential for hydrological, geomorphological and ecological functioning. Sediment forms a variety of habitats, which directly and indirectly support a broad range of flora and fauna. Dredging / drilling can affect the water environment. It can alter flow regimes, release contaminants accrued within the sediment, and create smothering effects, thereby damaging benthic habitats and migratory fish populations. Dredging should only be undertaken in a manner that protects the environment. The applicant should consider the methodology to be used, the disposal of dredged material, and the timing of works. Decisions should be underpinned by the fundamental scientific principles of hydraulics and geomorphology and take account of the multiple functions and services that a channel delivers. We recommend that any dredging is carried out in accordance with the Channel Management Handbook and our good practice guidance.	Trenching is considered the worst case scenario for the cable landfall (up to MHWS) (**Table 9.7**). The potential impacts of these activities on marine water quality are considered in **Section 9.5**. Potential impacts for the onshore cable route installation on transitional and freshwater bodies are considered in **Appendix 14.B: Water Environment Regulations Compliance Assessment**.
Natural England	17th March 2022, Scoping response (ref 384007)	The planning system plays a key role in determining the location of developments which may give rise to water pollution, and hence planning decisions can have a significant impact on water quality, and land. The assessment should take account of the risks of water pollution and how these can be managed or reduced.	A CEMP will be produced to ensure all works are undertaken in line with best practice for working in the marine environment. An Outline CEMP is provided in **Appendix 5.B: Outline CEMP**.

9.4 Existing Environment

42. This section describes the existing environment in relation to Marine Water and Sediment Quality associated with the White Cross study area. It has been informed by a review of the sources listed in **Table 9.9**.

9.4.1 Current Baseline

9.4.1.1 Water quality – contaminants

43. The Offshore Export Cable Corridor landfall routes pass through a WFD water body – the Barnstaple Bay coastal water body. The construction work required for the refurbishment of the onshore substation and cable trenching will take place directly adjacent to the Taw/Torridge transitional water body (see **Figure 9.1**). The assessment of potential effects on this water body arising from the onshore cable route installation is considered in **Chapter 14: Water Resources and Flood Risk**. However, the water quality information available for these water bodies is also relevant to this chapter and is therefore summarised here and the Water Environment Regulations Compliance Assessment is presented in **Appendix 14.B: Water Environment Regulations Compliance Assessment**.

44. Barnstaple Bay coastal water body is not designated as an artificial or heavily modified water body. It is currently classified as having an overall status of 'Moderate' (Environment Agency, 2023a). The status of ecological parameters within the water body, including macroalgae and phytoplankton, and the status of physico-chemical parameters (dissolved oxygen and inorganic nitrogen) is currently classified as 'good' however, the chemical status of the water body is classified as 'fail' due to high levels of polybrominated diphenyl ethers (PBDEs) and mercury.

45. The Taw/Torridge transitional water body is classified as a heavily modified water body due to physical modifications. It is also classified as having an overall status of 'moderate' (Environment Agency, 2023a). The status of its ecological parameters is classified as 'moderate' due to levels of dissolved inorganic nitrogen and it has a chemical status of 'fail' due to levels of benzo[ghi]perylene, mercury and PBDEs.

46. There are six Bathing Waters located along this coastline between Bideford and Mortehoe as shown in **Figure 9.1**. These include:

- Westward Ho!
- Saunton Sands
- Croyde Bay
- Putsborough
- Woolacombe Village

- Combesgate Beach, Woolacombe.

47. The offshore export cable route will make landfall within the Saunton Sands Bathing Water. Other Bathing Waters closest to the offshore export cable landfall (up to MHWS) are Westward Hoe! (c. 6.5km to the south) and Croyde Bay (c. 4km to the north). Saunton Sands and Westward Ho! are currently classified as 'Excellent' and Croyde Bay is currently classified as 'Good' based on water samples taken from 2017 through to 2021[2] (Environment Agency 2023b).

48. The Taw-Torridge estuary Shellfish Water is located within the estuary of the rivers Taw and Torridge, from where the two rivers meet to the mouth of the estuary and is designated to protect mussel (*Mytilus spp.*) beds (Cefas, 2013). Further Shellfish Waters are located upstream, the Taw estuary Shellfish Water and the Torridge estuary Shellfish Water. Mussels are farmed within these Shellfish Waters and a small area within the Torridge estuary Shellfish Water is farmed for Pacific oyster (*Crassostrea gigas*) (Cefas, 2013).

49. In terms of the coastal area, where the Offshore Export Cable Corridor landfall is located, the Interim Quality Status Report (QSR) (OSPAR, 2017) states that since the QSR 2010 (OSPAR, 2010) in the OSPAR region contaminant concentrations have continued to decrease, especially for PCBs. Although contaminant concentrations are generally below levels likely to harm marine species in the areas assessed, in most cases they have not yet reduced to within 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 PCB congeners) and locally increasing concentrations of PAHs and cadmium in open waters (OSPAR, 2017).

9.4.1.2 Water quality – suspended sediment

50. Cefas published average suspended sediment concentrations (SSCs) between 1998 and 2015 for the seas around the UK (Cefas, 2016) (**Plate 9.1**). The average annual suspended sediment concentrations towards the coast and in the vicinity of the Offshore Export Cable Corridor landfall are up to 15mg/l.

[2] It should be noted that Bathing Water classifications were not made for the 2020 season due to the impact of the COVID-19 pandemic on the sampling programme.

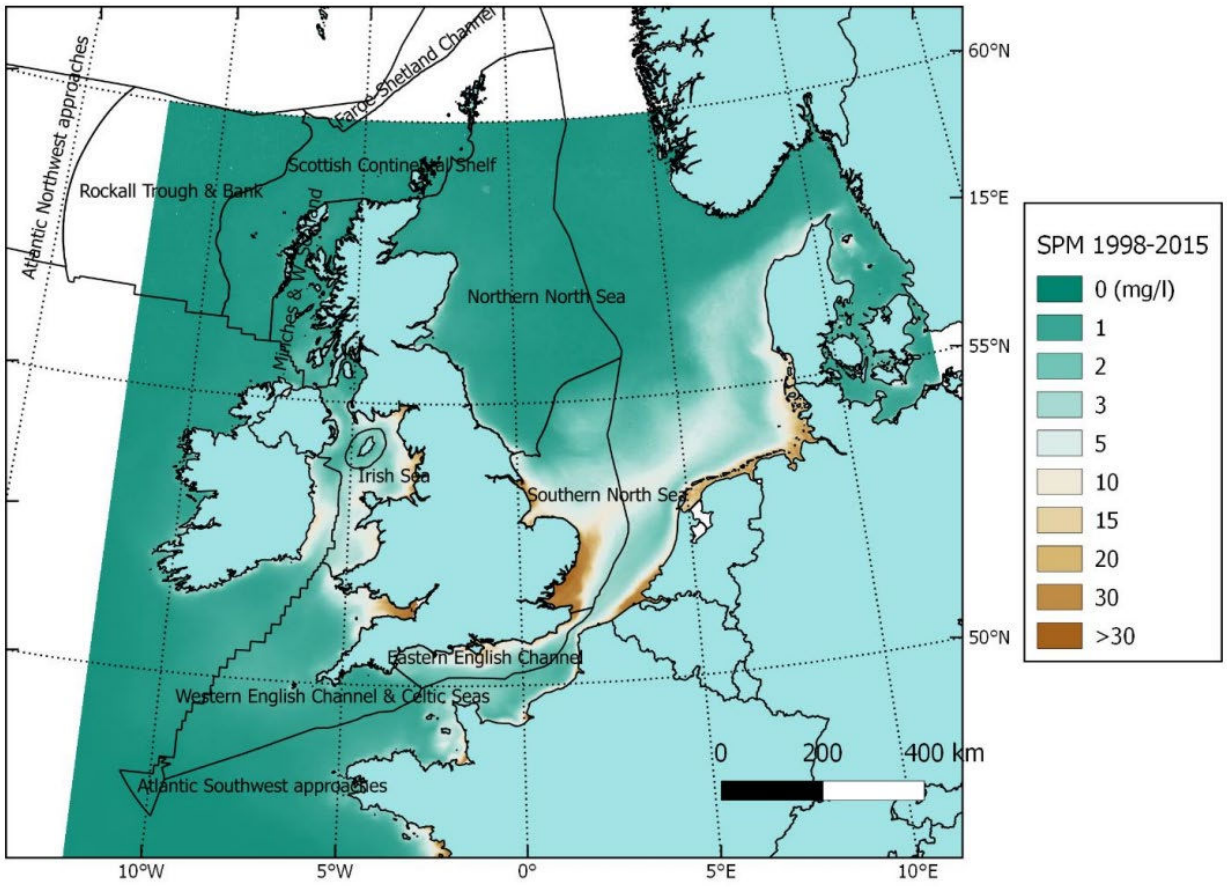

Plate 9.1 Average SSCs in the Celtic Sea for the period 1998-2015 (Cefas, 2016)

9.4.1.3 Sediment – physical characteristics

51. Sediment grain size is important to inform assessment of the risk of contamination because finer grained materials (silts and clays) function as a sink for contaminants and therefore have a greater potential to retain contaminants than larger grained materials (Cefas, 2001). Sediment grain size also assists in predicting the extent of any sediment plume should the material be disturbed.

52. Sediment composition at the landfall site is characterised by fine sands with some mud, associated with the sheltering effect of Bideford Bay (EMODnet, 2023).

53. This is supported by the PSA of sediments taken during the benthic surveys (OEL, 2022 / **Chapter 8: Marine and Coastal Processes** / **Appendix 8.A: Benthic Characterisation Report**) which showed that mud content was highest close to land (at ST01). The intertidal habitat survey also identified that the sediment in the vicinity of the landfall location was largely dominated by fine-very fine sand (EcoLogic, 2022 / **Appendix 10.B: Intertidal Survey Report**).

9.4.1.4 Sediment - contaminants

54. To inform the baseline for sediment quality for the Offshore ES, 14 grab samples were sub-sampled for chemical analysis during benthic surveys of the Windfarm Site and Offshore Export Cable Corridor route (**Chapter 10: Benthic and Intertidal Ecology**). Three of these samples are located in close proximity to the MLWS level at the landfall of the Export Cable Corridor and are therefore within the Study Area for this chapter. Analysis was undertaken for the following contaminants:

    - Heavy metals (arsenic, mercury, cadmium, chromium, copper, nickel, lead and zinc)
    - Organotins (tributyltin (TBT) and dibutyltin (DBT))
    - PCBs
    - PAHs.

55. The full data set is provided in the **Chapter 8: Marine and Coastal Processes** and **Appendix 8.A: Benthic Characterisation Report**.

56. The data is presented below in **Table 9.14** for metals and **Table 9.15** and **Table 9.16** for PAHs. All other data were below the limits of detection and are available in **Appendix 8.A: Benthic Characterisation Report**.

57. With respect to metals, concentrations indicate very low levels of contamination. Mercury was found at levels exceeding BAC at two stations (ST01 and ST09) but did not exceed Cefas AL1. Concentrations of nickel at ST01 very marginally exceeded Cefas AL1.

58. Concentrations of arsenic exceeded Cefas AL1 at four of the offshore stations; ST06, ST08, ST09 and ST10 (and BAC at three of those stations).

59. With respect to PAHs, five exceeded the BAC at only two stations (ST08 and ST09) but there were no exceedances of the Cefas AL1. Where exceedances occurred, concentrations were only marginally above the BAC value and do not approach ERL values. It can therefore be concluded that contamination across the wind farm site is very low.

60. Contaminants were not present at levels of concern within the two sample stations located closest to MLWS.

Table 9.14 Site specific data for metals (yellow indicates an exceedance of Cefas AL1 or BAC. There were no exceedances of ERL or AL2) [All data in mg/kg]

Site Reference	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)	Mercury (Hg)	Nickel (Ni)	Lead (Pb)	Zinc (Zn)
ST01	16.20	0.07	24.70	16.40	0.14	21.60	36.00	108.00
ST06	54.20	<0.04	12.80	7.10	0.03	12.30	17.00	38.30
ST08	40.70	0.06	12.60	8.30	0.05	11.60	17.60	50.80
ST09	22.70	0.06	22.80	13.40	0.09	18.90	29.30	89.30
ST10	49.80	<0.04	10.10	7.50	0.03	13.60	13.60	37.40
ST13	13.60	<0.04	9.40	4.50	0.03	6.80	10.70	33.40
ST15	13.60	<0.04	10.40	4.90	0.02	7.10	10.00	41.60
ST16	12.10	0.05	10.40	4.30	0.02	6.90	9.30	32.30
ST18	13.10	<0.04	10.80	5.20	0.02	7.10	10.40	35.80
ST19	12.10	<0.04	10.30	4.70	0.02	6.70	9.20	34.80
ST21	12.00	0.06	10.00	4.90	0.02	6.30	9.20	28.60
ST22	11.00	0.06	10.20	4.90	0.02	7.10	9.60	33.50
ST23	**18.60**	**0.05**	**11.10**	**6.80**	**0.02**	**13.70**	**16.00**	**69.00**
ST24	**19.30**	**0.04**	**11.00**	**6.20**	**0.02**	**13.70**	**15.90**	**65.40**
CEFAS AL1	20	0.4	40	40	0.3	20	50	130
CEFAS AL2	100	5	400	400	3	200	500	800
OSPAR BAC	25	0.31	81	27	0.07	36	38	122
OSPAR ERL	-	1.2	81	34	0.15	-	47	150

Table 9.15 Site specific data for PAHs (yellow indicates an exceedance of Cefas AL1 or BAC. There were no exceedances of ERL.) [All data in µg/kg]

Station	Acenaphthene	Acenaphthylene	Anthracene	Benzo[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[ghi]perylene	Benzo[e]pyrene	Benzo[k]fluoranthene
ST01	1.6	0	2.2	6.58	7.75	9.08	6.9	6.58	4.6
ST06	0	0	0	3	3.4	4.72	3.3	3.4	1.93
ST08	5.81	3.02	9.39	20.5	25.6	32.2	27	25.5	13.4
ST09	13	7.44	18.3	60.9	79.3	102	77.4	74	40.8
ST10	0	0	0	1.08	1.23	1.67	1.27	1.23	0
ST13	0	0	1.02	2.57	2.91	3.05	2.7	2.6	1.6
ST15	1.23	0	1.08	3.46	3.85	3.59	3.01	3.46	1.92
ST16	0	1.98	1.85	6.88	7.48	7.26	5.03	5.2	3.51
ST18	0	0	0	2.35	2.59	3.32	3.01	2.71	1.03
ST19	0	0	0	1.41	1.52	2.23	1.81	1.93	1.11
ST21	0	0	1.01	1.87	2.15	3.58	2.65	2.72	1.42
ST22	0	0	1.25	2.72	2.94	4.63	3.39	3.53	2.53
ST23	**0**	**0**	**0**	**2.7**	**2.77**	**5.44**	**3.84**	**4.3**	**2.86**
ST24	**0**	**0**	**0**	**0**	**0**	**1.72**	**1.12**	**1.31**	**0**
CEFAS AL1	100	100	100	100	100	100	100	100	100
CEFAS AL2	-	-	-	-	-	-	-	-	-
OSPAR BAC	-	-	5	16	30	-	80	-	-
OSPAR ERL	-	-	85	261	430	-	-	-	-

Table 9.16 Site specific data for PAHs (yellow indicates an exceedance of Cefas AL1 or BAC. There were no exceedances of ERL.) [All data in µg/kg]

Station	Chrysene	Dibenzo[ah]anthracene	Fluoranthene	Fluorene	Indeno[123cd]pyrene	Naphthalene	Perylene	Phenanthrene	Pyrene
ST01	8.93	1.49	13.2	2.45	7.29	5.25	2.26	9.23	10.1
ST06	5.02	0	5.65	1.37	3.23	3.23	0	6.13	4.48
ST08	33.8	5.93	45.8	9.79	27.1	26.1	7.42	40.1	35.8
ST09	95	17.3	122	25.6	79.7	60	21.8	98	95
ST10	1.78	0	2.15	0	1.31	1.96	0	2.4	1.8
ST13	3.37	0	5.19	0	2.8	1.83	0	3.38	3.95
ST15	4.93	0	7.57	1.29	3.03	4.79	1.05	7.6	6.82
ST16	7.89	1.19	10.4	1.13	5.37	2.93	1.98	4.14	9.06
ST18	3.26	0	6.29	1.2	3.03	3.18	0	5.55	5.18
ST19	2.15	0	3.28	0	1.76	1.67	0	3	2.8
ST21	3.17	0	4.15	1.17	2.45	3.84	0	4.84	3.41
ST22	3.94	0	6.91	1.47	3.36	3.95	1.57	5.97	5.21
ST23	**4.06**	**0**	**6.5**	**0**	**3.36**	**1.51**	**1.63**	**2.76**	**4.75**
ST24	**1.3**	**0**	**2.09**	**0**	**1.05**	**0**	**0**	**0**	**1.58**
CEFAS AL1	100	10	100	100	100	100	100	100	100
CEFAS AL2	-	-	-	-	-	-	-	-	-
OSPAR BAC	-	-	39	-	103	8	-	-	24
OSPAR ERL	-	-	600	-	-	160	-	-	665

9.4.2 Do Nothing Scenario

61. The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 require that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the ES (EIA Regulations, Schedule 4, Paragraph 3). From the point of assessment, over the course of the development and operational lifetime of the Onshore Project (operational lifetime anticipated to be 50 years), long-term trends mean that the condition of the baseline environment is expected to evolve. This section provides a qualitative description of the evolution of the baseline environment, on the assumption that the Onshore Project is not constructed, using available information and scientific knowledge of marine water and sediment quality.

62. The existing environment within the study area has been largely shaped by a combination of the physical processes which exist within the Bristol Channel and Irish Sea (**Chapter 8: Marine and Coastal 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, in a Do Nothing Scenario, trends in marine water quality would be expected to continue to improve.

9.5 Potential Impacts During Construction

63. As set out in **Table 9.7** the worst-case scenario for effects on marine water quality may arise due to direct physical disturbance of the intertidal seabed during installation of the cables which could increase suspended sediment concentrations in the water column due to trenching/backfilling. A description of the potential effects on water quality receptors caused by each identified impact is given in this section.

9.5.1 Impact 1: Localised temporary increases in suspended sediments due to cable installation

64. Activities which may release sediment into the water column include the installation of cables. The processes of mechanical excavation and backfilling using a land-based digger (at low tide) could release fine sediment to the beach surface that was previously buried. This sediment could then be released into the water column on the subsequent high tide as the beach becomes submerged, resulting in a

temporary, short-term and highly localised increase in suspended sediment concentrations.

65. The worst-case scenario of trenching across Saunton Sands would displace a volume of 324m^3 of sediment assuming 0.5m-wide, 1.2m-deep excavations. The installation of the cables would be mainly through sand (or coarser) because the energy levels at the beach are too high for significant deposition of finer sediment, both at the present day and historically. Hence, the volume of fine sediment excavated to create the trench, that could be suspended, would be very small. Most of the sediment disturbed by the excavation and remaining on the beach would be bedload and temporarily form part of the natural sediment transport processes. It is considered that this would be within the range of natural variability in the system.

66. Any increases in suspended sediment concentrations would be extremely short in duration (lasting the duration of the trenching activity – a maximum duration of five days). During this time, the suspended sediment would be rapidly dispersed by tidal and wave action.

9.5.1.1 Magnitude of impact

67. Due to the short-term and highly temporary nature of the impact the magnitude is considered to be **negligible**.

9.5.1.2 Sensitivity of the receptor

68. Water quality in the coastal area is considered to be of **low** sensitivity. This is because it is not within a confined area so has a high capacity to accommodate change due to its size and ability to dilute any alterations to water quality parameters.

9.5.1.3 Significance of effect

69. This gives rise to an effect of **negligible** significance.

9.5.1.4 Further Mitigation

70. No measures are required to mitigate this effect.

9.5.2 Impact 2: Remobilisation of existing contaminated sediments

71. Site specific data collected to inform this ES indicates that for all parameters, sediment contaminant concentrations are low (**Section 9.4.1.4**).

72. Where exceedances of sediment guidelines occur, these are marginal (i.e. only just above the lower guideline level value) which indicates that there is minimal risk to the marine environment. These exceedances are located offshore from MLWS in a discreet area within the wind farm site and along the offshore export cable corridor route. Contaminant concentrations close to the intertidal zone are less than defined levels of concern (**Table 9.14** to **Table 9.16**) and therefore disturbance of these sediments would not cause a deterioration in water quality.

73. Works within the offshore area will be short term, lasting the duration of the cable installation only. Additionally, sediments are not predicted to remain in suspension for long periods of time given that the offshore seabed material is predominantly sand and as such will settle quickly and be a temporary impact. Therefore, the risk to the water column for partitioning (the transfer of contaminants bound to sediment particles to being dissolved into the water column) to occur is reduced and it is considered highly unlikely that any contaminants would reach the intertidal zone.

9.5.2.1 Magnitude of impact

74. Due to the short-term and highly temporary nature of the impact the magnitude is considered to be **negligible**.

9.5.2.2 Sensitivity of the receptor

75. Water quality in the coastal area is considered to be of **low** sensitivity. This is because it is not within a confined area so has a high capacity to accommodate change due to its size and ability to dilute any alterations to water quality parameters.

9.5.2.3 Significance of effect

76. This gives rise to an effect of **negligible** significance.

9.5.2.4 Further Mitigation

77. No measures are required to mitigate this effect.

9.6 Potential Impacts During Operation and Maintenance

78. There are considered to be no potential effects on marine water and sediment quality during the operation and maintenance of the Onshore Project. This is because the cable will be buried beneath the beach of Saunton Sands, the dunes of Braunton Burrows and the Taw-Torridge Estuary. Transition pits are located within the car park and as such maintenance works would not be required within the

intertidal zone. Hence, there will not be any operational activities that would affect marine water and sediment quality related to the Onshore Project.

9.7 Potential Impacts During Decommissioning

79. No decision has been made regarding the final decommissioning policy for the Onshore Project as it is recognised that industry best practice, rules and legislation change over time.

80. The anticipated decommissioning activities are outlined in **Section 9.3.3**. The potential impacts of the decommissioning of the Onshore Project have been assessed for marine water and sediment quality on the assumption that decommissioning methods will be similar or of a lesser scale than those deployed for construction. The types of impact would be comparable to those identified for the construction phase:

- Impact 1: Localised temporary increases in suspended sediments due to cable installation
- Impact 2: Remobilisation of existing contaminated sediments.

81. The magnitude of impacts would be comparable to or less than those identified for the construction phase. Accordingly, given the construction phase assessments concluded "negligible effects" on marine water quality receptors, it is anticipated that the same would be valid for the decommissioning phase regardless of the final decommissioning methodologies.

9.8 Potential Cumulative Effects

82. The approach to CEA is set out in **Chapter 6: EIA Methodology**. Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment have been included in the CEA. Projects which are sufficiently implemented during the site characterisation for the Onshore Project have been considered as part of the baseline for the EIA. Where possible the Applicant has sought to agree with stakeholders the use of as-built project parameter information (if available) as opposed to consented parameters to reduce over-precaution in the cumulative assessment. The scope of the CEA was therefore be established on a topic-by-topic basis with the relevant consultees. The cumulative effect assessment for marine water and sediment quality was undertaken in two stages. The first stage was to consider the potential for the effects assessed as part of the Onshore Project to lead to cumulative effects in conjunction with other projects. The first stage of the assessment is detailed in **Table 9.17**.

Table 9.17 Potential cumulative effects considered for Marine Water and Sediment Quality

Impact	Potential for cumulative effect	Rationale
Impact 1: Localised temporary increases in suspended sediments	No	The assessment carried out above concludes that there will be a negligible effect on water quality arising from the construction of The Onshore Project. This is due to the small volume of material that would be disturbed and the open coast environment. Resuspension of coarser sediments would be limited whilst finer sediments would become entrained within a plume, it is predicted that they would quickly be widely dispersed by tidal and wave action and would be within the range of natural variability in the system. As such, cumulative effects with other plans or projects are unlikely and are not considered further.
Impact 2: Remobilisation of existing contaminated sediments	No	The assessment carried out above concludes that there will be a negligible effect on water quality arising from the release of contaminants. Contamination levels slightly exceed lower limits in the Offshore Project Area. No exceedances of limits were detected within sediments close to the intertidal therefore disturbance of these sediments would not cause a deterioration in water quality. Works within the offshore area will be short term, lasting the duration of the cable installation only. Additionally, sediments are not predicted to remain in suspension for long periods of. It is considered highly unlikely that any contaminants would affect water quality in the intertidal zone. As such, cumulative effects with other plans or projects are unlikely and are not considered further.

83. The second stage of the CEA is to evaluate the projects considered for the CEA to determine whether a cumulative effect is likely to arise. The list of considered projects (identified in **Chapter 6: EIA Methodology**) and their anticipated potential for cumulative effects are summarised in **Table 9.18**.

Table 9.18 Projects considered in the cumulative effect assessment on Marine Water and Sediment Quality

Project	Status	Distance from Onshore Development Area (km)	Included in the CEA?	Rationale
White Cross Offshore Project	Consent application submitted	0	No	All intertidal construction activities are assessed within this Chapter. The White Cross Offshore Project will not have a cumulative effect on marine water quality as they are the same activity. Cumulative effects with the cable crossing across the Taw and Torridge estuary are not anticipated as this will be undertaken using a trenchless technology.

84. It is noted that the first project listed is the Section 36 consent application for the offshore components of the White Cross Offshore Wind Farm which are a separate element to the onshore Town and Country Planning Application for which this ES is prepared. The specific combined project components are assessed cumulatively first and then cumulatively with all other projects.

9.9 Potential Transboundary Impacts

85. The Scoping Report identified that there was **no potential for significant** transboundary effects regarding Marine Water and Sediment Quality from the Onshore Project upon the interests of other European Economic Area (EEA) States.

9.10 Inter-relationships

86. Inter-relationship impacts are covered as part of the assessment and consider impacts from the construction, operation or decommissioning of the Onshore Project on the same receptor (or group). A description of the process to identify and assess these effects is presented in **Chapter 6: EIA Methodology**. The potential inter-relationship effects that could arise in relation to Marine Water and Sediment Quality include both:

- **Project lifetime effects:** Effects arising throughout more than one phase of the Onshore Project (construction, operation, and decommissioning) to interact to potentially create a more significant effect on a receptor than if just one phase were assessed in isolation

- **Receptor led effects:** Assessment of the scope for all relevant effects to interact, spatially and temporally, to create inter-related effects on a receptor (or group). Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

87. **Table 9.19** serves as a signposting for inter-relationships.

Table 9.19 Marine Water and Sediment Quality Inter-relationships

Topic and description	Related chapter	Where addressed in this Chapter	Rationale
Construction effects on suspended sediment concentrations and potential mobilisation of contaminants.	**Chapter 10: Benthic and Intertidal Ecology** **Chapter 11: Marine Mammal and Marine Turtle Ecology** **Chapter 21: Socio-Economics (including Tourism and Recreation)**	**Section 9.5**	Suspended sediment could cause disturbance to fish and turtles by causing a barrier to movement and benthic species through smothering. Sediments may also be contaminated which could harm fish, turtles and benthic species. Marine mammals may be affected through changes in prey availability. Suspended sediments (which may also contain contamination) may affect beach users during construction of the cable in the inshore area.
Inter-relationships for impacts during the decommissioning phase will be the same as those outlined above for the construction phase.			

9.11 Interactions

88. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The areas of interaction between impacts are presented in **Table 9.20** and **Table 9.21**, along with an indication as to whether the interaction may give rise to synergistic impacts.

89. An assessment for each receptor (or receptor group) related to these impacts should be considered in two ways. Firstly, the impacts are considered within a development phase (i.e. construction, operation, maintenance or decommissioning) to see if, for example, multiple construction impacts could combine. Secondly, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across development phases. The significance of each individual impact is determined by the sensitivity of the receptor and the magnitude of effect; the

sensitivity is constant whereas the magnitude may differ. Therefore, when considering the potential for impacts to be additive it is the magnitude of effect which is important – the magnitudes of the different effects are combined upon the same sensitivity receptor. If minor impact and minor impact were added this would effectively double count the sensitivity.

90. The assessment set out in **Section 9.5** concluded that the magnitude of potential effects on marine water and sediment quality arising from all impacts identified during the construction of the Onshore Project was **negligible**. As such interactions between these effects within and between the development phases would not occur.

9.12 Summary

91. This chapter has investigated the potential effects on marine water and sediment quality receptors arising from the Onshore Project. The range of potential impacts and associated effects considered has been informed by the Scoping Opinion, consultation, as well as reference to existing policy and guidance. The impacts considered include those brought about directly as well as indirectly.

92. The Onshore Project, landward of MLWS, is located within an open coastal area within the Bristol Channel, characterised by low suspended sediment concentrations and sandy sediments. Sediment chemical analysis of samples taken close to the MLWS limit show that sediments do not contain contaminants at levels of concern.

93. **Table 9.22** presents a summary of the impacts assessed within this ES chapter, any commitments made, and mitigation required and the residual effects. **No significant effects** on marine water quality were identified, with all effects assessed as of **negligible** significance.

94. As predicted effects on marine water and sediment quality arising from the Onshore Project are **negligible**, cumulative effects between the Onshore Project and other developments would be **negligible**.

Table 9.20 Interaction between impacts during construction

Potential Impact Construction	Impact 1: Localised temporary increases in suspended sediments due to cable burial	Impact 2: Remobilisation of existing contaminated sediments
Impact 1: Localised temporary increases in suspended sediments due to cable burial		Yes
Impact 2: Remobilisation of existing contaminated sediments	Yes	

Table 9.21 Interaction between impacts during decommissioning

Potential impact Decommissioning	Impact 1: Localised temporary increases in suspended sediments due to cable burial	Impact 2: Remobilisation of existing contaminated sediments
Impact 1: Localised temporary increases in suspended sediments due to cable burial		Yes
Impact 2: Remobilisation of existing contaminated sediments	Yes	

Table 9.22 Summary of potential impacts for marine water and sediment quality during construction and decommissioning of the Onshore Project

Potential impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation measures	Residual effect
Construction						
Impact 1: Localised temporary increases in suspended sediments due to cable burial	Water column	Low	Negligible	Negligible	n/a	Negligible
Impact 2: Remobilisation of existing contaminated sediments	Water column	Low	Negligible	Negligible	n/a	Negligible
Decommissioning						
Impact 1: Localised temporary increases in suspended sediments due to cable burial	Water column	Low	Negligible	Negligible	n/a	Negligible
Impact 2: Remobilisation of existing contaminated sediments	Water column	Low	Negligible	Negligible	n/a	Negligible

9.13 References

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