WHITE CROSS

White Cross Offshore Windfarm Environmental Statement

Chapter 16: Marine Archaeology and Cultural Heritage

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Glossary of Acronyms

Acronym	Definition
AEZ	Archaeological Exclusion Zone
ADBA	Archaeological Desk Based Assessment
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AoS	Area of Search
ATBA	Area To Be Avoided
BGS	British Geological Society
BMAPA	British Marine Aggregate Producers Association
CHIA	Cultural Heritage Impact Assessment
CIA	Cumulative Impact Assessment
CIfA	Chartered Institute of Archaeologists
CITiZAN	Coastal and Intertidal Zone Archaeology Network
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMFs	Electromagnetic Frequency
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
GIS	Global Imaging Systems
GIS	Geographical Information System
GPS	Global Positioning System
GT	Gross Tonnage
ha	Hectare
HDD	Horizontal Directional Drilling
HER	Historic Environment Record
HMS	Her Majesty's Ship
HMSO	Her Majesty's Stationery Office
HSC	Historic Seascape Character
HVAC	High-Voltage Alternating Current
IEMA	Institute of Environmental Management and Assessment
IHBC	Institute of Historic Building Conservation
IPC	Infrastructure Planning Commission

Acronym	Definition
IPMP	In-Principle Monitoring Plan
JNAPC	Joint Nautical Archaeology Policy Committee
km	Kilometre
LVIA	Landscape and Visual Impact Assessment
m	Metre
MBES	Magnetometer and Multibeam Bathymetry
MHWS	Mean High Water Springs
MHCLG	Ministry of Housing, Communities and Local Government
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MIS	Marine Isotope Stage
MPS	Marine Policy Statement
MoD	Ministry of Defence
MW	Megawatts
NHLE	National Heritage List for England
NE	Natural England
nm	Nautical Mile
NPPF	National Planning Policy Framework
NPPG	The National Planning Practice Guidance
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
nT	Nano Tesla
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
OS	Ordnance Survey
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
OWL	Offshore Wind Ltd
PAD	Protocol for Archaeological Discoveries
PINS	Planning Inspectorate
PPG	Planning Practice Guidance
ROV	Remote Operated Vehicle
SLVIA	Seascape, Landscape and Visual Impact Assessment
SBP	Sub-bottom Profiler
SSS	Sidescan Sonar
TCE	The Crown Estate
TJB	Transition Joint Bay
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance

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Acronym	Definition
VMS	Vessel Monitoring Systems
WCS	Worst Case Scenario
WCPS	West Coast Palaeolandscapes Survey
WTG	Wind Turbine Generator
WSI	Written Scheme of Investigation
WWI	World War I
WWII	World War II
ZTV	Zone of Theoretical Visibility

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	Offshore Wind Limited
Aviation archaeology	The remains of crashed aircraft and archaeological material associated with historic aviation activities.
Devensian	Devensian The Last Glacial Period (LGP), also known colloquially as the last ice age or simply ice age, occurred from the end of the Eemian to the end of the Younger Dryas, encompassing the period c. 115,000 –c. 11,700 years ago. British geologists refer to the LGP as the Devensian.
Cumulative effects	The effect of the Offshore Project taken together with similar effects from a number of different projects, on the same single receptor/resource. Cumulative impacts are those that result from changes caused by other past, present or reasonably foreseeable actions together with the Offshore Project.
Department for Business, Energy and Industrial Strategy	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.
Dynamic cables	The floating substructures will require cables to run through the water column from their platform base at the water surface to the touchdown point on the seabed.
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 Offshore Project on the physical, biological and human environment during construction, operation and decommissioning.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Expert Topic Group	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Export Cable Corridor	The area in which the export cables will be laid, either from the Offshore Substation or the point at which the inter-array cable junction box s converge (if no offshore substation), to the Onshore Substation comprising both the Offshore Export Cable Corridor and Onshore Export Cable Corridor..
Floating substructure	The floating substructure acts as a stable and buoyant foundation for the WTG. The WTG is connected to the substructure via the transition piece and the substructure is kept in position by the mooring system.

Defined Term	Description
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.
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record. Includes the study of soils and sediments and of natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes and the effects on buried sites and artefacts.
Glacial/interglacial	A glacial period is a period within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last 1 million years, the Anglian, the Wolstonian and the Devensian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.
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.
Generation Assets	The infrastructure of the Offshore 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 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.
Historic seascape character	The attributes that contribute to the formation of the historic character of the seascape
Holocene	The Holocene is the current geological epoch. It began approximately 11,650 cal years before present (c. 9700 BCE), after the Last Glacial Period, which concluded with the Holocene glacial retreat.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable route which would house HDD entry or exit points.
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.
Inter-array cables	Cables which link the wind turbines to each other and the Offshore Substation Platform, or at the inter-array cables junction box (if no offshore substation). Array cables will connect the wind turbines to one and other and to the Offshore Substation (if utilised). The initial section for the inter-array cables will be freely suspended in the water column below the substructure (dynamic sections) while the on seabed sections of the cables will be buried where possible.
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

Defined Term	Description
Landfall to MHWS	Where the offshore export cables come ashore
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links
Marine isotope stage	Marine isotope stages are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.
Maritime archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
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.
Mesolithic	10000 to 4000 BC The Middle Stone Age, falling between the Palaeolithic and Neolithic and marking the beginning of a move from a hunter gatherer society towards a food producing society.
Mooring system	The equipment (mooring lines and seabed anchors) that keeps the floating substructure in position during operation through a fixed connection to the seabed.
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.

Defined Term	Description
Neolithic	4000BC to 2000 BC often referred to as the New Stone Age, this period marks the transition from a hunter gatherer society to that of a farming society.
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
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 components 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 Offshore 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 Wind Limited	Offshore Wind Ltd (OWL) is a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy Ltd
Palaeoenvironmental analysis	The study of sediments and the organic remains of plants and animals to reconstruct the environment of a past geological age.
Palaeogeographic features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing prehistoric physical landscape features such as former river channels (palaeochannels).

Defined Term	Description
Palaeolithic	500000 to 10000 BC The Old Stone Age defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into Lower, Middle and Upper Palaeolithic.
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 components that make up the Offshore 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
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water
Seabed features	Features seen on the seafloor in the sidescan sonar or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Seabed prehistory	Archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower.
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.
Study area	This is an area which is defined for each EIA topic which includes the windfarm site as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each EIA topic is intended to cover the area within which an effect can be reasonably expected.
Technical stakeholders	Technical consultees are considered to be organisations with detailed knowledge or experience of the area within which the Offshore Project is located and/or receptors which are considered in the EIA and HRA. Examples of technical stakeholders include Marine Management Organisation, local authorities, Natural England and Royal Society for the Protection of Birds.
Transition joint bay	Underground structures at the Landfall to MHWS that house the joints between the offshore export cables and the onshore export cables
White Cross Offshore Windfarm	100MW capacity offshore windfarm including associated onshore and offshore infrastructure

Defined Term	Description
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.
Wind Turbine Generators (WTG)	The wind turbine generators convert wind energy into electrical power. Key components include the rotor blades, nacelle (housing for electrical generator and other electrical and control equipment) and tower. The final selection of project wind turbine model will be made post-consent application

16. Marine Archaeology and Cultural Heritage

16.1 Introduction

1. This chapter of the Environmental Statement (ES) presents the potential impacts of White Cross Offshore Windfarm Project (the Offshore Project) on Marine Archaeology and Cultural Heritage. Specifically, this chapter provides an overview of the existing environment of the Project seaward of Mean High-Water Springs (MHWS), followed by an assessment of the potential impacts and associated mitigation for the construction, operation, and decommissioning phases of the Offshore Project.

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 the Marine Management Organisation (MMO) on behalf of the Secretary of State for Business for The Department for Business, Energy, and Industrial Strategy (BEIS) for Section 36 Consent and Marine Licences under the Marine and Coastal Access Act (2009).

3. The existing environment, as set out in this ES chapter (**Section 16.4**), provides an account of the known archaeological and cultural heritage resource (including designated and non-designated heritage assets), a summary of the potential for previously unrecorded heritage assets and finds to be present within the offshore development area and a review of the historic seascape character. The known and potential offshore and intertidal archaeological resource is identified with respect to:

   - Seabed prehistory (i.e., archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower)
   - Maritime archaeology (i.e., the remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities)
   - Aviation archaeology (i.e., the remains of crashed aircraft and archaeological material associated with historic aviation activities)
   - Historic seascape character (i.e., the attributes that contribute to the formation of the historic character of the seascape)
   - Buried archaeology (including palaeoenvironmental deposits) within the intertidal zone below MHWS**.**

4. This assessment has been undertaken with specific reference to the relevant legislation and guidance, of which the primary sources are the National Planning Policy Framework (NPPF), the Marine Policy Statement (MPS) (and the South West Inshore and South West Offshore Marine Plans), and 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 **Chapter 6: EIA Methodology** and **Section 16.7.1**.

5. Impacts to Marine Archaeology and Cultural Heritage are assessed with reference to Principles of Cultural Heritage Impact Assessment in the UK, jointly authored by the Institute of Environmental Management and Assessment (IEMA), the Institute of Historic Building Conservation (IHBC) and the Chartered Institute for Archaeologists (CIfA) and published in July 2021. The relationship between these principles and the overarching approach to EIA is described in **Section 16.3.2.**

6. The assessment should be read in conjunction with the Onshore Project EIA and the following linked chapters:

   - **Chapter 8: Marine Geology, Oceanography and Physical Processes**

7. Additional information to support the Marine Archaeology and Cultural Heritage assessment includes:

   - **Appendix 16.A: White Cross Offshore Windfarm Archaeological Assessment of Geophysical and Hydrographic Data**
   - **Appendix 16.B: Offshore (outline) Written Scheme of Investigation and Protocol for Archaeological Discoveries**

16.2 Policy, Legislation and Guidance

8. **Chapter 3: Policy and Legislative Context** describes the wider policy and legislative context for the Offshore Project. The principal policy and legislation used to inform the assessment of potential impacts on **Marine Archaeology and Cultural Heritage** for the Offshore Project are outlined in this section.

16.2.1 National Policy Statement

9. The assessment of potential impacts upon **Marine Archaeology and Cultural Heritage** has been made with specific reference to the relevant 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.

10. Although the Offshore Project is not an NSIP, it is recognised that due to its size of 100MW and its location in English waters, certain NPS are considered relevant to the Offshore Project and decision-making and are referred to in this ES. Those relevant to White Cross are:

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

11. The specific assessment requirements for Marine Archaeology and Cultural Heritage, as detailed in the NPS, are summarised in **Table 16.1** together with an indication of the section of the ES chapter where each is addressed. While the Offshore Project is not an NSIP or consented through the Planning Act, the NPSs are considered to be of relevance.

12. 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.

13. **Table 16.1** 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.

14. 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 16.1**.

Table 16.1 Summary of NPS EN-1 and EN-3 provisions relevant to Marine Archaeology and Cultural Heritage

NPS Requirement	How and where this is considered in the ES
"As part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on the significance of the heritage asset." – **EN-1, paragraph 5.8.8**	The significance of the archaeological receptors considered in this chapter, and the contribution of setting to that significance, have been detailed in **Sections 16.4.1.2**, **16.4.2.7** and **175**. Issues relating to the setting of onshore heritage assets have been considered as part of the separate Onshore Project EIA.
"Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the	**Section 16.4** of this document provides a full assessment of the baseline environment.

NPS Requirement	How and where this is considered in the ES
applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact." – **EN-1, paragraph 5.8.9**	
"The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents." – **EN-1, paragraph 5.8.10**	This chapter provides an account of the potential impacts of the Offshore Project upon heritage assets and their significance (**Sections 16.5**, **16.6** and **16.7**.
"Consultation with the relevant statutory consultees (including English Heritage or Cadw) should be undertaken by the applicants at an early stage of the development." – **EN-3, paragraph 2.6.140**	Consultation has been undertaken with relevant statutory consultees, as outlined in **Section 16.3.11**. Consultation will be on going throughout the development process.
"Assessment should be undertaken as set out in section 5.8 of EN-1. Desk based studies should take into account geotechnical or geophysical surveys that have been undertaken to aid the windfarm design." – **EN-3, paragraph 2.6.141**	The assessment has been undertaken in accordance with Section 5.8 of EN-1, as detailed above. Geophysical and geotechnical studies have underpinned the assessment (**Section 16.4** and **Appendix 16-A**)
"The assessment should also include the identification of any beneficial effects on the historic marine environment, for example through improved access or the contribution to new knowledge that arises from investigation." – **EN-3, paragraph 2.6.142**	Any beneficial effects to the archaeology and cultural heritage resource resulting from the Offshore Project have been identified and incorporated as part of **Section 16.4**.
"Where elements of an application (whether offshore or onshore) interact with features of historic maritime significance that are located onshore, the effects should be assessed in accordance with the policy at section 5.8 of EN-1." – **EN-3, paragraph 2.6.143**	Potential impacts of the Offshore Project upon onshore heritage assets have been considered as part of the separate Onshore Project EIA.
Developers will be influenced by Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability… of protecting sites, buildings and objects of architectural, historic or archaeological interest; and … do what [they] reasonably can to mitigate any effect which the proposals would have on the… sites, buildings or objects." – **EN-5, paragraph 2.2.6**	Potential impacts upon sites and objects of archaeological interest offshore are set out in **Sections 16.5**, **16.6** and **16.7** along with a proposed approach to mitigation.

NPS Requirement	How and where this is considered in the ES
"The applicant is encouraged, where opportunities exist, to prepare proposals which can make a positive contribution to the historic environment, and to consider how their scheme takes account of the significance of heritage assets affected. This can include, where possible: • enhancing, through a range of measures such as sensitive design, the significance of heritage assets or setting affected • considering measures that address those heritage assets which are at risk or which may become at risk, as a result of the Scheme • considering how visual or noise impacts can affect heritage assets, and whether there may be opportunities to enhance access to, or interpretation, understanding and appreciation of, the heritage assets affected by the scheme" – **Draft EN-1, paragraph 5.9.14**	The potential for enhancement of the archaeological record with the Celtic Sea region is discussed in **Section 16.8**.
"Consultation with the relevant statutory consultees on the potential impacts on the marine historic environment should be undertaken by applicants at an early stage of development, taking into account any applicable guidance (e.g., offshore renewables protocol for archaeological discoveries)." – **Draft EN-3, paragraph 2.32.4**	Consultation has been undertaken with relevant statutory consultees, as outlined in **Section 16.3.11** Consultation will be on going throughout the development process. In demonstrating adherence to industry good practice, this chapter has been compiled in accordance with relevant standards and guidance as listed in **Section 16.2.4.2**.
"Assessment of potential impacts upon the historic environment should be considered as part of the Environmental Impact Assessment process undertaken to inform any application for consent. Desk based studies to characterise the features of the historic environment that may be affected by a proposed development and assess any likely significant effects should be undertaken by competent archaeological experts. These studies should take into account any geotechnical or geophysical surveys that have been undertaken to aid the wind farm design." – **Draft EN-3, paragraph 2.32.5**	The assessment has been undertaken as part of the EIA process, as detailed above. Geophysical and geotechnical studies have underpinned the assessment (**Section 16.4** and **Appendix 16-A**).

16.2.2 National Planning Policy Framework

15. This assessment has been undertaken in a manner consistent with the NPPF, a revised version of which was published by the Ministry of Housing, Communities and Local Government (MHCLG) in June 2019, replacing the original policy from March 2012.

16. Provision for the historic environment is principally given in section 16: Conserving and enhancing the historic environment of the NPPF, which directs local authorities to set out "a positive strategy for the conservation and enjoyment of the historic environment, including heritage assets most at risk through neglect, decay or other threats".

17. Local planning authorities should recognise that heritage assets are "an irreplaceable resource and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations" (MHCLG, 2019).

18. The aim of NPPF section 16 is to ensure that Regional Planning Bodies and local authorities, developers and owners of heritage assets adopt a consistent and holistic approach to their conservation and to reduce complexity in planning policy relating to proposals that affect them.

19. To summarise, UK government guidance provides a framework which:

- Recognises that heritage assets are an irreplaceable resource
- Requires applicants to provide a level of detail that is proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance
- Takes into account the desirability of sustaining and enhancing the significance of heritage assets, including any contribution made by their setting, and putting them to viable uses consistent with their conservation
- Places weight on the conservation of designated heritage assets (which include world heritage sites, scheduled monuments, listed buildings, protected wreck sites, registered parks and gardens, registered battlefields or conservation areas), with any anticipated substantial harm weighed against the public benefits of the proposal
- Requires applicants to include a consideration of the effect of an application on the significance of non-designated heritage assets, giving regard to the scale of any harm or loss and the significance of the heritage asset
- Regard proposals that preserve those elements of the setting that make a positive contribution to the asset (or which better reveal its significance) favourably

- Requires developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and impact, and to make this evidence (and any archive generated) publicly accessible.

20. The NPPF's associated Planning Practice Guidance (PPG) 'Conserving and enhancing the historic environment', published in 2014 and updated 2019, (MHCLG, 2019) includes further information and guidance on how national planning policy is to be interpreted and applied locally.

16.2.3 UK Marine Policy Statement

21. This assessment also takes account of the UK Marine Policy Statement (MPS) (DEFRA, 2011). The MPS sets out high level objectives for marine planning, which have directed development of the Plan at a local level. Marine Plans must be in accordance with other relevant national policy and are intended to contribute to the achievement of sustainable development in the UK marine area. There are 11 marine plan areas across England each of which has its own Marine Plans.

22. Those relevant to the Offshore Project are the South Marine Plans comprising the South West Inshore and South West Offshore Marine Plan (DEFRA, 2021). These outline the objective '*to conserve and enhance marine and coastal heritage assets by considering the potential for harm to their significance'.* '.

23. This objective recognises the need to consider whether developments are appropriate to the area they will be located and have an influence upon. It seeks to ensure that, as far as possible, the value of such assets and characteristics are not compromised. Policies specific to heritage assets are outlined in

Table 16.2 South West Marine Plans policy relevant to the Historic Environment

Plan Policies Specific to Heritage Assets	Section Reference
SW-HER-1 : Proposals that demonstrate they will conserve and enhance the significance of heritage assets will be supported. Where proposals may cause harm to the significance of heritage assets, proponents must demonstrate that they will, in order of preference:: a) avoid b) minimise	The primary method of mitigation when dealing with the archaeological resource as set out in this chapter is based on the prevention of damage to receptors by putting in place protective measures rather than attempting to repair damage. Avoidance by means of Archaeological Exclusion Zones (AEZs) will serve to ensure that such assets will not be compromised. Potential archaeological receptors are safeguarded or the effects upon them

Plan Policies Specific to Heritage Assets	Section Reference
c) mitigate – any harm to the significance of heritage assets. If it is not possible to mitigate, the public benefits for proceeding with the proposal must outweigh the compromise or harm to the heritage asset.	minimised by means of mitigation measures outlined in **Section 16.1.1.**

16.2.4 Other

24. In addition to the NPS, NPPF and Marine Plans there are a number of pieces of legislation, policy and guidance applicable to the assessment of Archaeology and Cultural Heritage. Further detail where relevant is provided in **Chapter 3: Policy and Legislative Context**.

16.2.4.1 Legislation

25. The Offshore Project is located within the UK Exclusive Economic Zone (EEZ), and within the English Territorial Sea (up to 12nm) from the coast into the UK EEZ. The following legislation applies to marine heritage within both the UK EEZ and English Territorial Sea:

- Protection of Wrecks Act 1973: Section One and Two
- Ancient Monuments and Archaeological Areas Act 1979 (as amended)
- Protection of Military Remains Act 1986
- Merchant Shipping Act 1995**.**

26. The above legislation provides protection for wrecks of high historical, archaeological, or artistic value, as well as allowing military wrecks and aircraft remains to be protected.

27. There are currently no known protected wrecks within the study area, although, if encountered, all military aircraft crash sites are automatically protected under the Protection of Military Remains Act 1986. Vessels, which meet the criteria of being sunk or stranded on or after the 4ht August 1914 while in military service, may be designated as either a Protected Place or a Controlled Site. Ownership of any wreck remains is determined in accordance with the Merchant Shipping Act 1995.

28. In 2000, the UK government ratified The European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (The Valletta Convention). The convention binds the UK to implement protective measures for the archaeological heritage within the jurisdiction of each party, including sea areas. The Articles of the Valletta Convention address:

- Article 1: Definition of archaeological heritage

- Article 2: Identification and designation
- Article 3: Control of archaeological work
- Article 4: Physical protection of archaeological heritage
- Article 5: Integration of archaeology in development planning
- Article 6: Funding of archaeological work (public and private)
- Article 7: Collection and dissemination of information
- Article 8: National and international exchange of information
- Article 9: Promotion of public awareness
- Article 10 and 11: Prevention of illicit circulation of elements of the archaeological heritage
- Article 12: Mutual technical and scientific assistance**.**

29. The UNESCO Convention on the Protection of Underwater Cultural Heritage, adopted in 2001, is intended to enable States to better protect their submerged cultural heritage. The UK was one of a number of States that abstained from the 2001 vote and has not ratified the Convention. The UK has, however, adopted the 'The Rules', an Annex to the Convention which sets out a standard for archaeological investigations, as government policy for underwater cultural heritage.

16.2.4.2 Guidance

30. In demonstrating adherence to industry good practice, this chapter has been compiled in accordance with the following relevant standards and guidance:

- Principles of Cultural Heritage Impact Assessment in the UK (IEMA, IHBC and CIfA, 2021)
- The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition) (Historic England, 2017)
- CIfA Standard and Guidance for Historic Environment Desk-Based Assessments (2014a) and Code of Conduct (2014b)
- Environmental Archaeology, A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition) (Historic England, 2011)
- Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Historic England, 2013)
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011)
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008)

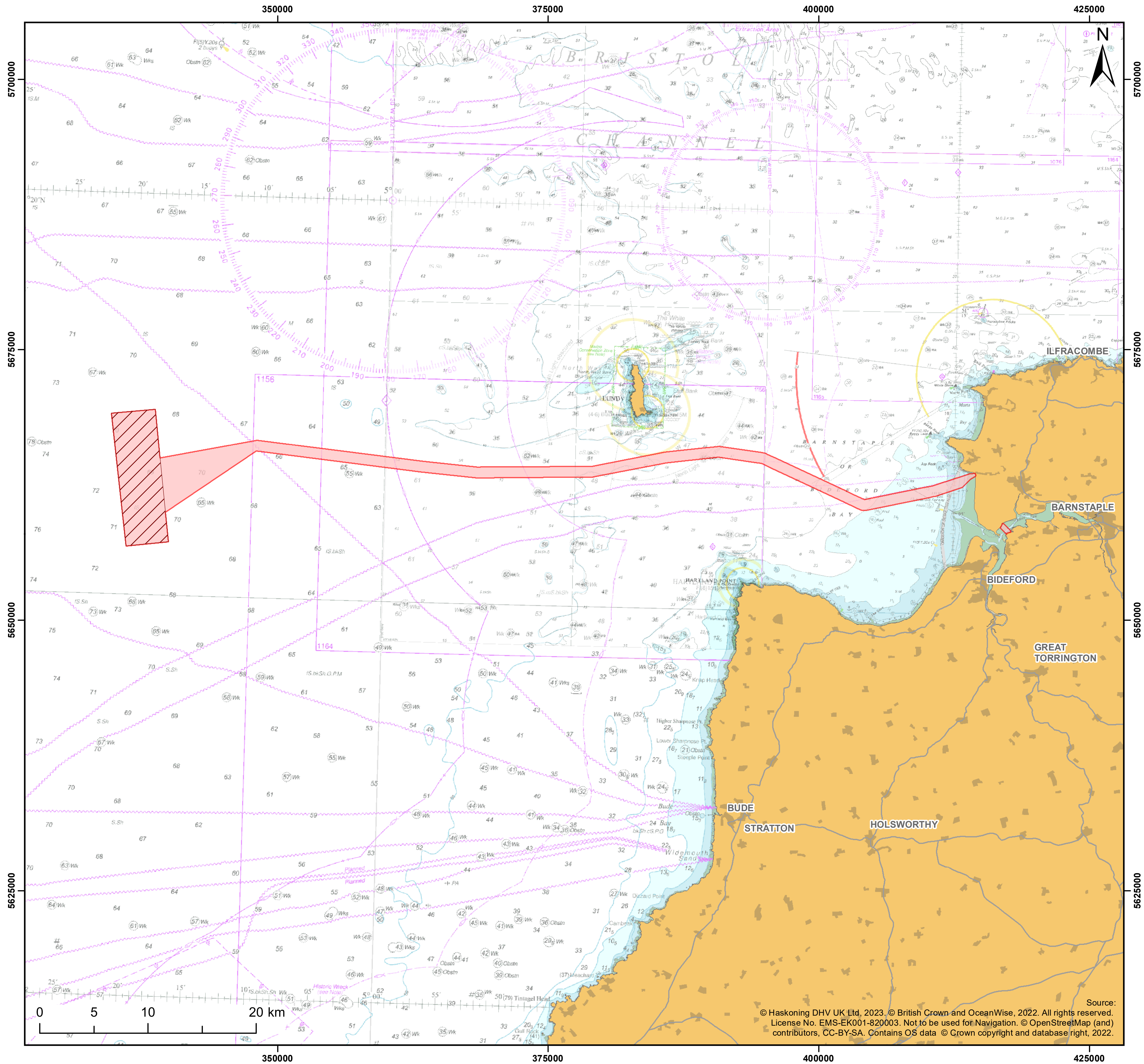
- Historic Environment Guidance for the Offshore Renewable Energy Sector Guidance (Wessex Archaeology, 2007)
- Code for Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC), 2006)
- Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

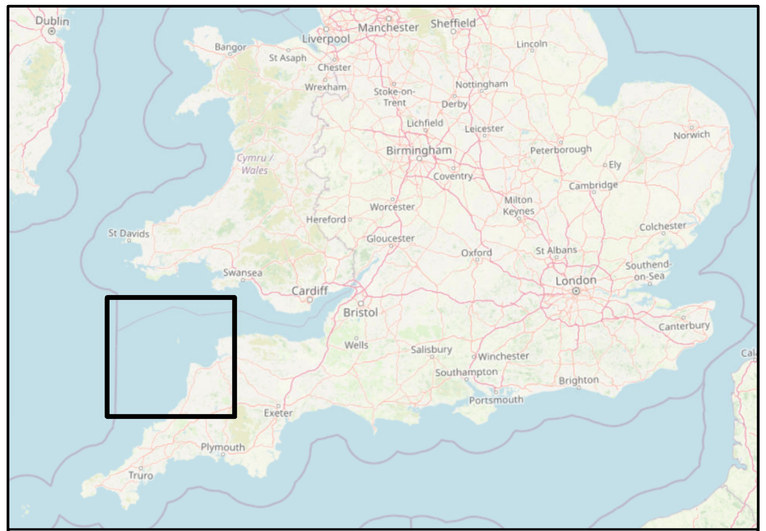
16.3 Assessment Methodology

16.3.1 Study Area

31. The study area for **Marine Archaeology and Cultural Heritage** is defined as the Offshore Development Area, including the intertidal zone at the Landfall to MHWS (**Figure 16.1**). This study area corresponds to the footprint within which development activities could occur and, consequently, the area of potential impacts to the Marine Archaeology and Cultural Heritage existing environment.

32. The Windfarm Site is located over 52km off the North Cornwall and North Devon coast (west-north-west of Hartland Point). The Offshore Export Cable will connect the Offshore Substation Platform (OSP) to shore. Onshore, the National Grid connection is confirmed as East Yelland. The Offshore Export Cable will come ashore at a Landfall to MHWS at Saunton Sands on the North Devon Coast, and then be routed underground to the East Yelland Onshore Substation where it connects into the National Grid Electrical Transmission Network. A full description of the Offshore Project is given in **Chapter 5: Project Description**.





Legend:
- Windfarm Site
- Offshore Development Area

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Marine Archaeology and Cultural Heritage Study Area

Figure: 16.1 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0478

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	03/03/2023	AB	GSP	A3	1:350,000
P01	19/12/2022	AB	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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16.3.2 Approach to Assessment

33. **Chapter 6: EIA Methodology** provides a summary of the general impact assessment methodology applied to the Offshore Project. The following sections confirm the methodology used to assess the potential impacts on Archaeology and Cultural Heritage.

34. The impact assessment methodology adopted for Archaeology and Cultural Heritage will define heritage assets, and their settings, likely to be impacted by the Offshore Project and assess the level of any resulting benefit, harm, or loss to their cultural significance. The assessment is not limited to direct impacts, but also assesses possible indirect impacts upon heritage assets which may arise due to changes to hydrodynamic and sedimentary processes and changes to the setting of heritage assets, whether visually, or spatial associations, and a consideration of historic relationships between places which may impact their significance.

35. As set out in Principles of Cultural Heritage Impact Assessment in the UK (IEMA, IHBC and CIfA, 2021, hereafter 'the Principles'), Cultural Heritage Impact Assessment (CHIA) is concerned with "understanding the consequences of change to cultural significance". The principles of assessment are:

    A. understanding cultural heritage assets

    B. evaluating the consequences of change

36. Understanding cultural heritage assets distinguishes between:

- describing the asset (what it is and what is known about it)
- ascribing cultural significance (a description of what is valued about it)
- attributing importance (a scaled measure of the degree to which the cultural significance of that asset should be protected).

37. Evaluating the consequences of change also distinguishes between three separate analytical stages:

- understanding change (a factual statement of how a proposal would change a cultural heritage asset or its setting, including how it is experienced)
- assessing impact (a scaled measure of the degree to which any change would impact on cultural significance)
- weighting the effect (the measure that brings together the magnitude of the impact and the cultural heritage asset's importance).

38. The relationship between these principles and the general approach to **Chapter 6: EIA Methodology** is described below.

16.3.2.1 Understanding cultural heritage assets

39. A description of the assets, and their cultural significance, relevant to the assessment of Archaeology and Cultural Heritage is provided in **Section 16.4**. At this stage of the Offshore Project, many of these assets are not yet fully understood. However, as set out in the Principles, as well as in national planning guidance including the NPSs (see **Table 16.1**) and NPPF (see **Section 16.2.2**), proportionality is key. Applicants must provide a level of detail that is proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance.

40. The level of detail provided in **Section 16.4**, therefore, sufficiently characterises these assets so that potential impacts upon their cultural significance can be understood for the purposes of EIA.

41. As discussed in consultation with heritage stakeholders (see **Table 16.12**), further investigation and data gathering will be progressed post-consent, including high resolution surveys, alongside additional mitigation requirements to be set out in the Outline WSI (Offshore).

42. This is in line with the Principles which describe how, "an understanding of the cultural heritage asset is likely to be an iterative process which regularly reappraises the consequential impact on cultural significance as a proposal evolves or as more evidence emerges from research and investigations". **Section 16.4**, therefore, also highlights where there is a need to acquire additional information, and when this will be progressed, as part of an ongoing iterative design process.

43. As defined in the NPPF (MHCLG, 2021, Annex 2) cultural (or heritage) significance is the sum of the heritage values or interests that we, as a society, recognise in a heritage asset and seek to protect or enhance for future generations. A statement of cultural significance should explain why we value a heritage asset.

44. Understanding the cultural significance of an asset should not be confused with a description of that asset which does not articulate 'what matters and why'. Historic England's 'Conservation Principles' (Historic England, 2017) defines the term cultural significance as encompassed by four headings: archaeological interest, architectural interest, artistic interest, and historic interest. These terms are used in articulating the cultural significance of heritage assets for the purposes of this impact assessment.

45. As defined in the Principles (IEMA, IHBC and CIfA, 2021), cultural significance does not have a scale associated with it and it is therefore not appropriate to refer to 'high' or 'low' significance. This scaling is addressed through the separate consideration of a heritage asset's importance. Cultural significance is not directly related to designation status, nor is it defined in law. However, the reasons for designation may articulate aspects of heritage significance.

46. In describing the cultural significance of heritage assets, reference will also be made to the contribution of setting to that significance. The setting of a heritage asset is described as the surroundings in which a heritage asset is experienced (Historic England, 2017). Elements of an asset's setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral.

47. The importance of a heritage asset is a measure of the degree to which we seek to protect and preserve the cultural significance of that asset through, for example, legislation and planning policy. Determining the importance of an asset is a key decision in impact assessment as it will affect judgements regarding the relative weight to be given to protecting different assets during the design of a proposal.

48. Importance is scaled (unlike cultural significance) and requires the assessor to make a judgement regarding the merits of different heritage assets. It is therefore appropriate to refer to 'high' or 'low' importance for example. The statutory designation of heritage assets provides examples of how assets can be assigned a level of importance against explicit criteria. Some designated assets are judged to be of national importance, for example Scheduled Monuments, and World Heritage Sites are, again by definition, sites of international importance.

49. In determining the significance of effect for the purposes of EIA, this last analytical stage (attributing importance) broadly equates to 'sensitivity' as described in **Section 16.3.2.2** below.

16.3.2.2 Evaluating the consequences of change

50. The Principles describe change as, "both the act and the result of making something different from how it was before, whether directly or indirectly, temporarily or permanently, reversibly or irreversibly". It is also important to note that change may or may not lead to an impact on cultural significance. Before a scaled measure of this change can be determined it is necessary to describe the potential change to a heritage asset or its setting. To this end, a narrative approach describing the nature of potential changes is provided for each impact assessed in **Sections 16.5, 16.6** and **248**.

51. This is followed by the determination of a scaled measure of the degree to which any change would impact cultural significance, which broadly equates to the 'magnitude of impact' as described in **Section 16.3.2.3**. This change could have a positive (beneficial) or negative (adverse) outcome. It is not a measure of the reach or extent of the proposal but rather the change to 'what matters' about a heritage asset.

52. The final stage is weighting the effect (the measure that brings together the magnitude of the impact and the cultural heritage asset's importance). For the Offshore Project this is articulated through the significance of effect matrix presented in **Table 16.5**. Following on from the previous stages of the assessment, which draw out the narrative regarding the importance of a cultural heritage asset, its cultural significance, and how the proposal will impact this significance, this measure is indicative of the weight that should be given to the matter in influencing the design of the proposal or, ultimately, in influencing whether the proposal will be acceptable and permitted.

16.3.2.3 Definitions of sensitivity, value, and magnitude

53. The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is impacted. However, while impacts to a heritage asset's setting or character can be temporary, impacts which result in damage or destruction of the assets themselves, or their relationship with their wider environment and context, are permanent. Once destroyed an asset cannot recover. On this basis, the assessment of the significance of effect of any identified impact is largely a product of the importance of an asset (rather than its sensitivity) and the degree to which any change would impact on cultural significance.

54. For the purposes of this EIA, the criteria for determining the heritage importance of any relevant heritage assets are described in **Table 16.3**.

55. The categories and definitions of heritage importance do not necessarily reflect a definitive level of importance of an asset. They are intended to provide a provisional guide to the assessment of perceived heritage importance, which is to be based upon professional judgement incorporating the evidential, archaeological, historical, aesthetic, architectural and communal heritage values of the asset or assets. It is important to note that the importance and cultural significance of an asset can be amended or revised as more information comes to light (i.e., as part of further investigations planned post-consent).

56. **Table 16.3** includes heritage assets of uncertain heritage importance i.e., where the importance, existence and / or level of survival of an asset has not been ascertained (or fully understood) from available evidence. Although **Table 16.3** provides a

definition for assets of an uncertain heritage importance, where uncertainty occurs, the precautionary approach is to assign the highest likely level of importance. This precautionary approach represents good practice in cultural heritage impact assessment and reduces the potential for impacts to be under-estimated.

Table 16.3 Criteria for determining heritage importance

Sensitivity	Definition
High (perceived International / National Importance)	• World Heritage Sites • Scheduled Monuments • Grade I and II* Listed Buildings or structures • Protected wrecks • Aviation crash sites • Designated historic landscapes of outstanding interest • Conservation Areas containing buildings or structures with high heritage importance, or high concentrations of listed buildings • Assets of acknowledged international/national importance • Assets that can contribute significantly to acknowledged international/national research objectives
Medium (perceived Regional Importance)	• Grade II Listed Buildings or structures • Designated special historic landscapes • Other types and character of Conservation Areas • Assets that contribute to regional research objectives • Assets with regional value, educational interest, or cultural appreciation
Low (perceived Local importance)	• 'Locally Listed' buildings or structures • Assets that contribute to local research objectives • Assets with local value, educational interest, or cultural appreciation • Assets compromised by poor preservation and/or poor contextual associations

Sensitivity	Definition
Negligible	• Assets with no significant value or archaeological/historical interest
Uncertain/Unknown	• The importance/existence/level of survival of the asset has not been ascertained (or fully ascertained/understood) from available evidence

57. Magnitude broadly equates as the degree to which cultural significance is positively or negatively changed by the Offshore Project.

58. Direct impacts, indirect impacts, and impacts from a change in setting on the significance of heritage assets are considered relevant. Impacts may be adverse or beneficial. Depending on the nature of the impact and the duration of development, impacts can also be temporary and / or reversible or permanent and / or irreversible.

59. The finite nature of archaeological remains means that physical impacts are almost always permanent and irreversible as the 'fabric' of the asset and, hence, its potential to inform our historical understanding, will be removed. By contrast, impacts resulting from the change in the setting of heritage assets will depend upon the longevity of construction and operation of the Offshore Project and the sensitivity with which the landscape/seascape is re-instated after decommissioning / demolition, if applicable.

60. The magnitude of adverse impact with respect to Archaeology and Cultural Heritage directly relates to the extent of harm to, or loss of, key elements of the assets cultural significance, which may include its setting.

61. The magnitude of beneficial impact with respect to Archaeology and Cultural Heritage directly relates to the level of public benefit associated with an individual impact. Benefits may correspond directly to the project itself where a project will enhance the historic environment (e.g., through measures which will improve the setting of a heritage asset or public access to it).

62. Alternatively, benefits may occur on the basis of data gathering exercises undertaken for the purpose of a project which will enhance public understanding by adding to the archaeological record (e.g., through the accumulation of publicly available information and data). The measure of beneficial impact (high / medium / low) is, therefore, necessarily situational, and specific to a given site, area, or subject. One such example of a positive magnitude of impact could be relevant to, for example, new survey data being acquired, which will ultimately be made publicly accessible.

63. The criteria used for assessing the magnitude of impact regarding archaeology and cultural heritage are presented in **Table 16.4.**

Table 16.4 Magnitude of Impact to Heritage Assets

Magnitude	Definition
High Adverse	Key elements of the asset's fabric and/or setting are lost or fundamentally altered, such that the asset's cultural significance is lost or severely compromised
Medium Adverse	Elements of the asset's fabric and/or setting which contribute to its significance are affected, but to a more limited extent, resulting in an appreciable but partial loss of the asset's cultural significance.
Low Adverse	Elements of the asset's fabric and/or setting which contribute to its cultural significance are affected, resulting in a slight loss of cultural significance.
Negligible	The asset's fabric and/or setting is changed in ways which do not materially affect its cultural significance.
Low Beneficial	Elements of the asset's physical fabric which would otherwise be lost, leading to a slight loss of cultural significance, are preserved *in situ*; or Elements of the asset's setting are improved, slightly enhancing its cultural significance; or Research and recording leads to a slight enhancement to the archaeological or historical interest of the asset. This only applies *in situ*ations where the asset would not be otherwise harmed i.e., it is not recording in advance of loss.
Medium Beneficial	Elements of the asset's physical fabric which would otherwise be lost, leading to an appreciable but partial loss of cultural significance, are preserved *in situ*; or Elements of the asset's setting are considerably improved, appreciably enhancing its cultural significance; or Research and recording leads to a considerable enhancement to the archaeological or historical interest of the asset. This only applies *in situ*ations where the asset would not be otherwise harmed i.e., it is not recording in advance of loss.
High Beneficial	Elements of the asset's physical fabric which would otherwise be lost, severely compromising its cultural significance, are preserved *in situ*; or Elements of the asset's setting, which were previously lost or unintelligible, are restored, greatly enhancing its cultural significance.

16.3.2.4 Significance of effect

64. In basic terms, the potential significance of effect is a function of the sensitivity of the receptor and the magnitude of the impact (see **Chapter 6: EIA Methodology** for further details). As described above, for Archaeology and Cultural Heritage this equates to the importance of a heritage asset weighed against the magnitude of change to its cultural significance. The determination of significance is guided using

a significance of effect matrix, as shown in **Table 16.5**. Definitions of each level of significance are provided in **Table 16.6**.

65. Likely significant effects identified within the assessment as major or moderate are regarded as significant in terms of the EIA regulations. Potential impacts should be described using significance of effect, followed by a statement of whether this is significant in terms of the EIA regulations, e.g., "*minor adverse effect, not significant in EIA terms / moderate adverse effect, significant in EIA terms*". Appropriate mitigation has been identified in consultation with the regulatory authorities and relevant stakeholders where possible. 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 16.5 Significance of effect matrix

		Negative Magnitude				**Beneficial Magnitude**			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Importance	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 16.6 Definitions of effect significance

Significance	**Definition**
Major	Change in cultural significance, both adverse or beneficial, which are likely to be important considerations at a national or regional level because they contribute to achieving national or regional objectives. Effective/acceptable mitigation options may still be possible, to offset and / or reduce residual impacts to satisfactory levels.
Moderate	Change in cultural significance, both adverse or beneficial, which are likely to be important considerations at a local level. Effective / acceptable mitigation options may still be possible, to offset and / or reduce residual impacts to satisfactory levels.
Minor	Change in cultural significance, both adverse or beneficial, which may be raised as local issues but are unlikely to be material considerations in the decision-making process. Industry standard mitigation measures may still apply.
Negligible	No discernible change in receptor condition.

66. Where effects to heritage assets will be avoided through the implementation of embedded mitigation the significance of effect is defined as no change.

16.3.3 Historic Seascape Character

67. The approach to the assessment of historic seascape character differs to that outlined above for heritage assets.

68. The historic character of the seascape is described in terms of ability to accommodate change. A key aspect of this ability is how that character is perceived by the public. For this reason, an approach is required which recognises the dynamic nature of seascape and how all aspects of the seascape, no matter how modern or fragmentary, can form part of the character of that seascape.

69. It is not meaningful, therefore, to assign a level of importance to these perceptions of character, which are by nature subjective, nor to assign a measure of magnitude to understand the nature of the potential changes. Rather, this change is expressed as a narrative description of the seascape character, how it is perceived by the public and how these perceptions could be affected by the Offshore Project, which may or may not be perceived as important from a historic perspective. In this respect, while damage to, or destruction of, a heritage asset is considered permanent and irreversible, impacts to historic seascape character are dynamic, and may be temporary and reversible.

70. Changes to the historic seascape character and the extent to which these changes can be accommodated are discussed in **Section 16.4.4**.

16.3.4 Cumulative Effects Assessment Methodology

71. The cumulative effect assessment (CEA) considers other plans, projects and activities that may impact cumulatively with the Offshore Project. As part of this process, the assessment considers which of the residual impacts assessed for the Offshore Project on their own have the potential to contribute to a cumulative effect, 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 CEA.

72. For Archaeology and Cultural Heritage, cumulative effects may occur where archaeological receptors also have the potential to be affected by other existing, consented and/or proposed developments or activities. This includes consideration of the extent of influence of changes to marine physical processes (see **Chapter 8: Marine Geology, Oceanography and Physical Processes**) arising from the proposed Offshore Project alone and those arising from the Offshore Project cumulatively in combination with other OWF developments.

73. Cumulative effects are considered in **Section 16.8**.

16.3.5 Transboundary Impact Assessment Methodology

74. The transboundary assessment considers the potential for transboundary effects to occur on Archaeology and Cultural Heritage receptors as a result of the Offshore Project; either those that might arise within the 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.

75. For Marine Archaeology and Cultural Heritage, transboundary impacts may be relevant where wrecks of non-British, European nationality are subject to impact from development and may therefore fall within the jurisdiction of another country.

76. Transboundary impacts may also occur if the cumulative effects of changes to physical processes have the potential to impact archaeology across extended sea areas. In addition, there is potential for developments, individually and cumulatively, to affect larger-scale archaeological features such as palaeolandscapes and to affect the setting of heritage assets and historic landscapes/seascapes which may also extend across these boundaries. This may also include sensitivities in conjunction with local community groups and interests.

77. Transboundary impacts to heritage assets will not occur due to the localised nature of disturbance which do not cross territorial borders. Similarly, transboundary impacts with respect to **Chapter 8: Marine Geology, Oceanography and Physical Processes**, have been scoped out of the assessment as agreed with the MMO in the Scoping Opinion (Case reference: EIA/2022/00002).

16.3.6 Worst-Case Scenario

78. In accordance with the assessment approach to the Project Design Envelope, or 'Rochdale Envelope', set out in **Chapter 6: EIA Methodology**, the impact assessment for **Marine Archaeology and Cultural Heritage** has been undertaken based on a realistic worst-case scenario of predicted impacts. The Project Design Envelope for the Offshore Project is detailed in **Chapter 5: Project Description**.

79. **Table 16.7** presents the realistic worst-case scenario components considered for the assessment of Marine Archaeology and Cultural Heritage.

Table 16.7 Definition of realistic worst-case scenario details relevant to the assessment of impacts in relation to Marine Archaeology and Cultural Heritage

<table>
<tr><th>Impact
Construction</th><th>Realistic worst-case scenario</th><th>Rationale</th></tr>
<tr><td>Impact 1: Direct impact to known heritage assets</td><td>N/A</td><td>Direct impacts to known heritage assets will not occur due to the application of embedded mitigation</td></tr>
<tr><td>Impact 2: Direct impact to potential heritage assets</td><td>Largest seabed disturbance (area) = 6,079,583.6m2 (based on):

WTGs (anchoring system):
• 8 WTGs with 6 catenary anchors at 100m^2 per anchor. Footprint per WTG (including mooring line) = 2,424m^2. Total footprint of WTGs = 19,392m^2

OSP:
• Based on max total project pile footprint area 1256.64m^2

Inter-array cables (Based on):
• 29.76km of cable and a 20m installation corridor = 480,000m^2
• Total area protection material for inter-array cables = 22,400m^2
• Total area of sand wave excavation works = 12,000m^2

Export cables (Based on):
• 2 cables 93.60km long and 25m installation corridor = 4,680,000m^2</td><td>The worst-case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits.</td></tr>
</table>

Impact	Realistic worst-case scenario	Rationale
	- Maximum area cable scour protection material = 252,560m^2 - Total area of sand wave excavation works = 280,800m^2 **Scour protection (Based on):** 7,540m^2 per WTG (8) = 60,320m^2 **Landfall Cable Installation (to MHWS)** - Two cables buried into a trench 0.5m x 270m = 135m^2 **WTGs and OSP** - WTG scour protection = 120,637m^3 - Offshore Substation Platform scour protection = 2,513.27m^3 **Inter-array cables (Based on):** - Volume of sediment disturbance during cable installation = 267,840m^3 - Total volume of cable protection – 23,040m^3 - Total volume of sand removed during sand wave excavation works = 24,000m^3 **Offshore Export Cables (Based on):** - Maximum volume of cable protection – 136,320m^3 - Volume of sediment disturbance during cable installation – 1,684,800m^3	

Impact	Realistic worst-case scenario	Rationale
	• Total volume of sand removed during sand wave excavation works – 842,400m^3	
Impact 3: Indirect impact to heritage assets from changes to physical processes	**Worst case scenario of subtidal sediment from single cable burial:** • 25m wide, up to about 93.6km long = 4,680,000m^2 (plan area for two cables) • Sand wave removal for a single cable would disturb about 4.7km of the seabed (assumed to be 3% of total cable length) up to 50m wide = 280,800m^2 (plan area for two cables). Assuming an average sand wave height of 3m = 842,400m^3 (volume for two cables) **Worst case scenario volume of sediment disturbed due to Offshore Export Cable installation:** • Cable burial for two cables would displace a volume of 1,684,800m^3 assuming 3m wide, 3m deep excavation for each Jetting/ploughing considered the worst case. **Worst case scenario seabed footprint due to installation vessels** • Jack up vessels installing foundations for one Offshore Substation Platform (with a total footprint of 1,256.64m^2)	The worst-case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits. Reflects the worst-case scenarios for marine physical processes which are set out in **Chapter 8: Marine Geology, Oceanography and Physical Processes**

Impact	Realistic worst-case scenario	Rationale
	with a total seabed disturbance footprint from vessels = 302m^2	
Impact 4: Impacts to the setting of heritage assets	• Maximum construction duration of approximately 3 years • Construction vessel movements: up to 56 per annum	The worst-case scenario represents the maximum intrusive effect of construction activities for the longest duration.
Operation and maintenance		
Impact 1: Direct impact to known heritage assets	N/A	Direct impacts to known heritage assets are not anticipated to occur due to the retention of AEZs throughout the Offshore Project lifespan and restriction of activities to red line boundary. Any currently unknown heritage assets which are identified during pre-construction surveys would be subject to avoidance, if required.
Impact 2: Direct impact to potential heritage assets	Total number of cable repairs of lifetime: 10 Total number of remediation events (re-burial): 40 Total area of seabed affected by remediation events: 1,500,000m^2.	The worst-case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits.
Impact 3: Indirect impact to heritage assets from changes to physical processes	Eight floating substructures (supporting turbines) and one Offshore Substation Platform supported by a jacket foundation. The floating substructure for each will be of the semi- submersible type and will feature up to four buoyancy columns (up to 15m outer diameter) connected by pontoons and braces. The jacket foundation comprises four columns connected by beam and braces.	The following impacts in set out **in Chapter 8: Marine Geology, Oceanography and Physical Processes** are relevant to the worst-case for offshore archaeology and cultural heritage: Impact 1 - Impacts on waves and tidal currents due to the physical presence of the infrastructure, Impact 2 - Impacts on bedload sediment transport and seabed morphological change

Impact	Realistic worst-case scenario	Rationale
	The catenary mooring and anchor footprint per turbine would be the sum of the drag anchor footprint (10m x 10m) and mooring seabed footprint (length of 600m x 0.5m chain width) multiplied by the maximum number of mooring lines (six) = 2,424m^2. For eight turbines = 19,392m^2. The chain will have an open structure allowing sediment throughput and the chain will have a maximum height above seabed of 0.5m. The total length of unburied export cable (for two cables) is estimated at 34.08km. This is 18% of the total export cable length. This length would require protection using approximately 136,320m^3 of rock along the two cables. About 14,400m^3 of rock is estimated to be required to facilitate crossing of eight cables and pipelines. The total length of unburied inter-array cable (cable crossings, entry to substation/turbine and unburied due to soil uncertainties) is estimated at 3.2km. This length would require protection using approximately 23,040m^3 of rock.	due to the physical presence of the infrastructure Impact 3- Impacts on bedload sediment transport and seabed morphological change due to cable protection
Impact 4: Impacts to the setting of heritage assets	**Presence of windfarm infrastructure:** • Up to 8 turbines • One service platform **Maximum temporal footprint**:	The worst-case scenario represents the maximum intrusive effect of installed infrastructure and operation and maintenance activities for the longest duration.

Impact	Realistic worst-case scenario	Rationale
	• The operational lifetime of the Offshore Project is a minimum of 25years **O&M vessels:** • Maximum number of vessels on site at any one time: 5 vessels • O&M vessel movements: 40 per annum	
Decommissioning		
Impact 1: Direct impact to known heritage assets **Impact 2: Direct impact to potential heritage assets** **Impact 3: Indirect impact to heritage assets from changes to physical processes** **Impact 4: Impacts to the setting of heritage assets**	The decommissioning policy for the Offshore Project infrastructure is not yet defined however it is anticipated that structures above the seabed would be removed. The following infrastructure is likely be removed, reused, or recycled where practicable: • WTG's and foundations (some foundation material below seabed level may be left in *in situ* (e.g., piles)) • OSPs including topsides and foundations The following infrastructure is likely to be decommissioned *in situ* depending on available information at the time of decommissioning: • Scour protection • Crossings and cable protection and part of the foundations (those above seabed level) • Offshore cables may be removed or left *in situ* and consideration to leave	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. Direct impacts to known heritage assets are not anticipated to occur due to the retention of AEZs throughout the Offshore Project lifespan and restriction of activities to red line boundary.

Impact	Realistic worst-case scenario	Rationale
	scour protection and cable protection *in situ* will also be undertaken.	

16.3.7 Summary of Mitigation

80. This section outlines the embedded mitigation relevant to the **Marine Archaeology and Cultural Heritage** assessment, which has been incorporated into the design of the Offshore Project (**Table 16.8**). Where other mitigation measures are proposed, these are detailed in the impact assessment

Table 16.8 Embedded mitigation measures for marine archaeology and cultural heritage

Parameter	Mitigation measure	Description
Known heritage assets	Archaeological Exclusion Zones (AEZs) (**Section 16.5.1.2**)	For archaeologically significant anomalies that are clearly identifiable in the survey data and where the extents are largely known, AEZs will be employed. AEZs will remain for the life of the Offshore Project or until ground truthing or higher resolution data determines a reduction in potential, significance, or extents.
	Temporary Archaeological Exclusion Zones (TAEZs) (see **Section 16.5.1.2**)	Where an anomaly is not visible in the survey data but likely to exist on the seabed at a known position or where the extents of an anomaly are not fully identifiable, TAEZs will be employed. TAEZs have been identified as highly likely to be altered following higher resolution or full coverage data assessment, however, they will remain in place until alterations have been formally agreed.
Potential heritage assets (maritime or aviation)	Avoidance by micro-siting of design following the acquisition of high-resolution geophysical data, to be acquired post-consent.	Avoidance where possible of identified anomalies.
		Avoidance by micro-siting where possible of previously recorded sites that have not been seen in the geophysical data and at which the presence of surviving material is considered unlikely
		Further investigation of any identified anomalies and previously recorded sites that cannot be avoided by micro-siting of design and the application of either embedded mitigation (avoidance) or additional mitigation (**Section 16.1.1**).

Parameter	Mitigation measure	Description
	Implementation of a protocol for archaeological discoveries to address unexpected discoveries which might be encountered during planned activities	In order to account for unexpected discoveries of archaeological material during construction, operation and decommissioning, a formal protocol will be required. It is recommended that if any objects of possible archaeological interest are encountered, that they should be reported using a protocol

81. The aim of any mitigation will be to avoid, reduce or offset of any impacts that may occur to heritage assets. Avoidance can be achieved using AEZs, TAEZ or through micrositing for example. In terms of reducing impacts, this can be achieved through further geophysical or geoarchaeological investigations to reduce, as far as possible, the potential for unintended impacts. Furthermore, impacts can be offset by professionally executed and published archaeological studies reporting the outcome and results of any archaeological mitigation undertaken for the Offshore Project.

82. As stated above, the primary means of preventing impacts to known heritage assets is avoidance. It is also noted that the AEZs may be reduced, enlarged, or removed in agreement with Historic England if further relevant information becomes available. However, unless modified by agreement, it is important that AEZs are retained throughout the Offshore Project lifetime. Additionally, monitoring of AEZs may be required by the regulator and curator to ensure adherence both during construction and in the future operation of the windfarm.

83. TAEZs may be removed following further investigation and in consultation with Historic England if the feature proves to be non-archaeological. However, it may also be formalised as an AEZ if further investigation identifies an important heritage asset.

84. The proposed approach to the delivery of this embedded mitigation, undertaken post-consent, and how the outcomes of additional investigation will influence the final design of the Offshore Project, are set out in the Outline Written Scheme of Investigation (WSI) (Offshore) (**Appendix 16.B**). This has been prepared in accordance with industry good practice guidance on Archaeological WSIs (The Crown Estate, 2021).

16.3.8 Baseline Data Sources

16.3.8.1 Site specific surveys

85. In order to provide site specific and up to date information on which to base the impact assessment, a geophysical site characterisation survey was conducted across the Offshore Development Area. This was conducted by N-SEA and Ultrabeam Hydrographic (Ultrabeam) between May and August 2022. And consisted of Sidescan Sonar (SSS), Multibeam Bathymetry (MBES), Magnetometer, and Sub-bottom Profiler (SBP).

86. The offshore survey was planned with a line spacing of 75 m for the main lines, and 5 km for the cross lines, the nearshore survey was planned with a line spacing of 45 m for the main lines, and 500 m for the cross lines. The line planning ensured 100% coverage of SSS data was achieved, including the nadir (@ 100 m and 50 m range respectively). The MBES swathe sector angle was set between 80-120° to produce a full coverage dataset, with 10% overlap, in the depth of water over the survey areas.

87. In addition, SBP and TVG data were collected along each of the survey lines, the TVG separation was 1.5 m, and the maximum altitude was 8 m. The survey navigation tracklines are presented in **Figure 3**, the SSS coverage in **Figure 4**, and the MBES coverage in **Figure 5** of **Appendix 16.A**.

88. The survey achieved 100% SSS and MBES coverage of the Offshore Development Area, with TVG and SBP collected to the line plan specification as outlined above. The equipment specification for the offshore survey is shown in **Table 2** of **Appendix 16.A**, and the nearshore survey in **Table 3** of **Appendix 16.A**.

89. The data were collected to a specification| appropriate to achieve the following interpretation requirements:

- SSS: ensonification of anomalies > 0.5 m
- MBES: ensonification of anomalies > 1.0 m offshore and 0.2 m nearshore
- Magnetometer (TVG): 5 nT threshold for anomaly picking
- SBP: penetration of up to 16m was achieved
- Single Channel Sparker (SCS): penetration of up to 60 m was achieved.

90. MSDS Marine were appointed to undertake the archaeological assessment of the acquired geophysical survey data. MSDS Marine are a specialist marine and coastal contractor and are a CIfA registered organisation.

91. MSDS Marine undertook an audit of the data to assess its suitability for archaeological assessment. It was determined that the overall quality of the data was good and therefore, considered of an appropriate specification, coverage, and quality, to undertake a robust archaeological assessment to inform the EIA process.

92. It should be noted that MSDS Marine's assessment was undertaken at an earlier phase of the Offshore Project, when a second landfall option was under consideration. For the purposes of this assessment anomalies which lie within the former landfall location have been removed and are not presented on the figures, however, are still present within **Appendix 16.A** which is referenced throughout this assessment.

93. As part of their assessment, MSDS Marine applied a 500m buffer to the extents of the windfarm site in order to incorporate the full extents of the survey coverage and the provide additional historic environment data searches and information. This was done to provide a wider context to the assessment.

94. The assessment of SBP data has been undertaken in two phases as follow:

- Phase 1 comprises review of the SBP geophysical interpretative report prepared by N-Sea to inform the engineering design of the project. The report was reviewed by MSDS Marine to understand the wider geology and stratigraphy and to identify units of potential archaeological interest. A sub-set of SBP profiles were reviewed to corroborate the findings in the N-Sea geophysical interpretative report. Horizon maps created by N-Sea were plotted in relation to wider palaeolandscape features to understand the context of the units of archaeological interest.
- Phase 2 comprises further bespoke SBP interpretation of units of archaeological interest to resolve localised variations and identify deposits of potential archaeological interest that may be targeted in future geotechnical surveys. This information is ongoing and will be presented in a separate report to **Appendix 16.A** which will be available post-submission and will inform archaeological input into future geotechnical investigations.

16.3.8.2 Other available sources

95. In addition to the geophysical survey data, the sources presented in **Table 16.9** have been used to inform the Archaeology and Cultural Heritage assessment.

Table 16.9 Existing data sources used in this chapter

Data Set	Spatial coverage	Summary
The United Kingdom Hydrographic Office (UKHO)	UK	Records of wrecks and obstructions data including 'dead' and salvaged wrecks that

Data Set	Spatial coverage	Summary
data for charted wrecks and obstructions		are no longer charted as navigational hazards.
Maritime records maintained by Historic England	England	Maritime records, including documented losses of vessels, and records of terrestrial monuments and findspots, including the archaeological excavation index.
The National Heritage List for England (NHLE) maintained by Historic England	England	Official, up to date, register of all nationally protected historic buildings and sites in England – listed buildings, scheduled monuments, protected wrecks, registered parks and gardens, and battlefields (including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973).
Devon Historic Environment Record (HER)	Devon	HERs are information services that provide access to comprehensive and dynamic resources relating to the archaeology and historic built environment of a defined geographic area. HERs contain details on local archaeological sites and finds, historic buildings and historic landscapes and are regularly updated.
The Coastal and Intertidal Zone Archaeology Network (CITiZAN)	UK	CITiZAN, the Coastal and Intertidal Zone Archaeological Network, highlights the threat of coastal erosion to a wealth of foreshore and intertidal sites. These archaeological features encompass a huge time span, many are of considerable local or national significance.
Relevant mapping including Admiralty Charts, historic maps, and Ordnance Survey	UK	Information relation to previously charted wrecks, seabed topography and topography.
Existing archaeological studies and published sources	Irish Sea/Celtic Sea	Background information on the archaeology of the Celtic Sea, including the results of nearby offshore windfarm projects including the Atlantic Array offshore wind farm.
West Coast Palaeolandscapes Survey	West Coast of England	Study mapping submerged landscapes contained within an area of the Irish Sea and Bristol Channel using wide variety of seismic data sources.

96. A site walkover survey was also undertaken in August 2022 to determine whether any heritage assets survive above ground within the intertidal zone (**Section 16.4.3**).

16.3.9 Data Limitations

97. The records held by the UKHO, Historic England (NHLE and formerly the National Record of the Historic Environment (NRHE)), Devon HER and the other sources used in this assessment are not a record of all surviving cultural heritage assets, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these datasets is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown. In particular, this relates to buried archaeological features.

98. Additionally, there are spatial limitations with the data sources. Often records within these data sets are not know assets, but records of loss which are subsequently given an arbitrary location within the general vicinity. As such, some records may not be associated known archaeological remains

16.3.10 Scope

99. Upon consideration of the baseline environment, the Offshore Project description outlined in **Chapter 5: Project Description**, and Scoping Opinion, potential impacts upon **Marine Archaeology and Cultural Heritage** have been scoped in or out. These impacts are outlined, together with a justification for why they are or are not considered further, in **Table 16.10** and **Table 16.11** respectively.

Table 16.10 Summary of impacts scoped in relating to Marine Archaeology and Cultural Heritage

Potential Impact	Justification
Construction Phase	
Direct impact to known heritage assets	Direct impacts to heritage assets, either present on the seafloor or buried within seabed deposits, may result in damage to, or destruction of, archaeological material
Direct impact to potential heritage assets	It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). Therefore, unavoidable direct impacts may occur if archaeological material is present within the construction footprint of the Offshore Project.
Indirect impact to heritage assets from changes to physical processes	During the construction phase of the Offshore Project, there is the potential for foundations

Potential Impact	Justification
	installation activities to disturb sediment, potentially resulting in changes in seabed levels.
Impacts to the setting of heritage assets	Changes within the physical setting of heritage assets will occur (i.e., the introduction of the Offshore Project into the seascape).
Operation and maintenance phase	
Direct impact to known heritage assets	Direct impacts to heritage assets, either present on the seafloor or buried within seabed deposits, may result in damage to, or destruction of, archaeological material
Direct impact to potential heritage assets	It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). Therefore, unavoidable direct impacts may occur if archaeological material is present within the construction footprint of the Offshore Project.
Indirect impact to heritage assets from changes to physical processes	During the operational phase of the Offshore Project, there is the potential for the presence of foundations to cause changes to the tidal and wave regimes due to physical blockage effects
Impacts to the setting of heritage assets	Changes within the physical setting of heritage assets will occur (i.e., the introduction of the Offshore Project into the seascape).
Decommissioning phase	
Direct impact to known heritage assets	Direct impacts to heritage assets, either present on the seafloor or buried within seabed deposits, may result in damage to, or destruction of, archaeological material
Direct impact to potential heritage assets	It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). Therefore, unavoidable direct impacts may occur if archaeological material is present within the construction footprint of the Offshore Project.
Indirect impact to heritage assets from changes to physical processes	Changes associated with decommissioning would be comparable to those for the construction phase.
Impacts to the setting of heritage assets	Changes within the physical setting of heritage assets will occur (i.e., the introduction of the Offshore Project into the seascape).

Table 16.11 Summary of impacts scoped out relating to Marine Archaeology and Cultural Heritage

Potential Impact	Justification
Transboundary impacts, associated with changes to marine physical processes	Changes crossing an international boundary, are not expected to occur as the proposed scheme is located well within the European Economic Zone (EEZ) boundary. As such, it was proposed at scoping to scope out indirect transboundary effects

Potential Impact	Justification
	on Marine Archaeology and Cultural with which the MMO agreed (see **Table 16.12**).

16.3.11 Consultation

100. Consultation regarding **Marine Archaeology and Cultural Heritage** has been undertaken in line with the general process described in presented within **Chapter 7: Consultation**. The key elements to date have included scoping and the ongoing Evidence Plan Process (EPP) via the Introductory and Expert Topic Group (ETG) meetings held on 02/12/2021, 17/05/22 and 11/01/2023 where EIA methods and geophysical survey results were discussed, along with mitigation measures. Attendees included Historic England, Devon and Cornwall County Councils and Marine Management Organisation (MMO). Full details will be provided in the Consultation Report which will be developed further throughout the EIA process and submitted as part of the planning application.

101. A summary of the key issues raised during consultation specific to **Marine Archaeology and Cultural Heritage** is outlined below in **Table 16.12**, together with how these issues have been considered in the production of this ES.

Table 16-12 Consultation responses

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
Historic England and Devon and Cornwall County Councils	02/12/2021	An overall introduction to the Offshore Project was provided, including Offshore Project details, the route selection process, and Scoping Assessment Methodology.	N/A
Historic England and Devon County Council	17/05/22	Overall project update including key findings of the Scoping Assessment, planned geophysical investigations and route refinement.	N/A
MMO/Historic England	27/05/22 Scoping Response	**Transboundary Impacts (indirect)**: The Applicant states "Indirect transboundary impacts, associated with changes to marine physical processes, where those changes cross an international boundary, are not expected to occur as the proposed scheme is located well within the European Economic Zone (EEZ) boundary. As such it is proposed to scope out indirect transboundary effects on Marine Archaeology and Cultural Heritage." The MMO agrees that this can be scoped out of the assessment as no pathways for impacts are expected.	**Table 16.11**
MMO/Historic England	27/05/22 Scoping Response	**WSI:** The Scoping Report, while alluding to mitigation measures, does not describe the production of an archaeological Written Scheme of Investigation (WSI), in consultation with advice from either Historic England or local authority curators. The MMO requests that a WSI is produced by the Applicant to accompany any ES.	**Section 16.1.1**
MMO/Historic England	27/05/22 Scoping Response	**Guidance:** Regarding Section 2.10 (Marine Archaeology and Cultural Heritage) the MMO add the following which should be referred to in any ES produced for this proposed project:	**Section 16.2.4.2**

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		• Gribble J. and Leather S. (2011) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector. Published by COWRIE Ltd • Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate 2014).	
MMO/Historic England	27/05/22 Scoping Response	**Survey**: Section 2.10.6 provides useful reference to marine geology (Section 2.2) and indirect impacts if buried heritage assets become exposed to increased wave/tidal action. We draw attention to this risk given the sedimentological description provided in Section 2.2.5 that the seabed in the proposed floating WTG array area is dominated by sand. Further survey and evaluation therefore should determine the risk of encountering other, presently unknown heritage assets as may occur that are buried or partially buried. We note the very brief reference to historic (seascape) character in paragraph 617 which will require further elaboration in any ES produced. Historic England concur with impacts summarised under phases of construction, operation and maintenance and decommissioning. We also concur with the attention given to possible cumulative impacts and that, for this proposed project, indirect transboundary effects could be scoped out.	**Section 16.2.4.2, 16.4.4** and **16.8**
MMO/Historic England	27/05/22 Scoping Response	**Approach to Assessment**: In Section 2.10.7we note the attention given to available data and information (e.g., Table 2.24) and the survey data acquisition campaign summarised in Table 2.25 and those data will be supplied to a professional, experienced, and accredited archaeological contractor/consultant; we therefore welcome the statement made in Appendix A (Section 2.6 Good Practice) on this matter. Historic England concur with the statement made in paragraph 637 that professional geo-archaeological advice and services will also be	**Section 16.1.1** and **Section 16.1.1**

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		obtained as part of any geotechnical survey programme conducted for this proposed development.	
MMO/Historic England	27/05/22 Scoping Response	**ES**: Section 4.2 (Offshore) includes important information about the non-designated historic environment, as could be encountered in the project's Area of Search, and the potential to encounter prehistoric archaeological materials (e.g., paragraphs 116 and 152). Historic England notes the attention given to inshore, estuarine and coastal archaeological potential (e.g., paragraphs 138, 143 and 156), which is of relevance in the planning of surveys for the electricity export cable corridor from the WTG array and offshore substation to landfall location. However, attention is drawn to the identification of HMHS Glenart Castle (Table 4.2), a hospital ship attacked and sunk on 26th February 1918, as located within the marine Area of Search. It is important that such sites are afforded the maximum respect.	**Section 16.4**
MMO/Historic England	27/05/22 Scoping Response	**WSI**: Paragraph 149 mentions that because the Proposed Development will use floating WTGs, impacts to the seabed in the array site will be limited to the placement of anchors/moorings. It is therefore an important aspect of the assessment presented in any ES to evaluate different impacts as could be associated with different anchoring and mooring configurations. Paragraph 154 mentions that in locations of high archaeological potential, if intrusive ground works are required, such work should be informed by an archaeological Written Scheme of Investigation (WSI) which includes targeted geophysical survey methodologies sufficient to support archaeological analysis. Paragraphs 160 and 161 identify that there is "high potential for unrecorded or fragmentary wreck remains within the cable corridor and array site". Therefore, it is relevant that a WSI is produced to set out the methodological approach for marine survey data capture which best supports archaeological	**Section 16.5**, **Section 16.1.1** and **Appendix 16.B.**

Consultee	Date, Document, Forum	Comment	Where addressed in the ES
		analysis and interpretation and that a draft WSI should accompany any ES produced. The drafting of any WSI should be informed by the recently published guidance from The Crown Estate, referenced in paragraph 37. Historic England adds that this is an important distinction that requires the attention of the Applicant between offering "engineering led geophysical data" for archaeological review and the commissioning of geophysical data capture that also best serves archaeological analysis. It is in the best interest of all parties that techniques and methodologies for data capture as efficient as possible. Furthermore, the WSI is an important means to set out how any investigations should be conducted if in-situ protection, i.e., through avoidance, is not a viable strategy. The WSI should include a full methodological approach to geo-archaeological analysis and reporting, as informed by any geotechnical survey campaign commissioned by the Applicant. It is also important to add that given the potential to encounter prehistoric geoarchaeological material that adequate attention is given to acquiring geotechnical material exclusively for archaeological analysis	
MMO/Historic England	27/05/22 Scoping Response	**WSI**: Section 5.2 (Offshore), the MMO concurs with the statement that in locations of known high potential that avoidance is the best strategy, but if not possible, impacts could be limited by using HDD drilling for cable installation.	**Section 16.1.1** and **Appendix 16.B.**
Historic England	11/01/2023 ETG 2	Historic England highlighted the importance of the of archaeological remains of the North Devon US Assault Training Centre, not only for the importance any remains themselves but also as a collective entity and character area which has much public interest.	**Section 16.4.3**

16.4 Existing Environment

102. This section describes the existing environment in relation to **Marine Archaeology and Cultural Heritage** associated with the White Cross study area. It has been informed by a review of the sources listed in **Table 16.9**.

16.4.1 Seabed Prehistory

16.4.1.1 Description of idented assets

103. There are no known seabed prehistory sites within the study area.

104. The potential for prehistoric sites to be present within study area, either exposed on or buried within the seabed, is primarily associated with surviving terrestrial features and deposits corresponding to times when sea levels were lower and hence prehistoric hominin populations may have inhabited what is now the seabed. Archaeological material may also be present within secondary contexts, as isolated finds within deposits comprising material from terrestrial phases that may have been reworked by marine or glacial processes, for example.

105. The Offshore Development Area is located within an area of high prehistoric archaeological potential, within which, archaeological and palaeoenvironmental evidence related to human occupation of the UK may be preserved. The Offshore Development Area has been shaped by three major glaciations over the past 970,000 years, leading to lower sea levels and, consequently, there have been long periods when these areas, and the wider Bristol Channel region, were exposed as land suitable for hominin occupation (Wenban-Smith, 2002).

106. The West Coast Palaeolandscapes Survey has mapped parts of the Celtic Sea and all of the Bristol Channel revealing a series of lakes, floodplains, river channels and seabed features (Fitch and Gaffney, 2011). Sometime after 16,000 BC Britain was cut off from Ireland with some of the study area, largely the cable route, remaining dry land until c.7000 BC.

107. By the Mesolithic period the Bristol Channel changed drastically, with sea level rise causing the coastline to retreat further inland (Fitch and Gaffney, 2011). Lundy remained connected to the mainland at this time by a small promontory and was likely a centre for Mesolithic activity (Schofield, 1994). The scheduled monument Prehistoric settlement at North End, Lundy (List entry: 1016029) supports this with occupation evidence dating to 8000 BC.

108. The Devon HER records extensive evidence of Mesolithic occupation within the wider coastal regions of the Offshore Development Area namely the intertidal zone at Westward Ho!, around Croyde and around Northam. The records largely comprise large amounts of Mesolithic flints with Mesolithic finds at Westward Ho! Including peat deposits, middens, flints, a whale bone harpoon, and a submerged forest.

109. By the Neolithic period, the coastline around the UK was largely as it is today. As such, evidence from the Neolithic onwards is likely to be of an increasingly maritime nature.

110. An archaeological review of the geophysical survey assessments and ground model covering the windfarm site was conducted by MSDS Marine. This was done to inform the undertaking of the palaeolandscape assessment and potential for previously undiscovered submerged prehistoric sites to be present. This included a review of geophysical survey data reports, select seismic profiles and ground model outputs including mapped horizons and grids. These sources were reviewed to establish an understanding of the geological make-up of the Offshore Development Area, formations present and their palaeoenvironmental and archaeological potential. Information about the wider area has also been used to better contextualise the various environments experienced in the area during the Pleistocene and Holocene.

111. The principal sources which have been reviewed and assessed by MSDS Marine are set out in **Section 5.6** of **Appendix 16.A**. Data sources have been identified by MSDS marine within a 500m buffer around the windfarm site, this area is referred to as the assessment area.

112. **Table 16.13** provides a summary of the geological units and reflectors identified within the Offshore Development Area.

Table 16.13 Units and reflectors identified in the Offshore Development Area

Age	Units and Reflectors	Seismic Character	Interpretation	Thickness/Depth	Archaeological Potential
Offshore Export Cable Corridor					
Quaternary Sediments	Unit E	Continuous parallel reflectors, with one internal reflector near to landfall.	N-Sea indicate Holocene sediments, mainly fine sand. Interpreted by N-Sea as Holocene but may contain earlier sediments. See in-text discussion.	Varied, absent in some areas, up to 16m in other areas. Thickest in the nearshore area.	Potential for archaeological finds and features associated with non-marine Quaternary sediments should these survive
Pre-Quaternary Bedrock	Reflector 2	Erratic and discontinuous reflector in the east, and more continuous and wavey in the west.	Correlated with the top of Unit B in the Windfarm Site. Interpreted here as bedrock.	1m below the seabed midway along the Export Cable Corridor increasing to 15m BSB at the fan area.	None (predates earliest known evidence for hominins in the UK)
	Reflector 1	Reflector not described, but underlying reflector (thought to be within bedrock) described as localised and irregular.	Top of bedrock (Pilton Shales Formation). Could not be correlated with any other reflectors.	Depth varied and reflector not observed under sand waves and reflector likely at seabed to the south of Lundy indicating outcropping bedrock.	None (predates earliest known evidence for hominins in the UK)
Windfarm Site					

Age	Units and Reflectors	Seismic Character	Interpretation	Thickness/Depth	Archaeological Potential
Quaternary Sediments	Unit E	Horizontal layered reflectors evident within depressions in Unit B which represent erosion areas	Holocene sediments deposited on top of Unit A in the north of the Windfarm Site, and atop unit B in the east (also above the fault, unit D). This unit infills erosional depressions in the surface of the bedrock and could contain pre-marine deposits. Interpreted by N-Sea as Holocene but may contain earlier sediments.	Ranging from a few centimetres to c. 16 m. Local areas of greater thickness where Unit B has erosional depressions in surface.	Potential for archaeological finds and features associated with non-marine Quaternary sediments should these survive
Pre-Quaternary bedrock	Unit D	No clear strata defined	Deformation zone. Fault which separates the strata in the north and south of the Windfarm Site area. Unit A present to the north, and B and C to the south.	Extending to at least 60 m below seabed (BSB) (below penetration level)	None (predates earliest known evidence for hominins in the UK)
	Unit B	Continuous parallel and sub horizontal reflectors with some evidence of deformation, and shallow depressions	Clay and lignite sequence. Based on BGS records for this area the unit may represent Palaeogene sediments.	Not described	None (predates earliest known evidence for hominins in the UK)

Age	Units and Reflectors	Seismic Character	Interpretation	Thickness/Depth	Archaeological Potential
	Unit C	Discontinuous seismic reflectors. Some discontinuous layering	Sandy sequence. May relate to Unit A. Layering evident but not continuous, Overlain by Unit B.	Extending to at least 60 m BSB (below penetration level)	None (predates earliest known evidence for hominins in the UK)
	Unit A	Major west-plunging syncline present within the northern part of the Windfarm Site. Other folding also evident. Top marked by an erosion surface	Sedimentary rock (primarily clays, sandstone, mudstone) of Cretaceous, Jurassic, and Triassic age	Extending to at least 60 m BSB (below penetration level)	None (predates earliest known evidence for hominins in the UK)

113. A full discussion of these Units and deposits is provided in **Section 10** of **Appendix 16.A**. In summary, there is limited archaeological potential from the Quaternary Unit E. Unit E has the potential to hold evidence of glacial sediments (associated with the Western Irish Sea or Cardigan Bay Formations), Pleistocene and Holocene fluvial and related features, Holocene organic sediments laid down prior to marine inundation by c.5k BP and Marine sediments post-dating the Holocene marine transgression.

114. With the exception of the marine sediments, the potential for other deposits to occur is likely focused in areas where Unit E is at its thickest. The thin layer of Unit E which appears to be present across much of the Offshore Development Area is thought to represent marine deposits. The potential for fluvial deposits or sediments laid down under sub-aerial conditions in association with the Surface Sands Formation and other coastal formations indicates some archaeological and palaeoenvironmental potential may be associated with Unit E. This Unit should therefore be investigated further, focused on the areas where it is thickest (shown on **Figure 27** of **Appendix 16.A**) as intervening areas are interpreted as modern marine sediments.

16.4.1.2 Cultural significance of identified assets

115. There are no known seabed prehistory sites within the study area for which significance can be described.

116. As such, the significance of these palaeolandscapes, lies primarily in their archaeological interest or research value, particularly when considered alongside survey data and interpretations produced for other seabed development projects in the Celtic Sea. This is discussed further in terms of CEA **Section 16.8**.

117. The setting of a heritage asset is described as the surroundings in which a heritage asset is experienced (Historic England, 2017). Elements of a setting may make a positive or negative contribution to the cultural significance of an asset, may affect the ability to appreciate that cultural significance or may be neutral. Historic England's guidance on setting notes how the setting of buried heritage assets may not be readily appreciated by a casual observer but retain a presence in the landscape.

118. For offshore assets, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer'. With respect to former prehistoric landscapes in the Celtic Sea, these are largely experienced conceptually in terms of interpreted data and research. As such, the setting of these assets (in terms of the surroundings in which they are experienced) does not form a key part of their cultural significance. However, changes within the physical setting will occur (i.e., the

introduction of the Offshore Project into the seascape) and the capacity of these palaeolandscapes to accommodate this change is discussed alongside historic seascape character in **Section 16.4.4**.

16.4.1.3 Heritage importance of identified assets

119. The rarity of *in situ* prehistoric sites in offshore contexts means that should such sites be encountered with the Offshore Project's footprint these will be of national, or possibly international interest. Such sites would have cultural significant potential to contribute to acknowledged international and national research objectives. Given the particularly high importance of these *in situ* sites, the features and deposits which have the potential to contain *in situ* prehistoric archaeological material (i.e., interpreted palaeolandsurfaces and palaeolandscape features) should also be considered of high importance. Similarly, should palaeoenvironmental evidence be discovered in the context of an *in situ* prehistoric site this would also be of high importance.

120. Although palaeoenvironmental material encountered beyond the context of an *in situ* prehistoric site still has evidential value for understanding changes in the climate and environment with offshore contexts, isolated discoveries should be considered of low importance for the purposes of assessment.

121. Isolated finds of prehistoric archaeological material within secondary contexts also have evidential value for understanding patterns of population and exploitation of landscapes. These may comprise material from terrestrial phases that may have been reworked by marine or glacial processes. However, as these finds are derived, and out of context, they are regarded as being of medium rather than high importance.

122. The heritage importance of the potential heritage assets outlined above are presented in **Table 16.14** below.

Table 16.14 Heritage importance (seabed prehistory)

Asset Type	Definition	Importance
Potential *in situ* prehistoric sites	Primary context features and associated artefacts and their physical setting (if/where present)	High
	Known submerged prehistoric sites and landscape features with the demonstrable potential to include artefactual material	
Potential submerged landscape features	Other known submerged palaeolandscape features and deposits likely to date to periods of prehistoric archaeological interest with the potential to contain *in situ* material	High

Asset Type	Definition	Importance
Potential derived Prehistoric finds	Isolated discoveries of prehistoric archaeological material discovered within secondary contexts	Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material	Low
	Palaeoenvironmental material associated with specific palaeolandscape features or archaeological material	High

16.4.2 Maritime and Aviation Archaeology

123. There are no known sites within the study area that are subject to statutory protection from the Protection of Wrecks Act 1973, the Protection of Military Remains Act 1986 or the Ancient Monuments and Archaeological Areas Act 1979.

16.4.2.1 Seabed Features

124. SSS, MBES, and magnetometer data interpreted by MSDS Marine has demonstrated the presence of several seabed features which have been identified at varying levels of archaeological potential. Seabed features are discriminated by MSDS Marine in accordance with the definitions set out in **Table 16.15** below.

Table 16.15 MSDS Marine Criteria for discriminating the relevance of identified seabed features with the study area

Potential	Criteria
High	An anomaly almost certainly of anthropogenic origin and with a high potential of being of archaeological significance. High potential anomalies tend to be the remains of wrecks, the suspected remains of wrecks, or known structures of archaeological significance.
Medium	An anomaly believed to be of anthropogenic origin but that would require further investigation to establish its archaeological significance. Examples may include larger unidentifiable debris or clusters of debris, unidentifiable structures, or significant magnetic anomalies.
Low	An anomaly potentially of anthropogenic origin but that is unlikely to be of archaeological significance. Examples may include discarded modern debris such as rope, cable, chain, or fishing gear; small, isolated anomalies with no wider context; or small boulder-like features with associated magnetometer readings.

125. A total of 58 seabed features were identified within the Offshore Development Area as being of archaeological potential. 21 of these were located in the Windfarm Site, while the remainder are located within the Offshore Export Cable Corridor. The

distribution of these anomalies is presented on **Figure 16.2** and in **Table 16.16** below.

Table 16.16 Distribution of seabed features of archaeological potential

Potential	Windfarm Site	Offshore Export Cable Corridor	Total
High	0	2	2
Medium	0	3	3
Low	21	32	53
Total	21	37	58

126. Across the Offshore Development Area a total of 53 anomalies have been identified as being of low archaeological potential (see **Table 16.15**). These anomalies are summarised in **Table 16.17** below and are presented on **Figure 16.3**.

Table 16.17 Distribution of low potential anomalies

Anomaly Category	Windfarm Site	Offshore Export Cable Corridor	Total
Chain, cable, or rope	0	WC22_0065 WC22_0069	2
Likely geological	WC22_0002 WC22_0005 WC22_0009 WC22_0016 WC22_0019 WC22_0020 WC22_0022 WC22_0023 WC22_0029	WC22_0031 WC22_0034 WC22_0042 WC22_0073 WC22_0051 WC22_0064 WC22_0068	17
Potential debris	WC22_0003 WC22_0004 WC22_0008 WC22_0010 WC22_0012 WC22_0013 WC22_0014 WC22_0021 WC22_0026 WC22_0028	WC22_0032 WC22_0033 WC22_0036 WC22_0038 WC22_0039 WC22_0044 WC22_0049 WC22_0052 WC22_0054 WC22_0055 WC22_0056 WC22_0059 WC22_0060 WC22_0061 WC22_0062 WC22_0067	29

Anomaly Category	Windfarm Site	Offshore Export Cable Corridor	Total
		WC22_0072 WC22_0073	
Seabed disturbance	WC22_0025	0	1
Linear feature	WC22_0011	WC22_0035 WC22_0047 WC22_0058	4
Fishing gear	0	WC22_0040 WC22_0048	2
Total	21	32	53

127. The anomalies interpreted as of low archaeological potential (see **Table 16.15**) are a mixture of small features, often boulder-like, or likely to represent modern debris such as chain, cable, or rope or small items of debris with no features indicating archaeological potential. Each anomaly was reviewed and interpreted to be of low archaeological potential.

128. These are largely concentrated in the Windfarm Site and most westerly end of the Offshore Export Cable Corridor. The distribution of these anomalies is shown on **Figure 16.3**. Further information regarding low potential anomalies are presented in **Annex. A** *Anomalies of Archaeological Potential of* **Appendix 16.A**.

129. Three anomalies of medium archaeological potential have been identified within the Offshore Export Cable Corridor. These are presented on Figure 16.4and are summarised in **Table 16.18** below.

Table 16.18 Medium potential anomalies

Anomaly Category	Offshore Export Cable Corridor	Total
Potential debris	WC22_0041	1
Potential wreck	WC22_0045	1
Likely geological	WC22_0046	1
Total	3	3

130. Anomalies interpreted as being of medium archaeological potential have characteristics that indicate a likelihood of representing anthropogenic debris that has

the potential to be of archaeological interest, or where a precautionary approach has been taken for anomalies where the identification isn't clear.

131. WC22_0041 (see **Figure 12** of **Appendix 16.A**) is visible as a prominent elongated feature. It measures 11.8m x 3.9m with a protrusion to the north measuring 3.4m x 2.5m. The anomaly appears to be geological, however, it has no similar features surrounding it on the seabed. As such, it has been categorised as being of medium potential as a precautionary measure. The item anomaly is not associated with any UKHO records, with the nearest record 12218 (*Bessie Stephens*) located over 1.3km the northeast.

132. WS22_0045 (see **Figure 13** of **Appendix 16.A**) is the only anomaly visible in both the both the SSS and MBES data and has an associated magnetic anomaly of 117.1nT. Within the MBES data the anomaly appears as a relatively featureless, large, mound measuring 15.0 m x 4.7 m with a measurable height of 2.9 m. Within the SSS data the anomaly is visible as an oblong feature, angled to a point at the north-west. To the south-east the end is irregular and appears to slope off to the seabed, a similar form can be observed to the north of the anomaly.

133. This anomaly is not associated with any UKHO or records maintained by Historic England. Based on the form visible in the SSS data, and the associated magnetic anomaly, the anomaly has been interpreted as a potential wreck. The interpretation is however very precautionary, and the anomaly could represent a large geological feature, or a glacial erratic.

134. WC22_0046 (see **Figure 14** of **Appendix 16.A**) is visible in both the SSS and MBES data and has an associated magnetic anomaly of 48.5 nT. The anomaly is visible in both the MBES and SSS data as a large, 5.5 m x 5.2 m, feature, with a measurable height of 1.2 m. The form is not dissimilar to that of a boulder. Scour is visible on all sides. With the exception of WC22_0045, 280 m to the west, the anomaly is unusual in the surrounding environment. This anomaly is not associated with any UKHO records of records maintained by Historic England.

135. This anomaly has been assigned a precautionary medium potential rating due to the size of the feature, the uniqueness in the surrounding environment, and the association with a magnetic anomaly. However, the anomaly could represent a geological feature, or a glacial erratic.

136. Further information regarding the medium potential anomalies is presented in **Section 6.2** of **Appendix 16.A**.

137. Two anomalies have been identified as being of high archaeological potentially. Both are located in the Offshore Export Cable Corridor and are presented on Figure 16.5and are summarised in **Table 16.19** below.

Table 16.19 High potential anomalies

Anomaly Category	Offshore Export Cable Corridor	Total
Wreck	WC22_0043	1
Potential wreck	WC22_0063	1
Total	2	2

138. The anomalies interpreted as of high archaeological potential have characteristics that indicate a high likelihood of representing anthropogenic material that has a high potential to be of archaeological interest, or where a precautionary approach has been taken for anomalies where the identification isn't clear.

139. WC22_0043 (see **Figure 16** of **Appendix 16.A**) is visible in both the SSS and MBES data and has an associated magnetic anomaly of 25.3 nT. Two smaller magnetic anomalies are located the c. 160m northwest and c.60m south. The anomaly is visible within the SSS data as a spread of features over an area 19.8 m x 8.3 m. A prominent feature towards the centre has a measurable height of 1.7 m. Within the MBES data the anomaly is characterised by a small depression between two sand waves to the west, and a mound covered by sand waves to the east.

140. This anomaly is not associated with any UKHO or records maintained by Historic England. The form of the features, and the associated magnetic anomaly, potentially indicate the presence of anthropogenic material, the distribution of which could potentially represent the remains of a partially buried wreck or other concentration of debris. Thus, a high potential rating is considered appropriate.

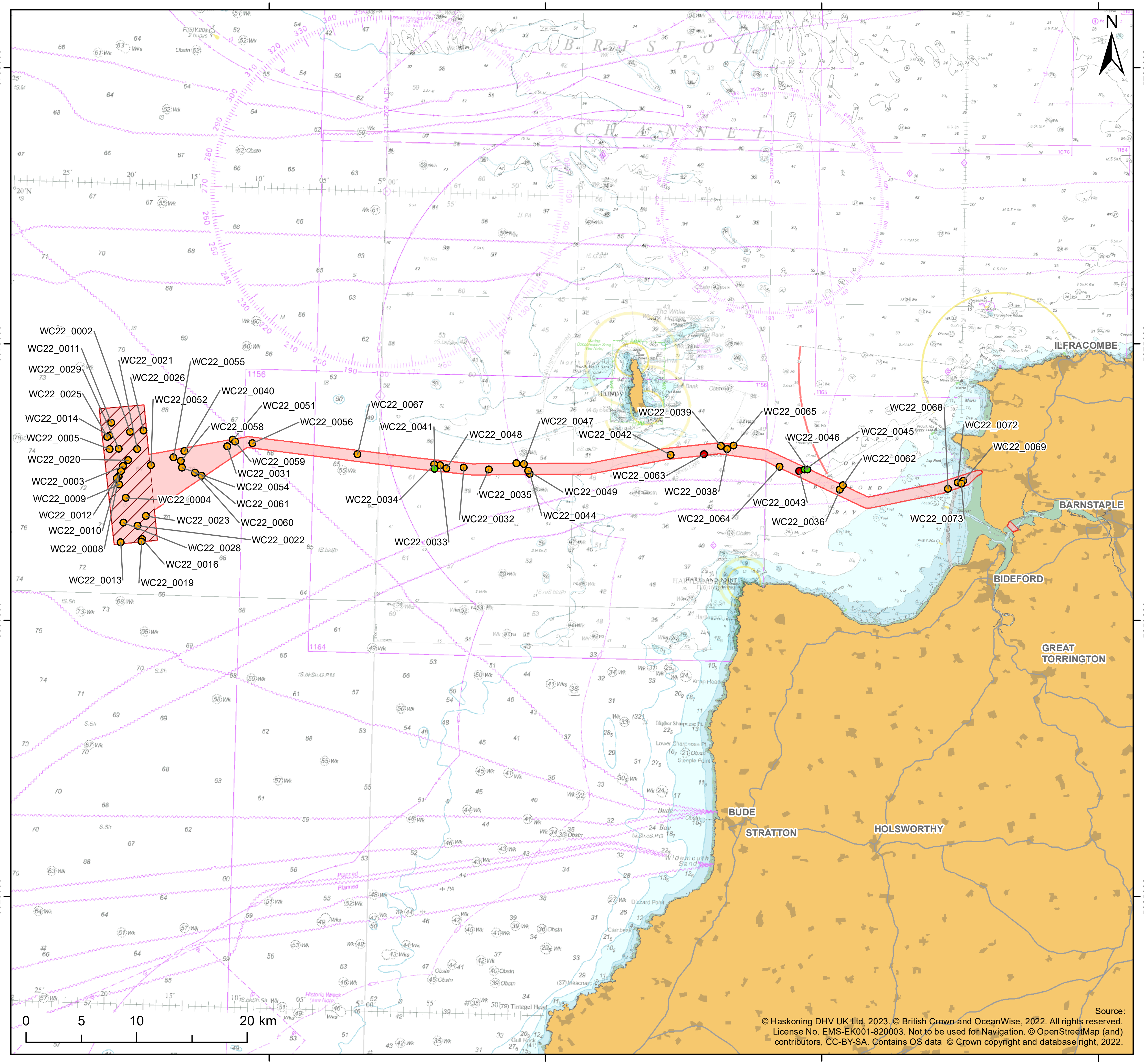
141. WC22_0063 (see **Figure 17** of **Appendix 16.A**) is visible within both the SSS and MBES data and MBES data and has an associated magnetic anomaly of 1,011.6 nT. A UKHO record (72153) is located at the position of the anomaly; however, it is not associated with a named vessel. Record 72153 was identified in 2007 as an obstruction, probably a seabed feature. The anomaly is visible within the SSS data as the remains of a wrecked vessel, measuring 52.6 m x 14.0 m, with a maximum measurable height of 2.3 m, and orientated north-west, south-east. The wreck is characterised by incoherent linear features towards the centre, with an upstanding feature comprising linear elements towards the south-east, and a larger upstanding feature towards the north-west. Whilst the features are broadly identifiable as structure, it is not possible to provide any great level of interpretation other than the wreck is likely constructed of iron, or steel. Along the eastern edge debris can be

identified extending up to 29 m from the main area of wreck, however, it appears largely contained elsewhere.

142. The MBES data confirms the presence of upstanding features to the north-west and south-east, and lower lying material towards the centre. Scour, although slight, can be identified most of the way around the wreck.

143. The interpretation of the anomaly as an unknown wreck, of unknown origin, means that a high potential rating is appropriate.

144. Further information regarding the medium potential anomalies is presented in **Section 6.3** of **Appendix 16.A**.



Legend:

- Windfarm Site
- Offshore Development Area

Archaeological Anomalies

- High
- Low
- Medium

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Distribution of Seabed Features of Archaeological Potential

Figure:	16.2	Drawing No:	PC2978-RHD-ZZ-XX-DR-Z-0551

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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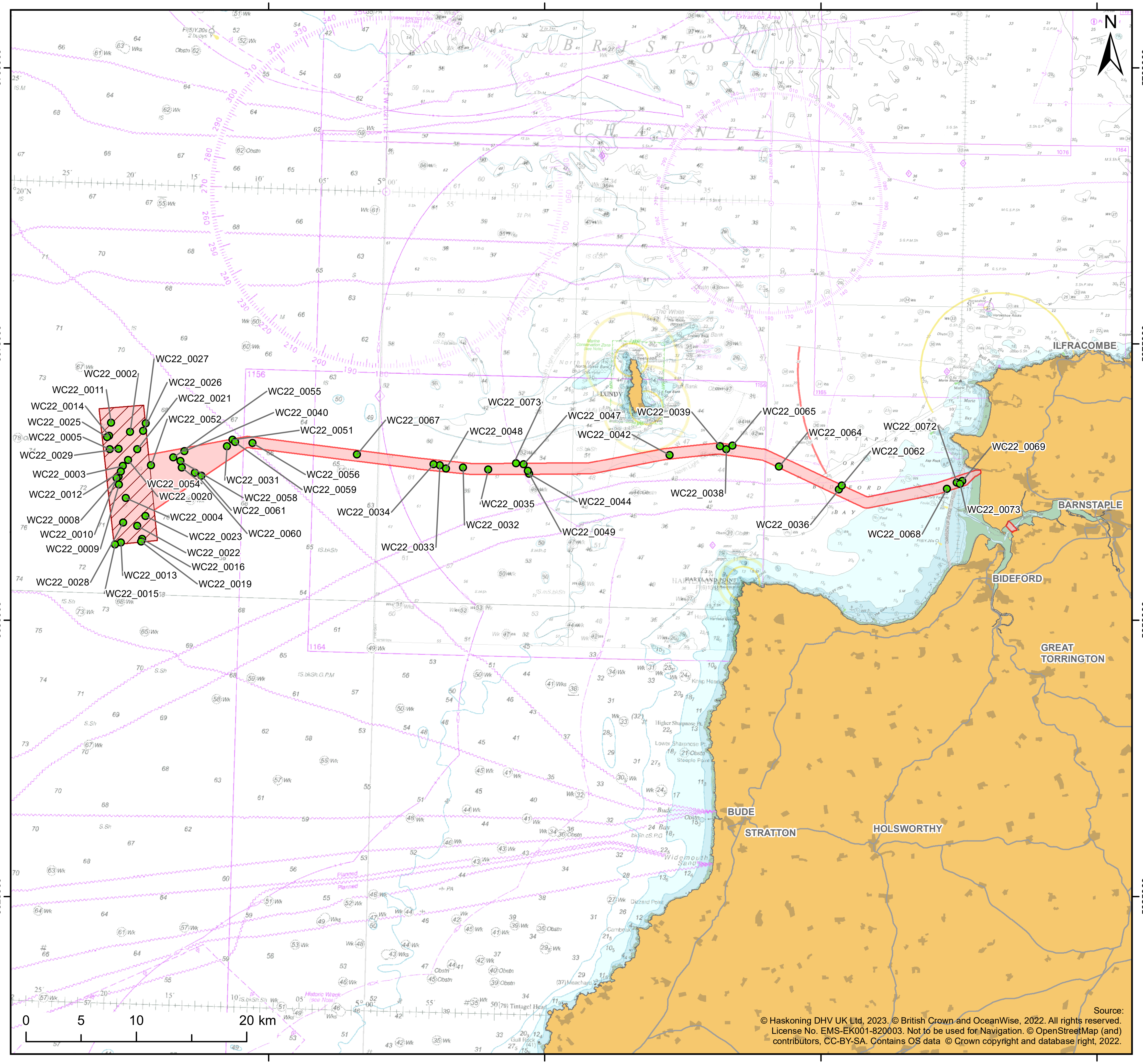

Legend:

- Windfarm Site
- Offshore Development Area
- Low Potential Anomalies

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Distribution of Low Potential Seabed Features

Figure: 16.3 Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0554

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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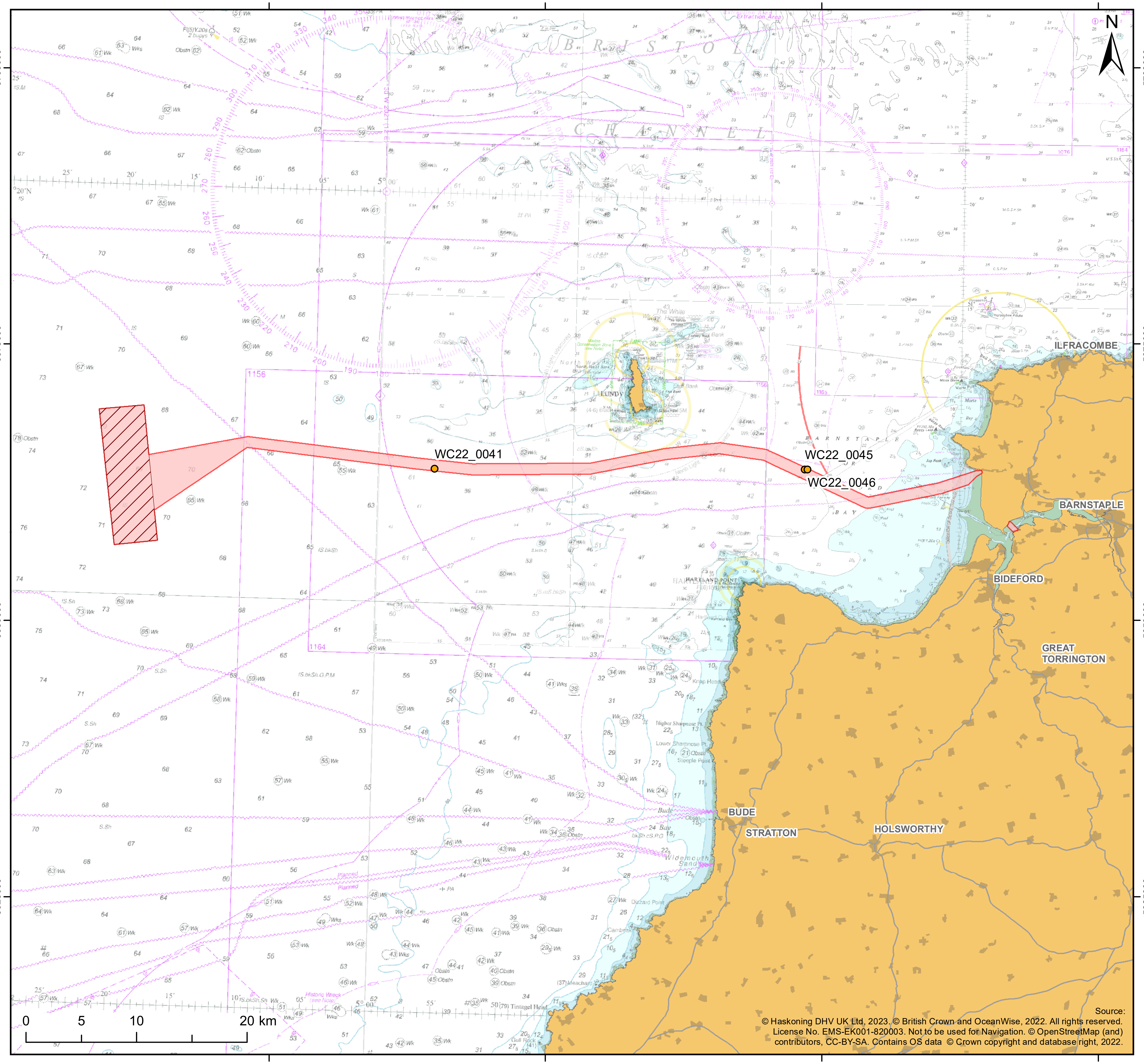

Legend:

- Windfarm Site
- Offshore Development Area
- Medium Potential Anomalies

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Distribution of Medium Potential Seabed Features

Figure: 16.4	Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0553

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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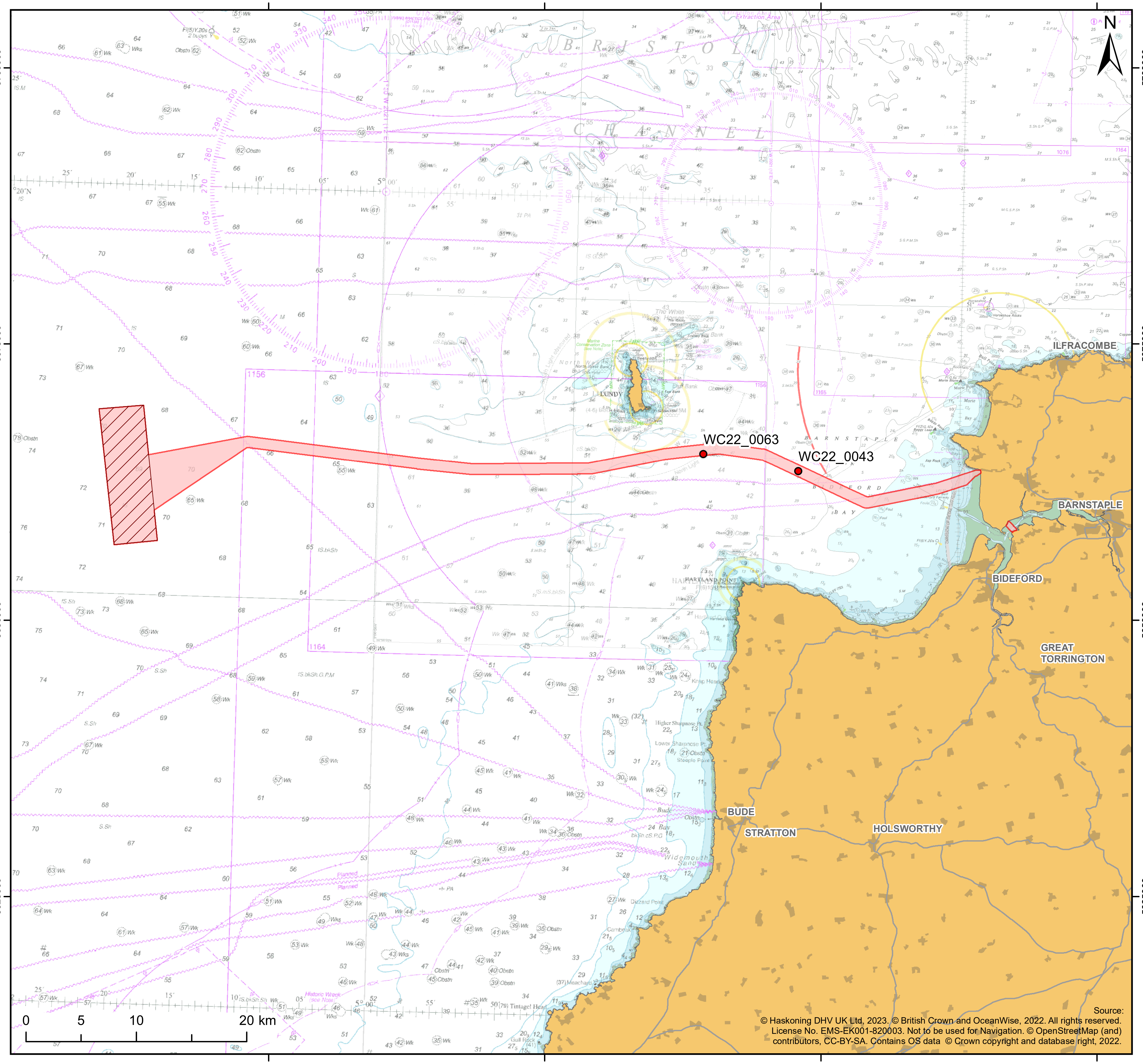

Legend:
- Windfarm Site
- Offshore Development Area
- High Potential

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Distribution of High Potential Seabed Features

Figure: 16.5 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0552

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	03/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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16.4.2.2 Magnetic Anomalies

145. Within the Offshore Development Area there are 481 magnetic anomalies ranging between ranging between 5 nT and 373 nT. Of these six relate to archaeological anomalies discussed above, while 36 relate to know infrastructure. The distribution of these magnetic anomalies is presented on **Figure 16.6** and in **Table 16.20** below.

Table 16.20 Magnetic Anomalies

Intensity (nT)	Windfarm Site	Offshore Cable Corridor	Total
5 to 50	52	324	376
50 to 100	0	33	33
100 to 200	0	22	22
200 +	0	8	8
Total	52	387	439

146. All isolated magnetic anomalies of 50nT or less are considered to be of limited potential to be of archaeological significance, while anomalies greater than 100nT are described as large and have a higher potential to be of archaeological significance.

147. The distribution of magnetic anomalies is presented in **Figure 16.6** with a full description presented in **Section 7** of **Appendix 16.A**. In summary within the Windfarm Site there is a fairly even spread of magnetic anomalies magnetic anomalies less the 50nT which likely represent items of debris or fishing gear and are therefore considered to be of limited archaeological potential. Within the ECC, from c.35km from the Windfarm Site to c.20km from the shore the density of anomalies increases notably, with an increase of anomalies >50nT, including a number >200nT. This area does encompass a large area of exposed, and protruding, bedrock and coarse sediments which may to some degree be masking features visible on the surface (**Figure 19** of **Appendix 16.A**).

148. As such, within areas of rocky seabed, the potential for general marine debris will increase due to items such as anchors and chain, pots, fishing gear, etc. becoming snagged, broken, and discarded. The protruding nature of seabed also has the potential to ‘catch’ debris that may be mobile on the seabed.

149. A high concentration of magnetic anomalies is present within the nearshore area of the Offshore Export Cable Corridor.

150. This concentration of magnetic anomalies can most likely be attributed to the American Army’s Assault Training Centre during World War II in preparation for the D-Day landings. Exercises including the use of live ammunition, explosives, boats, tanks, artillery, and air support were all undertaken, this included the reconstruction

of the expected defences that would be encountered during the D-Day landings. This was alongside strategic coastal defences implemented to protect the area from enemy incursions from the sea.

151. After the war the military infrastructure was removed from the beaches. This included the removal of a double row of 25 lb anti-tank mines above the high-water mark. It is notable that these mines had to be water jetted out as approximately 15 ft of sand had accumulated on top of them, likely due to blown sand. After location and detonation, the remains of the mines were bulldozed past the high-water line and out to sea.

152. In 2021 the Dynamic Dune's project excavated, 362 items of expended ordnance and 17 live items of ordnance and included rockets, Sherman tank shells, landmines, mortar shells, rifle grenades, and explosives.

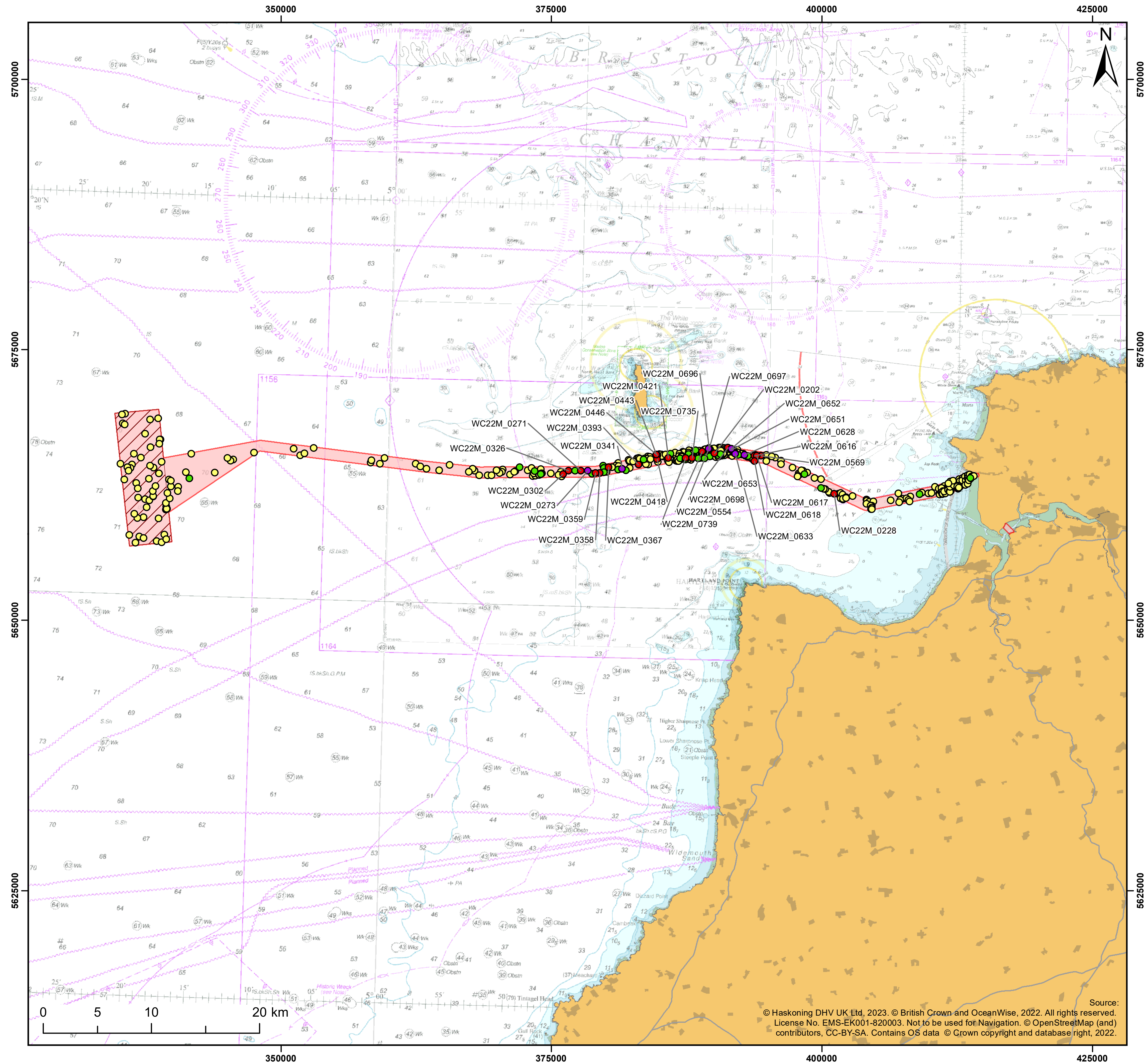
153. As such, it is likely that the majority of magnetic anomalies in the nearshore area relate to this military activity. Should any of these be associated with loss of life, they could fall under the Protection of Military Remains Act 1986, however, no loss of life is known to have occurred at Saunton Sands. Loss of life is associated with the American Army's Assault Training Centre as 98 US military personnel were killed during training exercises; however, this occurred a Woolacombe.

154. Magnetic anomalies considered to be of the highest archaeological potential are presented in **Table 16.21** below.

Table 16.21 Highest potential magnetic anomalies

Anomaly ID	Amplitude (nT)	Potential
WC22M_0202	139.9	Medium
WC22M_0228	160.5	Medium
WC22M_0271	168.5	Medium
WC22M_0273	201.9	Medium
WC22M_0302	138.9	Medium
WC22M_0326	165.6	Medium
WC22M_0421	156.8	Medium
WC22M_0554	170.3	Medium
WC22M_0569	108.1	Medium
WC22M_0616	133.6	Medium
WC22M_0617	116.4	Medium
WC22M_0618	137.6	Medium
WC22M_0628	238.0	Medium
WC22M_0633	256.7	Medium
WC22M_0651	184.1	High
WC22M_0652	239.7	High
WC22M_0653	129.8	Medium

Anomaly ID	Amplitude (nT)	Potential
WC22M_0696	268.4	High
WC22M_0697	373.3	High
WC22M_0698	260.3	High
WC22M_0735	104.0	Medium
WC22M_0739	109.0	Medium



Legend:

- Windfarm Site
- Offshore Development Area

Amplitude (nT)

- 0 - 50
- 50 - 100
- 100 - 200.
- 200+

Note: Labels for Magnetic Anomalies Amplitude apply to those over 100 nT

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Distribution of Magnetic Anomalies

Figure:	Drawing No:
16.6	PC2978-RHD-ZZ-XX-DR-Z-0555

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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16.4.2.3 UKHO records

155. Within the Offshore Development Area there are five UKHO records (see **Figure 16.7**), two within the Windfarm Site, two within the Offshore Cable Corridor and one in the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge). Three of the records are recorded as foul ground, while 72153 is wreck WC22_0063 discussed in **Section 16.4.2.1** above. The one located in Taw Estuary Crossing (12201) is recorded as 'dead' meaning it has not been recorded by repeated surveys so is not considered to be located at its recorded position.

16.4.2.4 Historic England Maritime Records

156. Within the Offshore Export Cable Corridor there are 42 reported losses at five named locations, while there is one record (832371) within the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge) (see **Figure 16.8**). A named location does not signify wreck remains but is an arbitrary point within the general vicinity of where the wreck was observed or thought to have happened. The named locations are summarised in **Table 16.22** below.

Table 16.22 Historic England Reported Loses

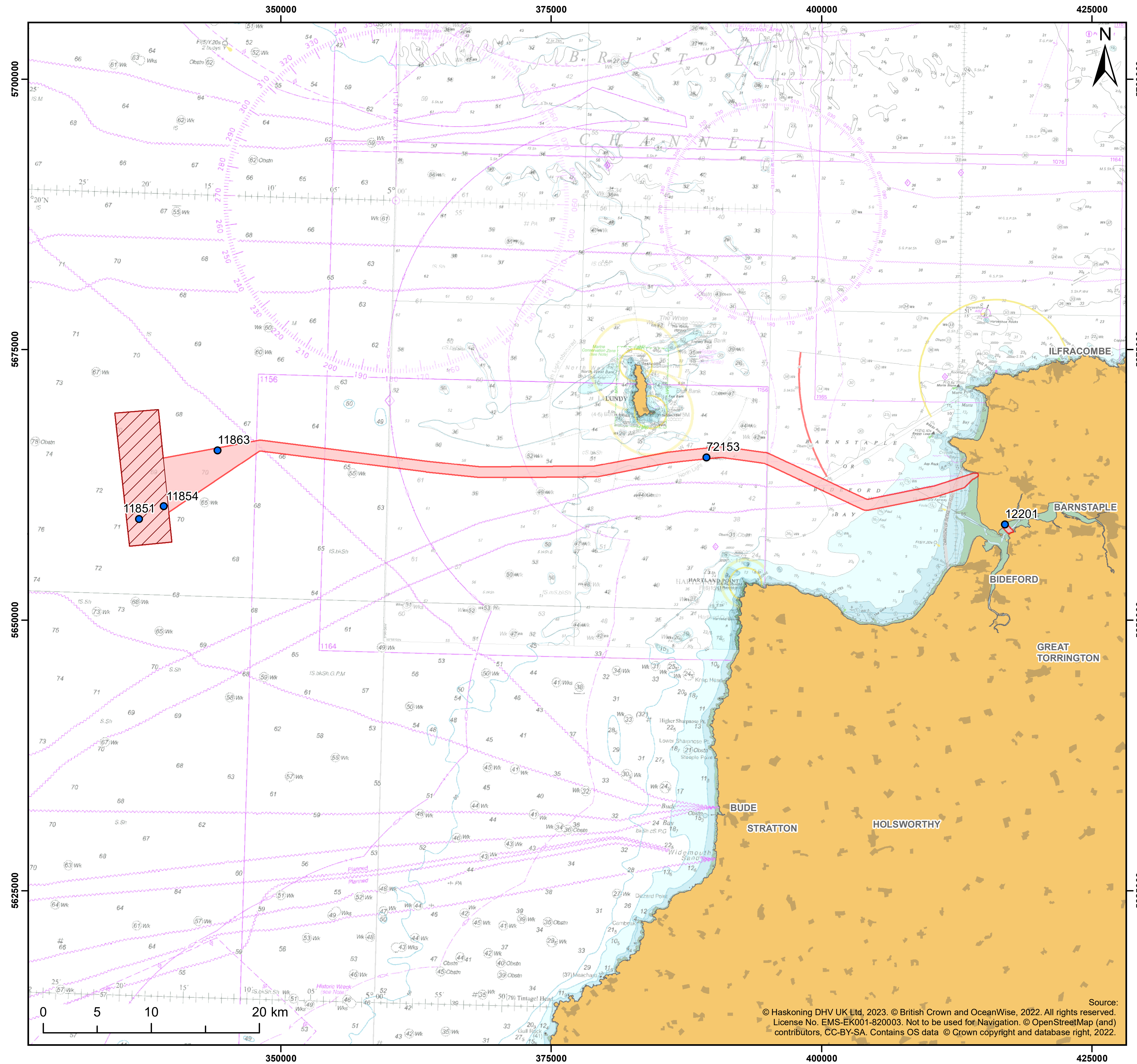
ID	Name	Description	Record Type
1342752	Whitley Mk V Bd359	British Bomber, 1943	Reported Loss
878070	Woolton	British Craft, 1785	Reported Loss
1366146	Le Busse	1724 wreck of Dutch or German craft which stranded near Bideford while bound from Bordeaux for the Netherlands and/or Lubeck. Constructed of wood, she was a sailing vessel.	Reported Loss
1383047	Jesus	1541 wreck of English cargo vessel which was lost in Barnstaple Bay en route from Andalucía to Bristol with sack wine (sherry); a wooden sailing vessel.	Reported Loss
877412	Martha	British Craft, 1744	Reported Loss
1062484	Seaflower	British Cargo Vessel, 1768	Reported Loss
878069	Sandwich	British Craft, 1785	Reported Loss
1069911	Kate	English Cutter, 1895	Reported Loss
1317671	N/A	1751 wreck of part of craft which stranded in Barnstaple Bay; a wooden sailing vessel.	Reported Loss
878111	N/A	Craft, 1823	Reported Loss
877424	Charles	British Cargo Vessel, 1757	Reported Loss
1069881	Aura	Welsh Cutter, 1890	Reported Loss
878199	Henry Patterson	Irish Brigantine, 1854	Reported Loss

ID	Name	Description	Record Type
880740	Model	English Ketch, 1911	Reported Loss
1062495	Kitty	1822 wreck of an English cargo vessel which foundered in Barnstaple Bay, while en route from Neath to Bideford with a cargo of culm. Built of wood, she was a sail-driven vessel.	Reported Loss
1069932	Veronica	Welsh Cargo Vessel, 1900	Reported Loss
1069871	Hero	Welsh Schooner, 1889	Reported Loss
1518118	N/A	1977 wreck of British sand barge which foundered opposite the beacon at the entrance to the River Taw. The possible remains of this vessel are recorded as 1518119.	Reported Loss
880373	Pride of The West	English Schooner, 1869	Reported Loss
1346031	Amphitrite	1819 wreck of English smack which was wrecked in Barnstaple Bay en route from San Miguel to Bristol and/or Newcastle-upon-Tyne. Laden with oranges, she was a wooden sailing vessel.	Reported Loss
1318218	Molly	Craft, 1752	Reported Loss
877419	Dieppe Packet	English Packet, 1751	Reported Loss
1069931	Linda	English Ketch, 1900	Reported Loss
1340453	Hero	1807 wreck of a vessel, lost in Barnstaple Bay while en route from Bridgewater to Plymouth.	Reported Loss
878108	Bee	1821 wreck of an English craft which foundered in Barnstaple Bay. Built of wood, she was a sail-driven vessel. The crew were drowned, but the sails and rigging were salvaged from the wreck.	Reported Loss
1069897	Emperor	English Ketch, 1893	Reported Loss
1069916	Active	English Sloop, 1896	Reported Loss
1338259	N/A	Sloop, 1799	Reported Loss
1395529	Ceres	1936 wreck of an English ketch which foundered in Barnstaple Bay after she leaked. This sailing vessel was built in 1811 and carried a cargo of slag.	Reported Loss
1230791	Mary And Anne	Cargo Vessel, 1750	Reported Loss
1359864	John And Mary	1825 wreck of a brig, stranded in Barnstaple Bay during a gale. Built of wood, she was a sail-driven vessel.	Reported Loss

ID	Name	Description	Record Type
1047842	N/A	1767 wreck of Dutch cargo vessel which was lost in Barnstaple Bay en route from Surinam for Amsterdam. The trajectory of her voyage, which had originated in Angola, suggests that this particular ship was involved in the slave trade.	Reported Loss
1062494	N/A	1822 wreck of brig which foundered in Bideford Bay; a wooden sailing vessel.	Reported Loss
880727	Thistlemor	English Cargo Vessel, 1909	Reported Loss
880803	Chrysolite	English Schooner, 1918	Reported Loss
1062482	Union	1753 wreck of English craft which stranded near Barnstaple en route from Cork for Bristol. Constructed of wood, she was a sailing vessel.	Reported Loss
1364459	Vestal	British Craft, 1838	Reported Loss
878115	Hawke	1829 wreck of an English craft, lost on the north tail of Appledore Bar. Built of wood, she was a sailing-vessel. The crew were drowned.	Reported Loss
1069930	Joseph And Thomas	English Ketch, 1899	Reported Loss
880717	Mary	English Smack, 1908	Reported Loss
1518044	Monte Gurugu	Spanish steam cargo vessel which sank in 1949 after it began to leak due to severe weather, exploded and split into before sinking c.12m NNW of Hartland Point and 8.5m SE of Rat Island	Reported Loss
1094903	City Of Exeter	1887 wreck of English cargo vessel which foundered 4 miles SW of Lundy while en route from Cardiff to St-Nazaire with coal. Built in 1870, she was an iron screw steamer.	Reported Loss

157. Record 832371 is categorised as an unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature.

158. No anomalies were identified at these locations by MSDS Marine; therefore, it is unlikely that these wrecks are located at these named locations. However, the number of reported losses highlights the potential for undiscovered wrecks or remains to be present within the Offshore Development Area.



Legend:

- Windfarm Site
- Offshore Development Area
- UKHO

Source:

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title: UKHO Records

Figure: 16.7 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0556

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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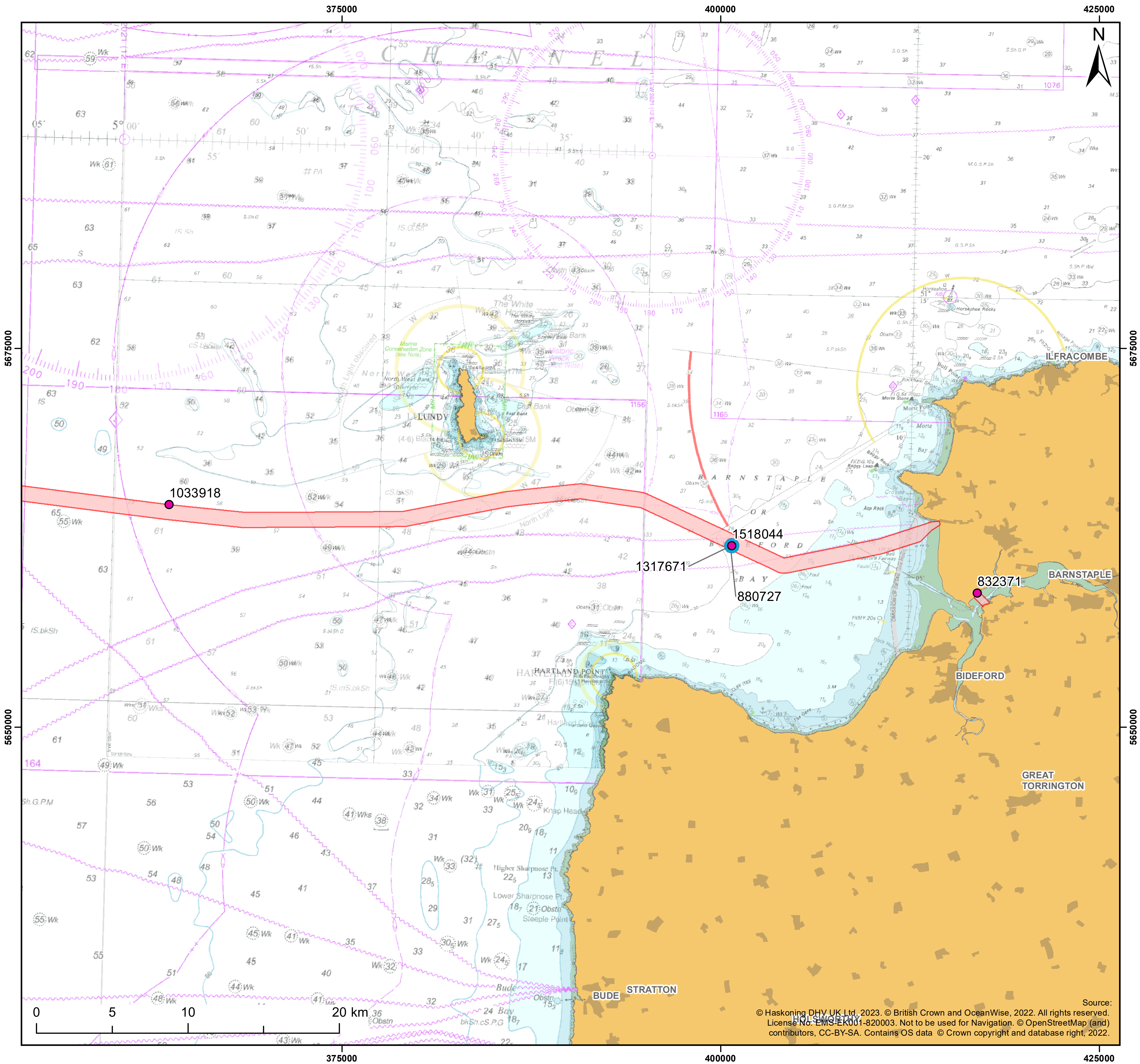

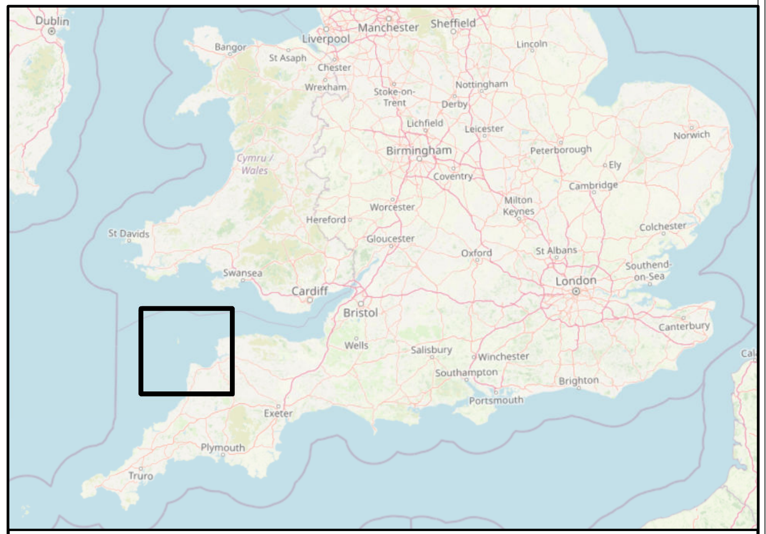

Legend:
- Offshore Development Area
- Monument polygons
- Monument Points

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title: NRHE Records

Figure:	Drawing No:
16.8	PC2978-RHD-ZZ-XX-DR-Z-0557

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/03/2023	ND	GSP	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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16.4.2.5 HER Records

159. Within the Offshore Export Cable Corridor, there is one HER record while. This is presented on **Figure 16.9** and comprises MDV57283 Braunton Areas A, B, C and D of US Assault Training Centre (MDV73990).

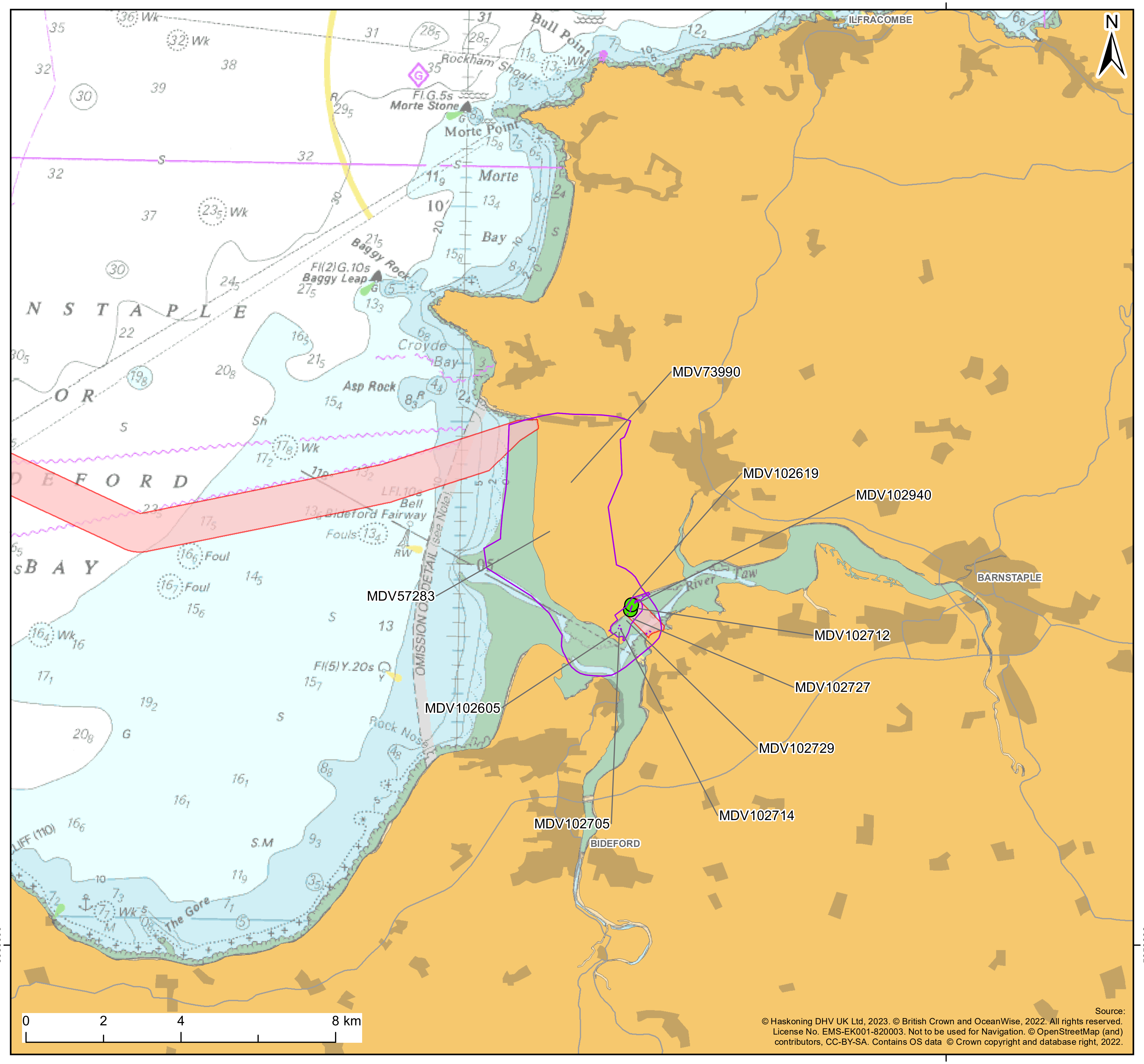
160. The Assault Training Centre covered eleven separate areas. The brief of the Assault Training Centre was to train combat units under realistic battle conditions in preparation for D-Day. This included overcoming on and offshore obstacles, reduction of fortifications, repulsing of counter attacks and establishing of the beach head.

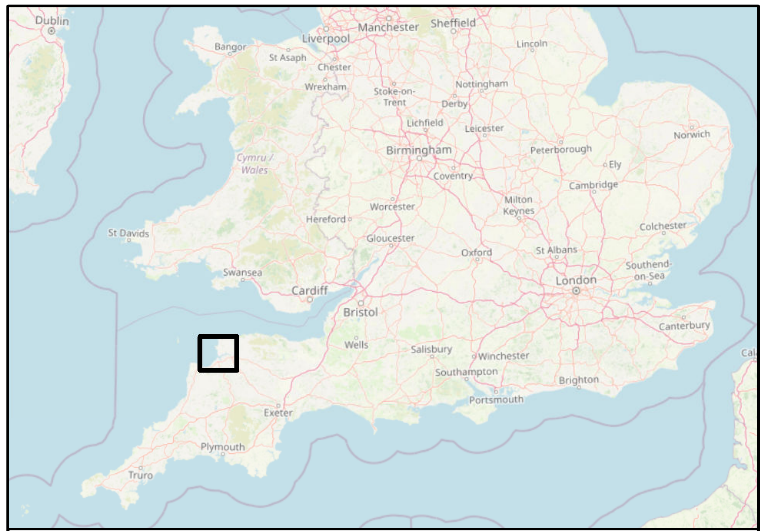
161. Facilities included a full-scale German-type 'Hedgehog' and full-scale obstacles and individual fortifications of various types sited along the sheltered beaches (including Croyde and Woolacombe). Also, mock-ups of various types of landing craft, obstacle courses, combat ranges and observation towers. Accommodation was in tent cities at Braunton and Croyde and at the hutted Braunton Camp.

162. Area A covered the southern part of Braunton Burrows with constructions including mock-up areas, an assembly area and five Estuary Beaches. Area B covered the southwestern part of Braunton Burrows with constructions including engineer obstacle courses, pillboxes, demolition range and two Estuary Beaches (Bass, 2005).

163. Area C spanned the central part of Braunton Burrows with the training ranges concentrated in the coastal strip with pillbox-sized concrete structures running parallel to the shore. Constructions included engineer and infantry demolition ranges, rocket range and Saunton Blue and Yellow Beaches as well as part of Estuary Red Beach.

164. Area D at the northern end of Braunton Burrows contained the greatest concentration and diversity of assault ranges and training constructions. The majority were built on Saunton Golf Course and were subsequently demolished or buried. Constructions included a flamethrower range, tank trap, target pits, radio towers, 'Hedgehog', pillboxes and Saunton Green, Yellow and Red Beaches (Bass, 2005).





Legend:

- Offshore Development Area
- Monument Polygons
- Monument Points

Client: Offshore Wind Ltd.	Project: White Cross Offshore Windfarm

Title: HER Records

Figure:	Drawing No:
16.9	PC2978-RHD-ZZ-XX-DR-Z-0558

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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16.4.2.6 Aviation remains

165. There are no known wrecks or aviation crash sites protected under the Protection of Military Remains Act 1986.

166. A single Historic England record for an aircraft is located within the Offshore Cable Corridor. This is the reported loss of an Armstrong Whitworth Whitley Mk. V night bomber (1342752) which was ditched off Barnstaple in 1943 due to bad weather (see **Figure 16.8**). A named location does not signify wrecked remains but is an approximate location of where the crash was thought to have happened.

167. No anomalies characteristic of aviation remains were identified by MSDS Marine within the geophysical data, however, should aviation remains be located within the windfarm these would likely be associated with WWI and WWII and would be afforded protection under the Protection of Military Remains Act 1986.

16.4.2.7 Cultural significance of identified assets

168. The cultural significance of unidentified wrecks and debris, archaeological anomalies and potential wrecks, aircraft, and isolated finds (which are yet to be discovered) is currently unknown. The archaeological interest (or otherwise) of these features will be further examined post-consent (e.g., investigation of individual anomalies (ground truthing) through Remotely Operated Vehicle (ROV) and/or diver survey).

169. Once the character, nature and extent of selected features are more fully understood, their cultural significance can be described to inform any requirements for further work on a case-by-case basis.

170. The cultural significance of shipwrecks lies largely in their historic and archaeological interest, in terms of their historical associations with people or events and with their research value.

171. Regarding setting, as for seabed prehistory above, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer'. Although some wreck sites have a setting which can be experienced and appreciated within their seascape (by divers or visitors on boats trips for example) none of the wrecks identified within the Offshore Development Area fall into this category, due to distance from shore, for example. Setting (in terms of the surroundings in which they are experienced), does not, therefore, form a key part of their significance.

16.4.2.8 Heritage importance of identified assets

172. The heritage importance of unidentified wrecks and debris, and potential wrecks, aircraft, and isolated finds (which are yet to be discovered) is currently unknown and these are, therefore, assessed as being of high importance as a precautionary measure. However, for 'potential' sites each individual discovery will be considered independently and any requirements for further data gathering, or analysis will be considered on a case-by-case basis proportionate to the importance of the discovery.

173. Isolated finds of maritime or aviation origin within secondary contexts will have evidential value for patterns of activities offshore and are assessed as being of medium importance. A summary of heritage importance is presented in **Table 16.24** below.

174. Isolated, fragmentary and buried remains associated with the US Assault Training Centre (MDV57283) are also assessed as being of medium importance. However, collectively would have higher archaeological importance, particularly if *in situ* archaeological sites were to be present.

Table 16.23 Heritage importance (maritime and aviation archaeology)

Asset Type	Definition	Importance
Known maritime heritage assets	Debris identified as possible wreck sites or associated debris (WC22_0043, WC22_0063 and WC22_0045)	High
	Previously recorded wrecks not seen in geophysical data	
Additional anomalies	Anomalies identified by geophysical assessment that could be of anthropogenic origin	High
Potential wrecks	Wrecks within the study area that are yet to be discovered	High
Potential derived maritime finds	Isolated artefacts lost from a boat or ship or moved from a wreck site	Medium
Potential derived aviation finds	Isolated artefacts lost from an aircraft or moved from a crash site	Medium

16.4.3 Intertidal Archaeology

16.4.3.1 Description of identified assets

175. Within the intertidal zone there are no designated heritage assets and 14 non-designated assets. One falls within the Offshore Development Area, while the remainder are located within the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge). The distribution of these is presented in **Figure 16.9** and presented in **Table 16.25**.

Table 16.24 Summary of HER Records in the Intertidal Zone

MonUID	Name	Summary
MDV102605	Possible intertidal structures north of West Yelland Marsh	Three linear features are visible in the intertidal zone on aerial photographs taken in 2010. They may be structural, as their alignment differs to the outcrops of rock in this location but could be a result of vegetation growth relating to modern activity. They are not visible on any earlier available aerial photographs and caution must be exercised in interpretation, but it is possible that they are intertidal structures that have eroded out of the shoreline.
MDV102705	Military training area between Broadsands and Crow Point, Braunton Burrows.	The area between Broadsands and Crow Neck was used for military training in the Second Word War; the 'embarkation beaches' were a core part of the US training area for Operation Overlord. Numerous structures, pits and tracks are visible on aerial photograph taken in the 1950s, and very few manifest in a recognisable form above the ground surface in 2010. They are described in greater detail in individual records. The site continued in military use and later structures are visible on aerial photographs into the 1950s.
MDV102712	Craters on the foreshore at Broadsands	Several craters are visible as earthworks on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord. The earthworks are visible in 1946 but have probably been levelled by water action since.
MDV102712	Craters on the foreshore at Broadsands	Several craters are visible as earthworks on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV102714	Two possible minefields on the foreshore at Broadsands	Two groups of craters in a rough grid pattern are visible as circular earthwork pits on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.

MonUID	Name	Summary
MDV102714	Two possible minefields on the foreshore at Broadsands	Two groups of craters in a rough grid pattern are visible as circular earthwork pits on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV102727	Possible anti-tank obstacles at Broadsands	Probable concrete anti-tank obstacles are visible as structures on aerial photographs in the 1940s, and form part of the Second World War U.S. military training site. Examination of aerial photographs from 2010 suggests that there is a row of features here.
MDV102728	Anti-tank obstacles at Broadsands	Probable concrete anti-tank obstacles are visible as a row of structures on aerial photographs in the 1940s, and form part of the Second World War U.S. military training site. They are not visible on later available aerial photographs and are likely to have been removed or covered by sand.
MDV102729	Two scaffold structures on Broadsands	Two scaffold structures are visible on aerial photographs in the 1940s. They are sited next to a channel and likely to have been used during military training, perhaps for U.S. troops to practice descent into landing craft during the latter part of Second World War.
MDV102940	Earthworks from mines or military training on the foreshore at Broadsands	An extensive area of linear earthworks is visible on aerial photographs taken between 1945 and 1946. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV102940	Earthworks from mines or military training on the foreshore at Broadsands	An extensive area of linear earthworks is visible on aerial photographs taken between 1945 and 1946. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV57283	Braunton Areas A, B, C and D of US Assault Training Centre	Braunton Areas A, B, C and D of US World War II Assault Training Centre in North Devon.
MDV102619	Anti-glider poles across Horsey Island and Braunton Marshes	A large number of pale upright poles across Braunton Marshes are visible on oblique aerial photographs between 1944 and 1945. They are interpreted as early Second World War anti-glider defences. Some infield poles may have been removed by 1944, and the remainder removed by 1946.

MonUID	Name	Summary
MDV102619	Anti-glider poles across Horsey Island and Braunton Marshes	A large number of pale upright poles across Braunton Marshes are visible on oblique aerial photographs between 1944 and 1945. They are interpreted as early Second World War anti-glider defences. Some infield poles may have been removed by 1944, and the remainder removed by 1946.

176. The records presented within **Table 16.25** are all related to MDV57283 Braunton Areas A, B, C and D of US Assault Training Centre which is summarised in **Section 16.4.2.5**.

177. As discussed above in **Section 16.4.2.2**, after the war the military infrastructure was demolished and bulldozed into the sea. As such, any remains will likely be fragmentary in nature. It must be noted however, that D-Day re-enactments organised by the Assault Training Centre Friends occur on an annual basis. As such, the Assault Training Centre is not only important due to potential physical remains but through its setting and public interest.

178. Of the 439 magnetic anomalies discussed above in **Section 16.4.2.2**, one of these is located within the intertidal zone. This is summarised in **Table 16.25** below. An additional, ten are located outside the Offshore Export Cable Corridor. These and WC22M_1029 are likely to be associated with the US Assault Training Centre (MDV57283). Should any of these be associated with loss of life, they could fall under the Protection of Military Remains Act 1986, however, no loss of life is known to have occurred at Saunton Sands.

Table 16.25 Magnetic anomalies within the intertidal zone

ID	Amplitude	POINT_X	POINT_Y
WC22M_1029	16	414032.8	5663298.9

179. Additionally, as discussed above in **Section 16.4.1**, the Devon HER records extensive evidence of Mesolithic occupation within the wider coastal regions of the Offshore Development Area namely the intertidal zone at Westward Ho!. Around Croyde and around Northam. Neolithic and Bronze Age finds, largely comprising flint scatters, have also been found at the locations above. As such, there is potential for prehistoric remains to be present within the intertidal zone. However, if present, these are likely to be isolated finds as the construction and subsequent the demolition of the US Assault Training Centre will have had a negative impact on any archaeological sites, possibly resulting in their removal.

16.4.3.2 Cultural significance of identified assets

180. The HER record relates to previously recorded assets which are largely no longer present, although there is potential for the presence of fragmentary remains relating to the US Assault Training Centre (MDV57283). Their cultural significance, therefore, is currently unknown although the archaeological interest (or otherwise) of any remains which come to light during the course of the Offshore Project will be described to inform any requirements for further work on a case-by-case basis.

181. Previously recorded assets are no longer present within their 'setting' and setting does not, therefore, contribute to their significance. However, whilst buried archaeological sites may not be 'readily appreciated by a casual observer' surviving defensive structures, such as the pillbox described above, will be encountered within their original, intended coastal setting, a contextual setting which was fundamental to their use in the preparation of the D-Day Landings. In this respect, should such remains be present, their setting would contribute to their significance especially as the site holds a public interest through the annual D-day re-enactments. However, below MHWS this contribution is limited through their survival as fragmentary, buried remains as opposed to *in situ* extant structures.

16.4.3.3 Heritage importance of identified assets

182. Should prehistoric sites be encountered within the intertidal zone, particularly in context with nearshore evidence of prehistoric occupation, these will be of national, or possibly international interest, with significant potential to contribute to acknowledged international and national research objectives. Given the particularly high importance of these *in situ* sites, any palaeoenvironmental evidence discovered in the context of an *in situ* prehistoric site would also be of high importance.

183. Although palaeoenvironmental material encountered beyond the context of an *in situ* prehistoric site still has evidential value for understanding changes in the climate and environment within offshore contexts, isolated discoveries should be considered of low importance for the purposes of assessment.

184. Isolated finds of prehistoric archaeological material within secondary contexts, also have evidential value for understanding patterns of population and exploitation of former landscapes, for example. However, as these finds are derived, and out of context, they are regarded as being of medium rather than high importance.

185. Isolated, fragmentary and buried remains associated with US Assault Training Centre (MDV57283) are also assessed as being of medium importance. However, collectively would have higher archaeological importance, particularly if *in situ*

archaeological sites were to be present. Should any of these be associated with loss of life, they would fall under the Protection of Military Remains Act 1986, however, no loss of life is known to have occurred at Saunton Sands.

186. The heritage importance of the potential heritage assets outlined above are presented in **Table 16.26**.

Table 16.26 Heritage importance (Intertidal Archaeology)

Asset Type	Definition	Importance
Potential *in situ* archaeological sites (i.e. relating to the US Assault Training Centre)	Primary context features and associated artefacts and their physical setting (if/where present)	High
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material	Low
	Palaeoenvironmental material associated with prehistoric settlements or archaeological evidence for prehistoric activities	High
Intertidal heritage assets	WW2 coastal defences (fragmentary and buried remains on beach)	Medium
Potential derived intertidal finds	Isolated artefacts and findspots dating to all periods which are located within the intertidal zone	Medium

16.4.4 Historic Seascape Character

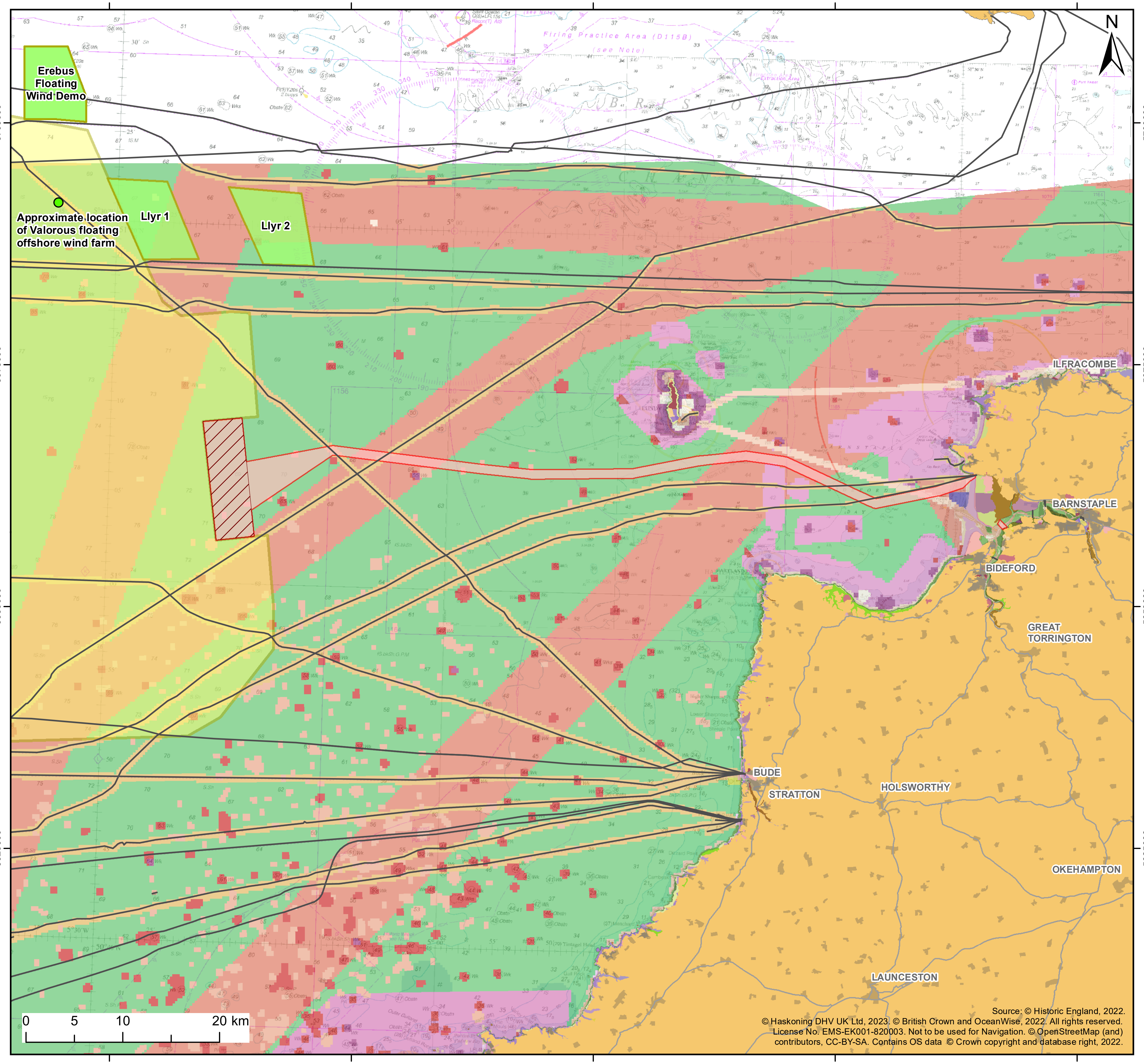
187. The Historic Seascape Character (HSC) of coastal and marine areas around England has been mapped through a series of eight separate projects funded by Historic England and undertaken between 2008 to 2015. This has since been followed by an initiative to consolidate the existing projects into a single national database (LUC, 2017a, 2017b, 2017c). The programme uses GIS to map data that can be queried to identify the key cultural processes that have shaped the historic seascape within a given area.

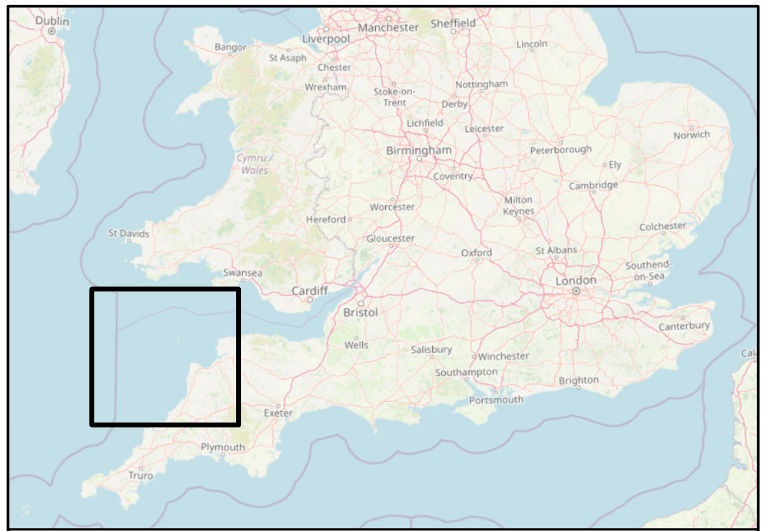
188. This was done as a pilot study and represents a 'point in time' study. As such, additional data and Offshore Project information has been taken into account for the assessment of the Bristol Channel and Severn Estuary and South West Peninsula HSCs (see **Table 16.27**).

189. The consolidated national GIS dataset was mapped against the study area, including other constructed and propsed project (**Figure 16.10**), to identify the primary cultural processes which have shaped the historic seascape of the study area. This includes both the current character types (**Figure 16.11**) and the previous

(prehistoric and historic) (**Figure 16.12**) character types for which information is available. The accompanying character texts were used to identify the primary values and perceptions for each character type summarised in **Table 16.27**.

190. A qualification of change since production of the HSC baseline as well as potential changes to the character should the application for the Offshore Project be successful is also included in **Table 16.27**.





Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Historic Seascape Character and Constructed/Proposed Development

Figure: 16.10 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0479

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	03/03/2023	AB	GSP	A3	1:400,000
P01	06/01/2023	AB	GSP	A3	1:400,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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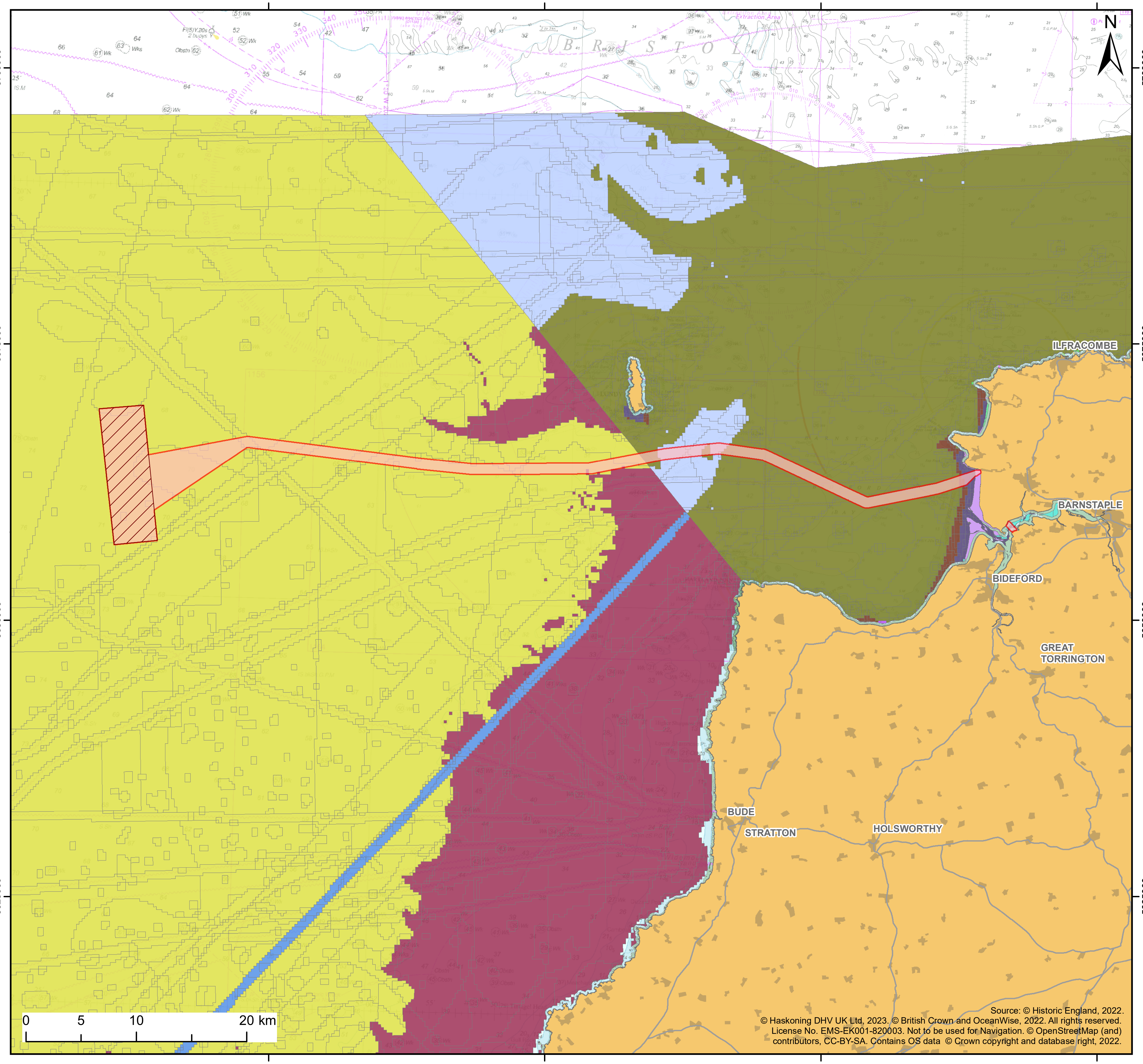

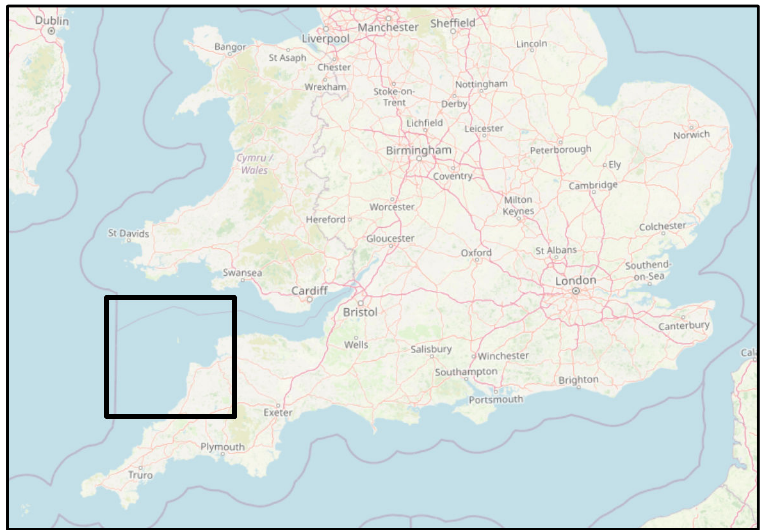

Legend:

- Windfarm Site
- Offshore Development Area

Historic Seascape Character: Previous Sub-types

- Anchorage, Early Modern (AD1750 – 1900)
- Anchorage, Unknown
- Buoyage, Unknown
- Ferry crossing, Early Modern (AD1750 – 1900)
- Fish trapping, Unknown
- Fishing ground, Early Modern (AD1750 – 1900)
- Fishing ground, Post Medieval (AD1540 – 1750)
- Landing point, Early Modern (AD1750 – 1900)
- Military practice area, Modern (AD1900 – Present)
- Mining (metals), Early Modern (AD1750 – 1900)
- Palaeolandscape component, Bronze Age (2500BC – 800BC)
- Palaeolandscape component, Mesolithic (10,000BC – 4000BC)
- Palaeolandscape component, Neolithic (4000BC – 2500BC)
- Palaeolandscape component, Upper Palaeolithic (50,000BC – 10,000BC)
- Rocky foreshore, Unknown
- Sandy foreshore, Unknown
- Submarine telecommunications cable, Modern (AD1900 – Present)
- Submerged forest, Unknown

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title: Historic Seascape Character - Previous Sub Type 1

Figure: 16.11 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0480

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	03/03/2023	AB	GSP	A3	1:350,000
P01	06/01/2023	AB	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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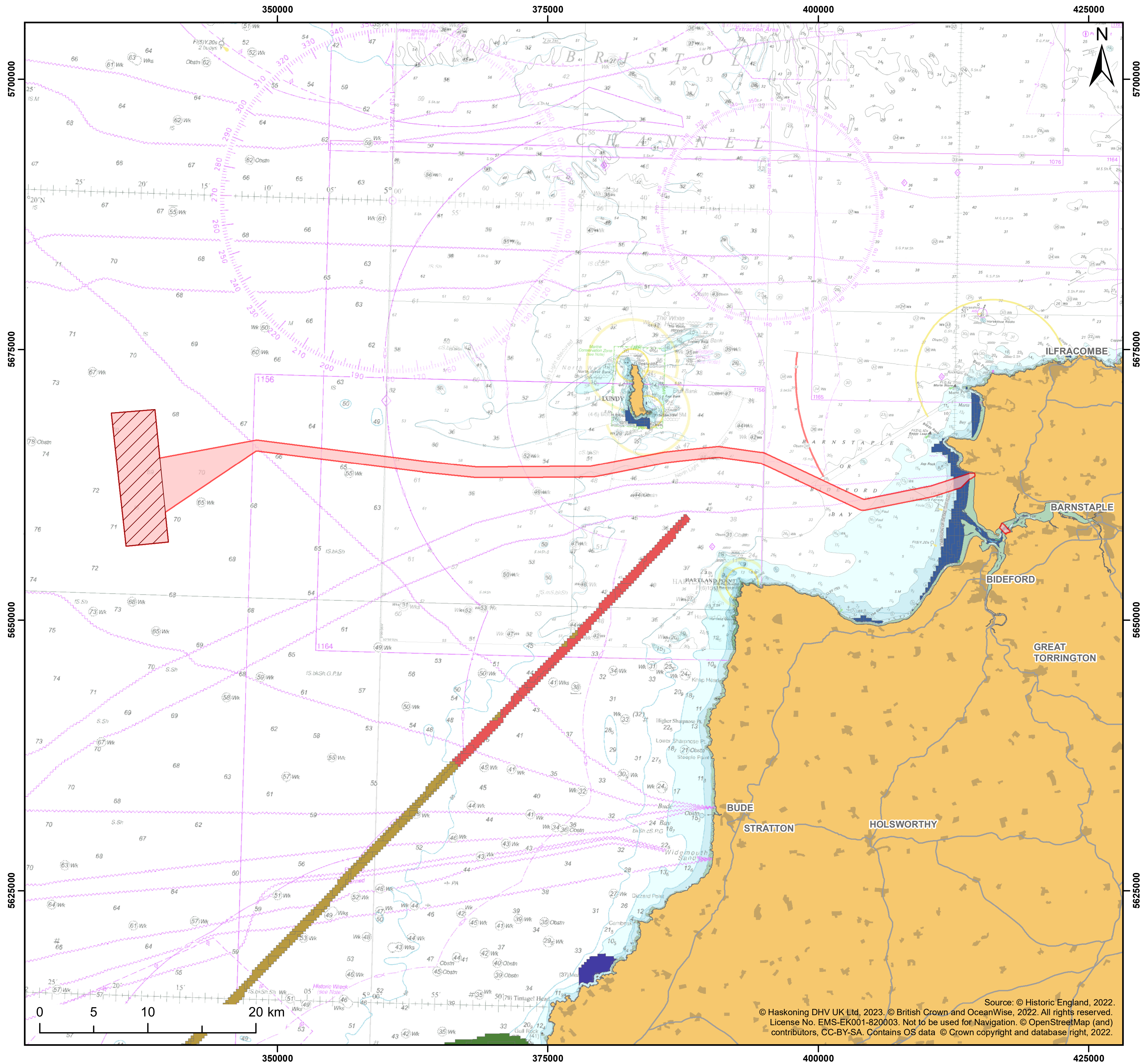

Legend:

- Windfarm Site
- Offshore Development Area

Historic Seascape Character: Previous Sub-types

- Fishing ground, Early Modern (AD1750 – 1900)
- Fishing ground, Medieval (AD1066 – 1540)
- Fishing ground, Post Medieval (AD1540 – 1750)
- Palaeolandscape component, Bronze Age (2500BC – 800BC)
- Palaeolandscape component, Mesolithic (10,000BC – 4000BC)
- Palaeolandscape component, Neolithic (4000BC – 2500BC)
- Seine netting, Early Modern (AD1750 – 1900)
- Submerged forest, Neolithic (4000BC – 2500BC)
- Submerged forest, Unknown

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Historic Seascape Character - Previous Sub Type 2

Figure: 16.12	Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0482

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	03/03/2023	AB	GSP	A3	1:350,000
P01	06/01/2023	AB	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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Table 16.27 Summary of historic seascape character types

Broad Character Types	Character Sub-Types	Descriptions, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with the Offshore Project
Fishing	Fishing ground	Fishing is one of the dominant character types mapped in the Offshore Development Area. It is one of the more dominant character types within the Bristol Channel and Severn Estuary and South West Peninsula HSCs. Historically herring and pilchard fishing dominated the 16th and 17th centuries, while long distance fishing emerged in the 18th century. By the mid-19th century travelling activity had emerged. Presently fishing in this region comprises bait digging, bottom trawling, shellfish collection, fixed netting, hand netting, long lining, seine netting, drift netting, pelagic trawling, demersal trawling, fishing grounds, potting, shellfish dredging and fish trapping. The West Country fisheries have, for much of their history, largely been domestic and relatively small-scale yet widely dispersed. This is reflected in the scale of the traditional fishing activities and comparative lack of industrial scale shipbuilding, although the South Devon trawling ports of the mid-late 19th century came to dominate the national fleet. Cornish fishing differed markedly from that practised further east in Devon, Dorset, and Somerset. It followed a pattern of pre-industrial methods and techniques right up until the 20th century. On the south coast there are many fishing ports, the largest and most significant being Newlyn, Cornwall and Brixham, Devon.	No identified change	Although there will be areas where fishing activities are temporarily displaced due to construction works, fishing activities will still be permitted in areas of the offshore development not undergoing construction activities. Similarly, fishing activities will not be prohibited during the operation phase of the Offshore Project, although temporary restrictions may apply during construction and around major maintenance activities. While fishing will not be prohibited during the operation phase of the Offshore Project, it is unlikely to occurs do to the risk of snagging on the seafloor.

Broad Character Types	Character Sub-Types	Descriptions, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with the Offshore Project
		Modern perceptions of fishing are often that it is now destructive of fish stocks and the seabed. But it is also still seen as an important element in the local economy in many places.		
Navigation	Navigation Activity: Ferry crossing Navigation route	Navigation' has always been important to the region's offshore areas with the South West peninsula lying at the junction of the Irish Sea, the Celtic Sea, the Atlantic Ocean and the English Channel. It is the first part of England to be reached by ships coming in from the west, and the final port of call for those leaving. Ferries have run across the Severn, notably from Aust to Beachley, since at least the twelfth century. Shorter ferry routes around the region, particularly across the rias of Cornwall and Devon provide or have provided ferries for foot passengers. Vehicle ferries can be found at King Harry Ferry on the Fal, Bodinnick on the Fowey, Torpoint on the Tamar, and Dartmouth. Longer distance ferries operate from Weston-Super-Mare to Steep Holm, Ilfracombe and Bideford to Lundy, Penzance to St Mary's, Plymouth to Roscoff and Santander, and Weymouth to the Channel Islands This Character Type has been shaped by exploratory navigation and coastal trade routes from the prehistoric period onwards.	No identified change.	Short term construction activities at the Landfall to MHWS l, and the presence of Landfall to MHWS infrastructure and offshore export cables, which will remain largely undetectable and therefore not perceived by the public, are considered unlikely to result in a meaningful change to the perceived character of maritime safety.
	Navigation Hazard: Maritime debris Wreck hazard Drying hazard	Historically, the sea has been perceived as a dangerous place which often behaves in unexpected and unpredictable ways. Based on the UKHO definition, wrecks become dangerous in shallow water when they are either	Survey and evaluation for new plans and projects have extended public understanding of these hazards and new wrecks and finds have been identified as a direct result of activities. This ongoing	The primary perceptions which associate hazardous water and wrecks with local heritage and stores relating to dangers of the high seas, to recreational diving and to wrecks as habitats could be

Broad Character Types	Character Sub-Types	Descriptions, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with the Offshore Project
		exposed and/or found less than 10m below the sea-level. Wrecks have most relevance from their roles as hazards to navigational activity or as indicators of areas and routes of past navigational, naval, or trading activity. Hazardous water includes wrecks and other hazards such as submerged rocks, shoal, or flats. Navigational hazards have always been a preoccupation for sailors, but they became prominent in people's consciousness, including in tales and myths, evoking rhymes, and songs, due to the danger associated within them. Wrecks, although fatal for many, added to the local heritage of stories about dangers on the high seas. There are also now perceived as recreational opportunities, with many wrecks dived by both amateur dive groups and professional organisations. Many wrecks are also valued for their strong contribution to habitat diversity and by the fishing community as they attract certain prey specifies. See **Section 16.4.2** for detail on wrecks within the study area.	accumulation of publicly available data acquired as part of the consenting process prior to activities is considered to be of public value.	enhanced through the provision of publicly available data on seabed features identified during geophysical survey, and in the event of unexpected discoveries reported through the PAD during construction activities. During operation, the Offshore Project may result in a change to the perception of navigational hazards on the basis that the introduction of wind turbines represents additional navigation hazards. They are, however, equipped with navigational features such as warning lights. On this basis, this character sub-types are considered to have the capacity to accommodate this level of change.
Communications	Submarine telecommunications cable	Mapped as a minor character type within the Offshore Development Area. There are four submarine telecommunications tables which cross the offshore cable corridor. These are: Ormonde UK-Ireland 2 Crossing (Active) TAT 11 (Decommissioned) TATA Atlantic South (Active) TATA W. Europe UK-Spain (Active) Two the cables make landfall at Saunton. Submarine telecommunications cables are mostly undetected in the marine	No identified change	As submarine telecommunications cables are mostly undetected in the marine environment it is unlikely that perceptions of this character type will be altered by construction activities or by the presence of installed infrastructure.

Broad Character Types	Character Sub-Types	Descriptions, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with the Offshore Project
		environment. However, they are a highly reliable form of transferring information and are critical to our present-day life. They can be perceived as obstacles to certain sea users such as fishermen and dredgers.		
Cultural topography	Rocky foreshore	The intertidal zone at the landfall is characterised by the sandy foreshore at Saunton Sand with a rocky foreshore along the cliffs to the north. These are primarily visited for leisure, forming one of the principle areas by which most people engage directly with the inter-tidal and marine zones.	No identified change.	Short term construction activities at the Landfall to MHWS, and the presence of Landfall to MHWS infrastructure and offshore export cables, which will remain largely undetectable and therefore not perceived by the public, are considered unlikely to result in a meaningful change to the perceived character type.
Recreation	Leisure fishing Leisure beach	The offshore cable corridor overlaps with Saunton Sand a popular leisure beach and tourist destination, and an area of leisure fishing. Recreation and tourism is an important industry in the region.	No identified change.	The presence of Landfall to MHWS infrastructure will remain largely undetectable and therefore not perceived by the public. No change to perceptions of the foreshore are anticipated. Access to the beach maybe temporarily halted during installation activities.
Military	Naval firing range	A 'Naval firing range' refers to an area of sea across which naval ships fire artillery at target sites or areas. In some cases, accompanied by land-based observation facilities housing equipment to record accuracy and damage. Around English Territorial Waters there are several designated military practice areas, formally entitled 'Practice and Exercise Areas' (PEXAs), which are in use or available for use by the Ministry of Defence (MoD) for practice and exercises. These include Royal Air Force (RAF) practice areas, submarine exercise areas and firing danger areas. One off	No identified change.	Short term construction activities associated with the offshore export cables, which will remain largely undetectable and therefore not perceived by the public, are considered unlikely to result in a meaningful change to the perceived character of this character type.

Broad Character Types	Character Sub-Types	Descriptions, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with the Offshore Project
		the south–east Cornwall coast is used for live firing exercises. Public access across these areas is only restricted during active exercises.		
Previous character types	Palaeolandscape component	Within the study area, the HSC describes the known existence of a general palaeolandscape, considered to be a mixture of peats and forest beds. There are no know palaeolandscape remains in the study area, however, peat deposits and submerged forest are recorded at Northam Burrows and Westward Ho! And the wider are. Many of these organic deposits preserve a wide range of biological remains including wood, pollen, plant macrofossils, insects, diatoms, and foraminifera. Pollen sequences dating to the Mesolithic period (10ka-6ka BP) are particularly well represented in the South West for example at Westward Ho! The archaeological community has only slowly built on the recognition that maritime archaeology is not only concerned with shipwrecks but also submerged former terrestrial landscapes and more recently, the character of all human activity and its effects on the marine environment. The archaeological potential that exists on the continental shelves has become more recognised in the UK in recent years with submerged landscapes becoming an ever more recognised and valued archaeological resource. See **Section 16.4.1** for detail on potential submerged prehistoric landscapes within the study area.	As stated for the cultural topography character type above, new plans and projects have further restricted access to these deposits and the underlying palaeolandscapes (through the physical presence of cables and foundations, for example) or reduced the extent of deposits, through dredging for example. However, a beneficial impact is the ongoing accumulation of publicly available data acquired as part of the consenting process prior to activities which is considered to be of public value.	There is the potential for positive enhancement of primary perceptions associated with a growing interest in submerged landscapes through the provision of publicly available data on palaeolandscapes following the further archaeological and geoarchaeological assessment of survey data. As the final design of layouts will take palaeolandscapes into account, this change can be offset by the accumulation of publicly available data acquired by the Offshore Project prior to construction which is considered to be of public value.

Broad Character Types	Character Sub-Types	Descriptions, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with the Offshore Project
	Military practice area	Within the intertidal zone there are Areas A, B, C and D of US Assault Training Centre (MDV57283) was partially located. The Assault Training Centre covered eleven separate areas. The brief of the Assault Training Centre was to train combat units under realistic battle conditions in preparation for D-Day. This included overcoming on and offshore obstacles, reduction of fortifications, repulsing of counter attacks and establishing of the beach head.	No identified change.	Short term construction activities at the Landfall to MHWS, and the presence of Landfall to MHWS infrastructure and offshore export cables, which will remain largely undetectable and therefore not perceived by the public, are considered unlikely to result in a meaningful change to the perceived character of maritime safety.
	Fishing ground	Described above	No identified change.	Although there will be areas where fishing activities are temporarily displaced due to construction works, fishing activities will still be permitted in areas of the offshore development not undergoing construction activities. Similarly, fishing activities will not be prohibited during the operation phase of the Offshore Project, although temporary restrictions may apply during construction and around major maintenance activities. While fishing will not be prohibited during the operation phase of the Offshore Project, it is unlikely to occurs do to the risk of snagging on the seafloor.

16.4.5 Climate Change and Natural Trends

191. The existing environment for archaeology and cultural heritage as set out above has been shaped by a combination of factors. The most prevalent of these being changes in global sea levels and associated climatic and environmental conditions. These have affected the burial and preservation of prehistoric archaeology, and latterly that of maritime and aviation archaeology.

192. Historic England (2018) recognise, "that the marine and inter-tidal zones are dynamic and have always undergone natural environmental change and changing patterns of use and exploitation which are nothing new".

193. The baseline conditions for Archaeology and Cultural Heritage will continue to be controlled by waves and tidal currents driving changes in sediment transport and then seabed morphology. However, the long-term established performance of these drivers may be affected by environmental changes including climate change driven sea-level rise. Climate change will have little effect offshore where landscape-scale changes in water levels (water depths) far outweigh the effect of minor changes due to sea-level rise.

16.4.6 Do Nothing Scenario

194. The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) 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 Offshore Project (operational lifetime anticipated to be a minimum of 25 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 Offshore Project is not constructed, using available information and scientific knowledge of **Marine Archaeology and Cultural Heritage**.

195. In a do-nothing scenario there is no anticipated change to the heritage assets within the study area or their settings.

16.5 Potential impacts during construction

196. The potential impacts during construction of the Offshore Project have been assessed for **Marine Archaeology and Cultural Heritage**. A description of the

potential effect on **Marine Archaeology and Cultural Heritage** caused by each identified impact is given in this section.

16.5.1 Impact 1: Direct impact to known heritage assets

16.5.1.1 Description of Impact

197. Direct impacts encompass direct effects from the physical siting of the Offshore Project. Direct impacts to heritage assets, either present on the seafloor or buried within seabed deposits, may result in damage to, or destruction of, archaeological material. It may also result in the deterioration or destruction of the relationships between that material and the wider environment (stratigraphic context or setting).

198. These relationships are crucial to developing a full understanding of an asset. Such impacts may occur if heritage assets are present within the footprint of infrastructure components of the Offshore Project (i.e., turbine anchors and cables) or within the footprint of activities such as seabed clearance or the placement of jack up barges.

16.5.1.2 Magnitude of impact

199. With the application of the embedded mitigation (see **Section 1**), it is anticipated that all direct impacts to known heritage assets resulting from the Offshore Project would be avoided.

200. Based on the characterisation of the existing environment and the identification of known and potential heritage assets a total of five AEZs and 24 TAEZs have been established within the Offshore Development Area (see **Appendix 16.A**). The AEZs and TAEZs are presented on **Figure 16.13** and **Figure 16.14**and are summarised in **Table 16.29** and **Table 16.30** below.

Table 16.28 Archaeological Exclusion Zones within the Offshore Development Area

Anomaly ID	Description	Potential	WGS84 Z30N X	WGS84 Z30N Y	AEZ (m)
WC22_0043	Potential wreck	High	397965.1	5663488.3	50 radius
WC22_0063	Wreck	High	389369.4	5665020.2	50 extents
WC22_0041	Potential debris	Medium	365016.8	5663704.8	35 radius
WC22_0045	Potential wreck	Medium	398452.7	5663633.1	50 radius
WC22_0046	Likely geological	Medium	398731.6	5663638.9	25 radius

Table 16.29 Temporary Archaeological Exclusion Zones within the Offshore Development Area

Anomaly ID	Description	Amplitude	WGS84 Z30N X	Y	AEZ (m)
WC22M_0202	Magnetic	139.9	390080.3	5665418.2	50
WC22M_0228	Magnetic	160.5	401149.5	5661683.6	50
WC22M_0271	Magnetic	168.5	377748.5	5663792.0	50
WC22M_0273	Magnetic	201.9	378372.7	5663798.4	50
WC22M_0302	Magnetic	138.9	376083.2	5663486.6	50
WC22M_0326	Magnetic	165.6	376611.7	5663790.0	50
WC22M_0421	Magnetic	156.8	385818.3	5664964.6	50
WC22M_0554	Magnetic	170.3	388929.1	5665594.9	50
WC22M_0569	Magnetic	108.1	394375.0	5665187.7	50
WC22M_0616	Magnetic	133.6	393786.4	5665204.5	50
WC22M_0617	Magnetic	116.4	393997.6	5665201.8	50
WC22M_0618	Magnetic	137.6	393763.2	5664673.9	50
WC22M_0628	Magnetic	238.0	392862.1	5665251.7	50
WC22M_0633	Magnetic	256.7	392010.7	5665381.5	50
WC22M_0653	Magnetic	129.8	391326.9	5665928.1	50
WC22M_0735	Magnetic	104.0	388016.0	5664970.2	50
WC22M_0739	Magnetic	109.0	387418.8	5664981.7	50
WC22M_0651	Magnetic	184.1	391620.2	5665734.9	100
WC22M_0652	Magnetic	239.7	391622.1	5665814.4	100
WC22M_0696	Magnetic	268.4	389586.1	5665891.4	100
WC22M_0697	Magnetic	373.3	389591.5	5665830.9	100
WC22M_0698	Magnetic	260.3	389552.7	5665817.0	100
WC22M_1084	Magnetic	2435.0	413494.2	5662514.6	100
WC22M_1088	Magnetic	194.2	413624.6	5662493.0	100

201. TAEZs are recommended for large magnetic anomalies where an anomaly is not visible in the dataset but is known to exist, where the position cannot be determined with enough accuracy for refined exclusion zones, or where the extents are not fully known. For example, large anomalies located in rocky areas do not have TAEZs recommended as they would likely have been visible in the MBES data if they were of medium or high archaeological potential.

202. AEZs/TAEZs are not recommended at this time for features interpreted as being of low archaeological potential or small magnetic anomalies (<100nT). The positions of these features will be avoided by means of micrositing during detailed Offshore Project design, where possible.

203. The archaeological assessment of pre-construction survey data, including high resolution geophysical data and ROV investigations undertaken for the purposes of unexploded ordnance (UXO) identification, will further clarify the nature and extent

of these anomalies and the scheme design will be modified to either avoid heritage assets (i.e., implement new AEZs where appropriate) or undertake additional mitigation. Seabed features identified as being of low archaeological potential are not known heritage assets but have the potential to be, so are considered further as 'potential' heritage assets under Impact 2 (see **Section 16.7.2** below).

16.5.1.3 Importance of the receptor

204. As set out in **Table 16.14**, **Table 16.24** and **Table 16.27** *in situ* prehistoric, maritime and aviation sites are assessed as being of potentially high heritage importance, as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material).

16.5.1.4 Significance of effect

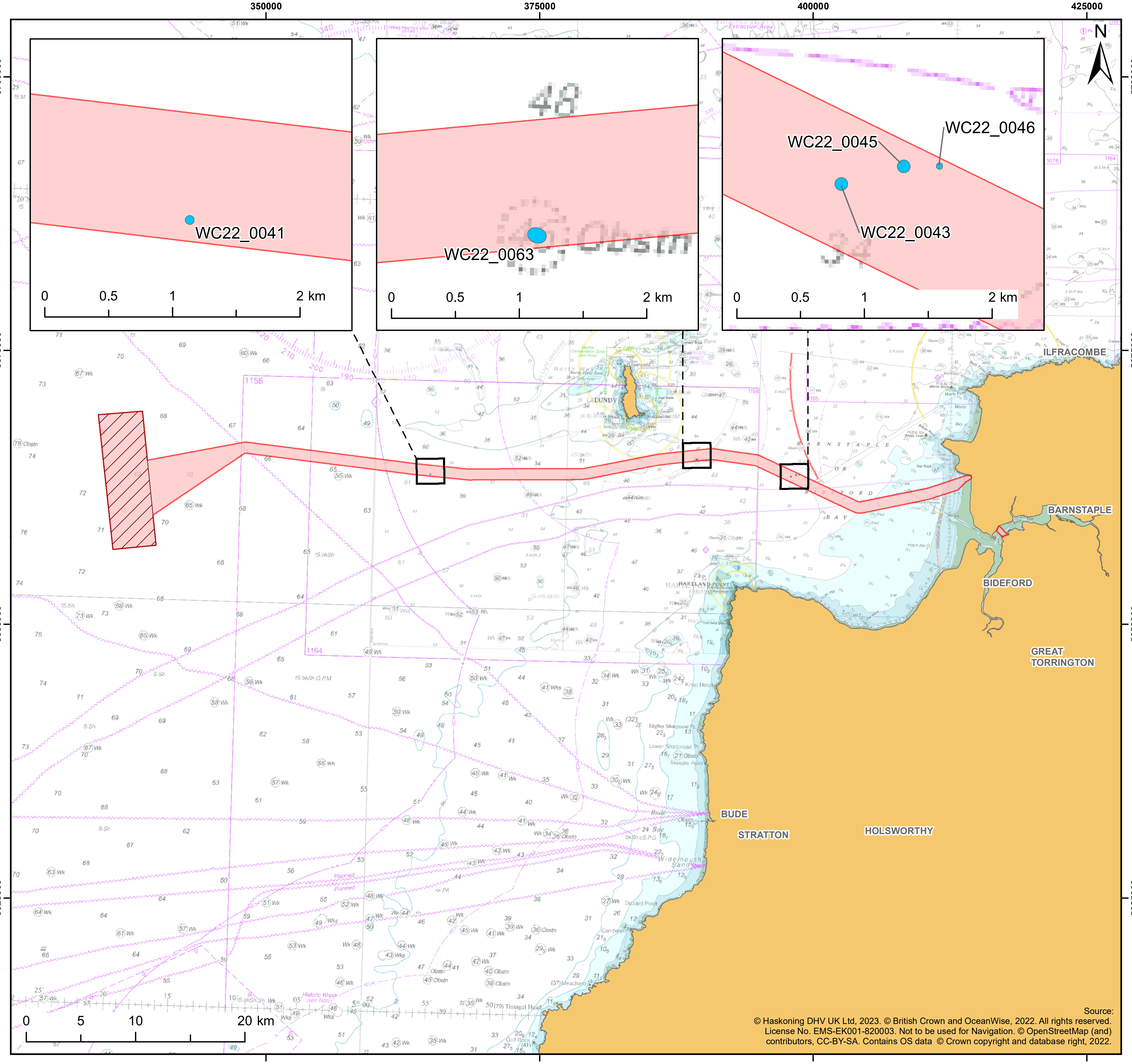
205. With the application of AEZs and TAEZs direct impacts to known heritage assets will be avoided, and there will be **no change** during construction.

16.5.1.5 Additional mitigation

206. AEZs (outlined in embedded mitigation) may be reduced, enlarged, or removed in agreement with Historic England if further relevant information becomes available. However, unless modified by agreement, it is important that AEZs are retained throughout the lifetime of the Offshore Project and monitoring of AEZs may be required by the regulator (MMO) and Historic England to ensure adherence both during construction and in the future operation of the wind farm.

207. TAEZs by their nature are more likely to be subject to change. TAEZs may be removed following further investigation and in consultation with Historic England if the feature proves to be non-archaeological. However, it may also be formalised as an AEZ if further investigation identifies an important heritage asset.

208. The approach to the implementation, revision, and monitoring of AEZs and TAEZs is set out in the Outline WSI (**Appendix 16.B**) which will be submitted alongside the ES and planning application. It is assumed that by the time of construction the majority or TAEZ will have been reduced or formalised as more information becomes available (additional geophysical data and UXO ROV investigations).



Legend:
- Windfarm Site
- Offshore Development Area
- AEZs

Client: Offshore Wind Ltd.

Project: White Cross Offshore Windfarm

Title: Archaeological Exclusion Zones

Figure: 16.13

Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0559

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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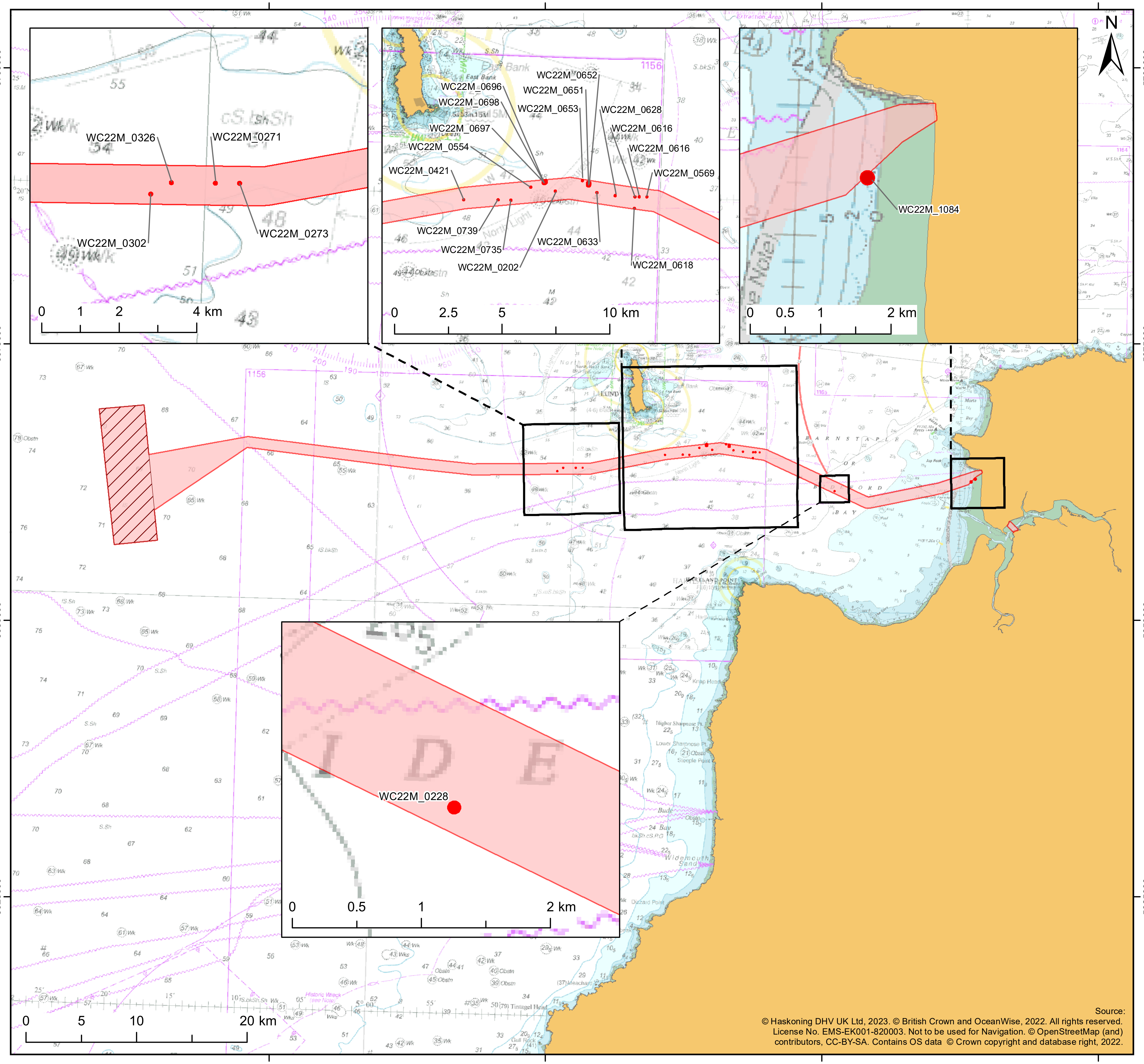

Legend:
- Windfarm Site
- Offshore Development Area
- TAEZs

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Temporary Archaeological Exclusion Zones

Figure: 16.14 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0560

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	07/03/2023	ND	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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16.5.2 Impact 2: Direct impact to potential heritage assets

16.5.2.1 Description of Impact

209. It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). Therefore, unavoidable direct impacts may occur if archaeological material is present within the Offshore Development Area of the Offshore Project associated with the following activities:

- Seabed preparation (including UXO and boulder clearance, where required)
- Installation of wind turbine moorings and foundations for OSP
- Installation of offshore cabling (inter array and platform link)
- Installation of the offshore cabling at Landfall to MHWS
- Installation of cabling crossing at Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge)
- Seabed contact by legs of jack-up vessels.

210. For the purpose of this assessment, potential heritage assets are regarded as comprising the following asset types:

- Potential *in situ* prehistoric sites, submerged landscape features, derived/isolated Prehistoric finds and palaeoenvironmental evidence
- Potential wrecks and derived/isolated maritime finds (including both seabed features and any further discoveries of material not seen in the geophysical data)
- Potential aircraft and derived/isolated aviation finds (including both seabed features and any further discoveries of material not seen in the geophysical data)
- Potential prehistoric, WWII and wreck remains within the intertidal zone
- Potential remains associated with the US Assault Training Centre (MDV57283).

16.5.2.2 Magnitude of impact

211. Until the final design and layouts are confirmed, there will remain an uncertainty in the precise nature and extent of any direct impacts. It is currently anticipated that, within the intertidal zone, either trenchless technology or open cut trenching will be used for the nearshore cable instillation. With the use of trenchless technology entry on the landward side of the beach, and exit below mean low water springs (MLWS) in the marine zone, will mean that impacts to potential intertidal archaeological material can be avoided.

212. With the use of trenchless technology for the nearshore cable installation the cable will pass beneath Quaternary deposits of potential archaeological interest and

therefore, no impact will occur. However, open and cut trenching would cause a direct impact to any potential heritage assets should these be present.

213. In terms of archaeological remains in the River Taw, the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge) is proposed as a trenchless cable installation crossing below the river. Options for the river crossing are likely to consist of a HDD or Direct Pipe, with connections likely being completed by an open-cut method. As such, archaeological remains will likely be avoided.

214. All direct impacts that result in damage to, or disturbance of, *in situ* archaeological material will be adverse, permanent, and irreversible. The 'fabric' of the asset and, hence, its potential to inform our historical understanding, will be removed.

215. In practice, the magnitude of the impact will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred. The extent of any impact will depend on the presence, nature, and depth of any such remains, in association with the depth, location and nature of construction-related groundworks and contact with the seabed. However, as a precautionary approach, it should be assumed that key elements of the asset's fabric could be lost or fundamentally altered, such that the asset's heritage significance is lost or severely compromised.

216. In accordance with the definitions set out in **Table 16.4**, without further mitigation, there is potential for direct impacts of **high adverse magnitude** upon potential *in situ* heritage assets.

16.5.2.3 Importance of the receptor

217. As set out in **Table 16.14**, **Table 16.24** and **Table 16.26**, *in situ* prehistoric, maritime and aviation sites are assessed as being of potentially high cultural heritage importance, as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material).

16.5.2.4 Significance of effect

218. In accordance with the significance matrix in **Table 16.5**, direct impacts to these heritage asset types thereby assessed as being of have the potential to be of **major adverse significance**, as a worst-case scenario.

219. Isolated/derived finds in secondary contexts are assessed as being of medium heritage importance. Should they be encountered during construction activities, direct

impacts to isolated finds are considered to be of potential **major adverse significance**.

16.5.2.5 Additional Mitigation

220. A further detailed archaeological assessment and interpretation of the SBP data is currently being undertaken by MSDS Marine to inform the planning of geotechnical investigations to reduce, as far as possible, the potential for unintended impacts during construction.

221. The examination of potential prehistoric deposits through the assessment of pre-submission geotechnical and geophysical data will further contribute to the body of scientific data available for the study of seabed prehistory within the Celtic Sea region (see **Section 16.8**). There will be archaeological input into any future sampling programmes and all available geotechnical data (e.g., samples / geotechnical logs acquired as part of engineering-led ground investigation works) will be subject to geoarchaeological assessment during the post-ES submission and post-application/post-consent stages of the Offshore Project.

222. If *in situ* prehistoric sites are identified resulting from such work, then mitigation measures to record and/or protect such sites will be agreed in consultation with Historic England.

223. Similarly, the archaeological assessment of high-resolution geophysical data to be acquired post-application/post-consent, together with ground-truthing of identified anomalies of potential archaeological significance, where required, will help to confirm, and clarify further the potential for maritime and aviation heritage assets.

224. As stated above in **Section 16.5.1.1**, AEZ and TAEZs are not recommended at this time for features interpreted as being of low archaeological potential or small magnetic anomalies (<100nT) although the design will be micro-sited to avoid the recorded locations where possible. As geophysical anomalies having potential archaeological interest, it is recognised that these features could also be modern or natural.

225. Where features cannot be avoided, then additional work may be required (to be undertaken post-consent) to establish the archaeological interest of the feature (e.g., investigation of individual anomalies (ground truthing) through ROV and/or diver survey). Once the character, nature and extent of selected features are more fully understood, appropriate mitigation measures (proportionate to the significance of the asset) to avoid, reduce or off-set impacts can be determined on a case-by-case basis. For example, if features of archaeological interest are confirmed during further

investigations, which are considered to be of sufficient significance to warrant preservation *in situ*, then they will be subject to the same mitigation as described for known heritage assets (AEZs) described in **Section 16.5.1** above.

226. Although measures will be taken to reduce, as far as possible, the potential for impact to previously undiscovered heritage assets it is still possible that unexpected discoveries may be encountered during construction. However, possible measures to further reduce the significance of potential impacts include ensuring that prompt archaeological advice is received in the event of a discovery and through recording and conserving any objects that have been disturbed.

227. In the event of an unexpected discovery, of an isolated find or multiple chance finds from a specific location possibly indicating a wider debris field representing previously unknown *in situ* archaeological material, this will be reported through a formal PAD, based upon the established Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014) (ORPAD). This will establish whether the recovered objects are of archaeological interest and allow for the application of appropriate mitigation measures where necessary.

228. For any new discoveries, any further mitigation which may be required will be considered on a case-by-case basis, proportionate to the significance of the discovery.

229. Isolated/derived artefacts, either of prehistoric, maritime or aviation origin within reworked deposits may be considered less sensitive to change than in-situ material, as their relationship with their context or physical setting is less relevant to understanding their significance.

230. In terms of potential intertidal remains, an archaeological watching brief or archaeological monitoring may be required, should open and cut trenching be used for the nearshore cable installation.

231. The approach to the implementation of the above mitigation measures (as well as embedded mitigation) is set out in the Outline WSI (**Appendix 16.B**).

16.5.2.6 Residual effect

232. If further seabed features are identified during post-PEIR submission and post-application/post-consent investigations, including the archaeological assessment of pre-construction survey data, these will be subject to the same mitigation measures (avoid, reduce, or offset) as set out directly above and in **Section 16.1.1**. Therefore, residual impacts will be the same as for known heritage assets (i.e., anticipated to be **no change**).

233. Similarly, regarding potential prehistoric sites, with the additional investigation of potential prehistoric deposits post-application/post-consent, and the application of additional mitigation in the event of the discovery of any prehistoric archaeological material, residual effects will be reduced or offset to levels considered non-significant in EIA terms (i.e., effects anticipated to be no worse than **minor adverse**).

234. In the event of unforeseen impact to potential sites both offshore and within the intertidal zone, the implementation of a formal PAD, supported by an archaeological watching brief or monitoring will ensure that any finds are promptly reported, archaeological advice obtained, and any recovered material is stabilised, recorded, and conserved.

235. The precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred. However, it is anticipated that the appropriate application of these additional mitigation measures, specifically tailored to the significance of a discovery, will result in residual effects no higher than **minor adverse** significance which is non-significant in EIA terms.

16.5.3 Impact 3: Indirect impact to heritage assets from changes to physical processes

236. As set out in **Chapter 8: Marine Geology and Physical Processes**, during the construction phase of the Offshore Project, all construction activities have been assessed as having a **negligible adverse** significance of effect. As such, there is **no pathway for change** to the fabric of any heritage asset.

16.5.4 Impact 4: Changes to the setting of heritage assets

237. Changes in setting due to construction activities will be temporary and of sufficiently short duration that they are not anticipated to give rise to material harm. As such, no change is anticipated. Long term impacts to the setting of heritage assets are discussed in **Section 16.6.4**.

16.6 Potential impacts during operation and maintenance

238. The potential impacts of the operation and maintenance of the Offshore Project have been assessed on **Marine Archaeology and Cultural Heritage**. A description of the potential effect on **Marine Archaeology and Cultural Heritage** caused by each identified impact is given in this section.

16.6.1 Impact 1: Direct impact to known heritage assets

239. As all known heritage assets will be avoided through the retention of AEZs throughout the lifetime of the Offshore Project, there is **no pathway for change** during routine or unscheduled maintenance activities.

16.6.2 Impact 2: Direct impact to potential heritage assets

16.6.2.1 Description of Impact

240. Direct impacts to potential heritage assets are unlikely to occur resulting from intrusive maintenance as any impacts would already have occurred during installation during the construction phase of the Offshore Project. These would already have been subject to appropriate and proportionate additional mitigation measures, as and where necessary.

241. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-ups deployed during planned or unscheduled maintenance activities, if these are located in areas which were not previously subject to disturbance.

16.6.2.2 Magnitude of impact

242. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred. Therefore, as for construction activities, and as a worst case, there is potential for direct impacts of **high adverse** magnitude upon potential *in situ* heritage assets and **low adverse** magnitude upon potential isolated finds.

16.6.2.3 Sensitivity of the receptor

243. As set out in **Table 16.14**, **Table 16.24** and **Table 16.26**, *in situ* prehistoric, maritime and aviation sites are assessed as being of potentially high cultural heritage importance, as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material).

16.6.2.4 Significance of effect

244. In accordance with the significance matrix in **Table 16.5**, direct impacts to these heritage asset types thereby have the potential to have **major adverse** effects, and significant in EIA terms, as a worst-case scenario.

245. Isolated/derived finds in secondary contexts are assessed as being of medium heritage importance. Should they be encountered during operation and maintenance

activities, direct impacts to isolated finds are considered to be of potential **minor adverse** significance which is non-significant in EIA terms.

16.6.2.5 Additional Mitigation

246. The archaeological assessment of post-construction monitoring data will further reduce, as far as possible, the potential for unintended impacts during operation. If further features of archaeological interest are identified these will be subject to the same mitigation as described for known heritage assets described in **Section 16.5.2** above with the primary approach being avoidance.

247. In the event of an unexpected discovery, the implementation of a formal PAD, throughout the operation phase, will allow for such discoveries to be efficiently reported, for advice to be provided and for any further mitigation to be considered on a case-by-case basis, proportionate to the significance of the discovery.

248. The approach to the implementation of these mitigation measures is be set out in an Outline WSI (**Appendix 16.B**).

16.6.2.6 Residual Effect

249. Although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that the implementation of a formal PAD, and the appropriate application of additional mitigation measures (see **Section 16.1.1**) if required, specifically tailored to the significance of a discovery, means that the residual effects will be no higher than **minor adverse** and not significant in EIA terms.

16.6.3 Impact 3: Indirect impact to heritage assets from changes to physical processes

250. As set out in **Chapter 8: Marine Geology and Physical Processes**, during the operation and maintenance phase of the Offshore Project, all changes to physical processes have been assessed as having an at worst **negligible adverse** significance of effect. As such, there is **no pathway for change** to the fabric of any heritage asset.

16.6.4 Impact 4: Changes to the setting of heritage assets

251. During the operational life of the Offshore Project the presence of the wind turbines and offshore platforms will introduce a clear change to the setting of offshore assets. However, as assessed in **Sections 16.4.1.1** and **16.4.2**, the setting of individual offshore heritage assets corresponds more broadly to their location (and

collective research value) within wider palaeolandscapes and maritime and aviation networks. Therefore, this is considered in more detail as part of their cumulative research value as discussed in **Section 16.8.1**.

252. Individually, the baseline setting of individual heritage assets is already influenced by passing vessels in this area associated with fishing and recreation, thereby reducing the potential magnitude of impact from the presence of vessels, personnel and infrastructure associated with maintenance activities, for example. The significance of effect would, therefore, be **negligible adverse** (which is non-significant in EIA terms) as the setting will change in a way which does not materially affect its cultural significance.

16.7 Potential impacts during decommissioning

253. The potential impacts of the decommissioning of the Offshore Project have been assessed on **Marine Archaeology and Cultural Heritage**. A description of the potential effect on **Marine Archaeology and Cultural Heritage** caused by each identified impact is given in this section.

16.7.1 Impact 1: Direct impact to known heritage assets

254. As all known heritage assets can be avoided through the retention of AEZs throughout the lifetime of the Offshore Project, there is **no pathway for change** during decommissioning.

16.7.2 Impact 2: Direct impact to potential heritage assets

16.7.2.1 Description of impact

255. Direct impacts to potential heritage assets are unlikely to occur as a result of decommissioning as any impacts would already have occurred during installation of the wind farm infrastructure during the construction phase and would already have been subject to appropriate and proportionate additional mitigation measures, as and where necessary.

256. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-ups deployed during decommissioning activities, if these are located in areas which were not previously subject to disturbance. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred.

16.7.2.2 Magnitude of impact

257. Therefore, as for construction activities, and as a worst case, there is potential for direct impacts of **major adverse** magnitude upon potential *in situ* heritage assets and **low adverse** magnitude upon potential isolated finds.

16.7.2.3 Sensitivity of the receptor

258. As set out in **Table 16.14**, **Table 16.24** and **Table 16.26**, *in situ* prehistoric, maritime and aviation sites are assessed as being of potentially high cultural heritage importance, as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material).

16.7.2.4 Significance of effect

259. In accordance with the significance matrix in **Table 16.5**, direct impacts to these heritage asset types thereby have the potential to have **major adverse** effects, and significant in EIA terms, as a worst-case scenario.

260. Isolated/derived finds in secondary contexts are assessed as being of medium heritage importance. Should they be encountered during decommissioning activities, direct impacts to isolated finds are considered to be of potential **minor adverse** significance which is non-significant in EIA terms.

16.7.2.5 Further Mitigation

261. The archaeological assessment of any further geophysical data will further reduce, as far as possible, the potential for unintended impacts during decommissioning. If further features of archaeological interest are identified these will be subject to the same mitigation as described for known heritage assets described in **Section 16.1.1** above with the primary approach being avoidance.

262. In the event of an unexpected discovery, the ongoing implementation of a formal protocol for archaeological discoveries, throughout the decommissioning phase, will allow for such discoveries to be efficiently reported, for advice to be provided and for any further mitigation to be considered on a case-by-case basis, proportionate to the significance of the discovery.

263. The approach to the implementation of these mitigation measures will be agreed in consultation with Historic England in accordance with industry standards and guidance at the time of decommissioning.

16.7.2.6 Residual effect

264. Although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that the implementation of a formal PAD, and the appropriate application of additional mitigation measures if required, specifically tailored to the significance of a discovery, means that the residual effects will be no higher than **minor adverse** and not significant in EIA terms.

16.7.3 Impact 3: Indirect impact to heritage assets from changes to physical processes

265. As set out in **Chapter 8: Marine Geology and Physical Processes**, during the decommissioning phase of the Offshore Project, all changes to physical processes have been assessed as having an at worse **negligible adverse** significance of effect. As such, there is **no pathway for change** to the fabric of any heritage asset.

16.7.4 Impact 4: Changes to the setting of heritage assets

266. Changes in setting due to decommissioning activities will be temporary and of sufficiently short duration that they are not anticipated to give rise to material harm. Therefore, **no change** is anticipated.

16.8 Potential Cumulative Effects

267. The approach to cumulative effects assessment (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 Offshore Project have been considered as part of the baseline for the EIA. Where possible Offshore Wind Limited (OWL) has sought to agree with stakeholders the use of as-built Offshore 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.

268. The cumulative impact assessment for **Marine Archaeology and Cultural Heritage** was undertaken in two stages. The first stage was to consider the potential for the impacts assessed as part of the Offshore Project to lead to cumulative impacts in conjunction with other projects. The first stage of the assessment is detailed in **Table 16.30**.

Table 16.30 Potential cumulative effects considered for Marine Archaeology and Cultural Heritage

Impact	Potential for cumulative effect	Rationale
Construction		
Impact 1: Direct impact to known heritage assets	No	Direct cumulative effects to known heritage assets are unlikely to occur due to the application of AEZs identified through EIA for constructed and planned projects as part of the consenting process.
Impact 2: Direct impact to potential heritage assets	Yes	Although the effect will be mitigated by agreed measures as part of the consenting process for each of the constructed and planned projects, the impacts will still have occurred, and permanent damage or destruction will have taken place. The assessment of cumulative effects, therefore, needs to consider the effect of multiple unavoidable impacts from multiple projects upon the archaeological resource.
Impact 3: Indirect impact to heritage assets from changes to physical processes	Yes	As set out in **Chapter 8: Marine Geology, Oceanography and Physical Processes** although there is not a sufficient level of information known at this stage, depending on their construction programmes, there is a potential temporal overlap in construction of the Offshore Project and other renewables projects in the Celtic Sea.
Impact 4: Impacts to the setting of heritage assets	No	Effects to the setting of individual assets are not anticipated to give rise to material harm.
Operation and maintenance		
Impact 1: Direct impact to known heritage assets	No	Direct cumulative effects to known heritage assets are unlikely to occur due to the continued avoidance and retention of AEZs throughout the life of constructed and planned projects.
Impact 2: Direct impact to potential heritage assets	Yes	There is potential for multiple unavoidable impacts associated with operations and maintenance activities (e.g., cable repairs and jack up legs) during the operation phases of multiple projects.
Impact 3: Indirect impact to heritage assets from changes to physical processes	Yes	As set out in **Chapter 8: Marine Geology, Oceanography and Physical Processes**, effects could potentially coalesce with those arising from other projects and disturb sediment transport pathways, particularly if protection measures are near to the coast

Impact	Potential for cumulative effect	Rationale
Impact 4: Impacts to the setting of heritage assets	No	The setting of marine heritage assets is not considered to form a key part of their significance, which lies primarily in their historical and research value.
Decommissioning		
Impact 1: Direct (physical) impact to known heritage assets	No	Direct cumulative effects to known heritage assets are unlikely to occur due to the continued avoidance and retention of AEZs throughout the life of constructed and planned projects.
Impact 2: Direct (physical) impact to potential heritage assets	Yes	There is potential for multiple unavoidable impacts associated with decommissioning considered cumulatively with activities associated with other projects.
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	In relation to **Chapter 8: Marine Geology, Oceanography and Physical Processes**, as no cumulative impacts are anticipated during the decommissioning phase there is no pathway for cumulative impacts to heritage assets.
Impact 4: Impacts to the setting of heritage assets	No	Impacts to the setting of individual assets are not anticipated to give rise to material harm.

269. The second stage of the CEA is to evaluate the projects considered for the CEA to determine whether a cumulative impact is likely to arise. The list of considered projects (identified in **Chapter 6: EIA Methodology Section 6.6.11**) and their anticipated potential for cumulative impacts are summarised in **Table 16.31**.

270. The project screening has been informed by the development of a CEA project list which forms an exhaustive list of plans, projects, and activities within the study area relevant to the Offshore Project. All projects considered for CEA across all topics have been identified within **Appendix 6.A: Cumulative Effects Assessment Long List** of **Chapter 6: EIA Methodology** which forms an exhaustive list of plans, projects, and activities relevant to the Offshore Project.

Table 16.31 Projects considered in the cumulative impact assessment on Marine Archaeology and Cultural Heritage

Project	Status	Expected Construction Date	Distance from windfarm site (km)	Included in the CIA?	Rationale
White Cross Onshore Project	Planned	2025/2027	0 (Landfall to MHWS)	Y	Potential for temporal overlap of export cable installation activities close to and at the coast.
The Llŷr Projects (floating offshore wind)	Pre-consent	2024/2026	22km	Y	The results of surveys and evaluations, and the distribution of reported discoveries cumulatively form part of a collective body of information regarding the marine historic environment within the Celtic Sea. These offshore renewables projects should be considered to have the potential to result in multiple direct impact to potential heritage assets which traverse the boundaries of the OWFs such as palaeolandscapes, and maritime and aviation networks relating to conflicts, migration, and trade routes, for example.
Erebus Floating Wind Demo	Pre-planning application	2026/2027	38km	Y	
Valorous Floating Wind Demo	Pre-planning application	2026/2029	34km	Y	
Llwelyn / Petroc offshore wind	Pre-scoping	2027/2030	<30km	Y	

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

16.8.1 Assessment of cumulative effects

16.8.1.1 Impact 2: Direct (physical) impact to potential heritage assets during all phases of the project

272. It is recognised that each of the projects included in **Table 16.31** will result in unavoidable direct impacts to potential heritage assets. When considered in isolation and, assuming the application of appropriate mitigation, physical impacts might only be determined to be of **negligible** or **minor adverse** significance at worst.

273. However, when considered collectively on a regional scale, these multiple unavoidable impacts may be considered of greater adverse significance. For example, it is possible that unique aspects of former landscapes, or of the *in situ* maritime and aviation archaeological resource, may be lost as a result. In addition, if a site is damaged or destroyed, comparable sites elsewhere may increase in importance due to greater rarity and any future direct impacts will be of greater significance.

274. Similarly, on a regional scale, the setting of heritage assets as part of wider the palaeolandscapes, maritime and aviation networks and heritage assets located along coastlines may contribute to considerations of cultural significance at a regional scale even if changes to that setting would not cause material harm on an individual basis.

275. However, each of the projects in **Table 16.31** will also undertake archaeological assessments in advance of construction, at varying scales of resolution, which are relevant to the wider understanding of the Celtic Sea. Decommissioned sites may yield additional information.

276. These archaeological assessments may include palaeolandscape features mapped through interpretations of SBP and MBES data and geoarchaeological assessment of geotechnical data. This helps to better understand the potential for terrestrial landscapes and inhabitable environments where prehistoric populations may have settled when sea levels were lower.

277. Despite the significant data that is being produced through the consenting process, the extent of these networks and seascapes/landscapes from various periods remain largely unmapped, and may either be confined within a project area, or may extend

beyond the bounds of a project. It is possible, therefore, that cumulative impacts could occur through multiple unavoidable impacts upon the same features, for example.

278. The potential cumulative magnitude of these impacts, however, remains poorly understood. It is acknowledged that strategic analysis in relation to the cumulative impact of multiple constructed and planned projects would facilitate greater understanding of the cumulative effect of offshore wind development within the Celtic Sea. Therefore, benefit would be demonstrated in mapping features from the projects listed in **Table 16.31**where datasets are available.

279. As such, on a regional level, the cumulative effects from the project with the projects listed in **Table 16.31** can be offset through the mapping of accessible data and provision of publicly accessible data post-consent with results from the Offshore Project and results from other offshore wind developments within the Irish Sea if available. In this way contribution could be made to regional research initiatives and provide 'joined-up' objectives for post-consent investigation and mitigation. This could include links with academic and industry wide research initiatives such as the BRITICE-CHRONO project and the West Coast Palaeolandscape Survey (Fitch and Gaffney, 2011). This approach is presented in the Offshore WSI (**Appendix 16.B**).

16.8.1.2 Impact 3 Indirect impact to heritage assets from changes to physical processes during all phases of the Offshore Project

280. The cumulative effects on marine geology, oceanography and physical processes are assessed in **Chapter 8** (**Sections 8.5**, **8.6** and **8.7**). All potential cumulative effects upon changes to the hydrodynamic regime are assessed either as having **no effect** or as **negligible**. There is therefore no pathway for significant effects upon the survival of archaeological material and indirect impacts will not occur.

16.9 Potential transboundary impacts

281. Transboundary impacts to heritage assets will not occur due to the localised nature of disturbance which do not cross territorial borders. Similarly, transboundary impacts with respect to **Chapter 8: Marine Geology, Oceanography and Physical Processes**, have been scoped out of assessment and transboundary impacts to heritage assets, therefore, will not occur due to changes to marine physical processes effects.

16.10 Inter-relationships

282. Inter-relationship effects are covered as part of the assessment and consider impacts from the construction, operation or decommissioning of the Offshore 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 Archaeology and Cultural Heritage** include both:

- Offshore Project lifetime effects: Effects arising throughout more than one phase of the Offshore 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.

283. **Table 16.32** serves as a signposting for inter-relationships.

Table 16.32 Marine Archaeology and Cultural Heritage Inter-relationships

Topic and description	Related chapter	Where addressed in this Chapter	Rationale
Construction			
Indirect impact to heritage assets from changes to physical processes	**Chapter 8: Marine Geology, Oceanography and Physical Processes**	**Section 16.8.1**	Significant changes to physical processes may impact the preservation/survival of buried/exposed heritage assets.
Operation and maintenance			
Indirect impact to heritage assets from changes to physical processes	**Chapter 8: Marine Geology, Oceanography and Physical Processes**	**Section 16.8.1**	Indirect impact to heritage assets from changes to physical processes
Decommissioning			
As for construction			

284. Inter-relationships between offshore archaeology and marine physical processes (**Chapter 8: Marine Geology, Oceanography and Physical Processes**) have been discussed as part of the impact assessment above. This has demonstrated that no significant impacts are expected for any single archaeological receptor resulting from the construction, operation or decommissioning of the Offshore Project. As such,

there is no potential for the accumulation of residual impacts on a single archaeological receptor.

16.11 Interactions

285. 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 16.33**, **Table 16.34** and **Table 16.35**, along with an indication as to whether the interaction may give rise to synergistic impacts. This provides a screening tool for which impacts have the potential to interact.

286. **Table 16.36** provides an assessment for each receptor (or receptor group) related to these impacts 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.

Table 16.33 Interaction between impacts during construction

Potential Interaction between Impacts				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of heritage assets and historic seascape character
Impact 1: Direct impact to known heritage assets		No	No	No
Impact 2: Direct impact to potential heritage assets	No		Yes	Yes
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes		Yes
Impact 4: Impacts to the setting of heritage assets and historic seascape character	No	Yes	Yes	

Table 16.34 Interaction between impacts during operation and maintenance and decommissioning

Potential Interaction between Impacts				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of heritage assets and historic seascape character
Impact 1: Direct impact to known heritage assets		No	No	No
Impact 2: Direct impact to potential heritage assets	No		Yes	Yes
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes		Yes
Impact 4: Impacts to the setting of heritage assets and historic seascape character	No	Yes	Yes	

Table 16.35 Interaction between impacts during decommissioning

Potential Interaction between Impacts				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of heritage assets and historic seascape character
Impact 1: Direct impact to known heritage assets		No	No	No
Impact 2: Direct impact to potential heritage assets	No		Yes	Yes
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes		Yes
Impact 4: Impacts to the setting of heritage assets and historic seascape character	No	Yes	Yes	

Table 16.36 Potential interactions between impacts - phase and lifetime assessment

Highest level significance					
Receptor	**Construction**	**Operation and Maintenance**	**Decommissioning**	**Phase Assessment**	**Lifetime Assessment**
Potential heritage assets	Minor adverse	Minor adverse	Minor adverse	No greater than individually assessed impact. While impacts to known heritage assets can be avoided, potential heritage assets may be subject to direct physical impact, indirect impacts from changes to physical processes and from changes to their setting (i.e., an artefact removed from the seabed). Once an impact has occurred (i.e., a new heritage asset has been discovered/encountered) the application of additional mitigation (such as additional recording, AEZs, micro-siting or relocation) means that the magnitude of each, spatially discrete impact (should an impact occur), will be no greater across all phases than each phase in isolation.	No greater than individually assessed impact As for the phase assessment, once a new heritage asset is discovered or encountered, the application of additional mitigation means that that the magnitude of each, spatially discrete impact (should an impact occur), will be no greater across the Offshore Projects' lifetime.

16.12 Potential monitoring requirements

287. Monitoring requirements will be described in the in-principle monitoring plan (IPMP) submitted alongside the application and will be further developed. This will be agreed with stakeholders prior to construction based on the IPMP and will take account of the final detailed design of the Offshore Project.

288. The requirements for monitoring for archaeology and cultural heritage are set out in the Outline WSI. This is anticipated to comprise the archaeological assessment of post construction marine geophysical data to include an assessment of AEZs to confirm that impacts have not occurred during or post-construction and that the size and extent of the AEZs remain fit for purpose.

16.13 Summary

289. This chapter has provided a characterisation of the existing environment for Marine Archaeology and Cultural Heritage based on both existing public data and site-specific survey data, which has established that there will be at worst minor adverse residual impacts with archaeological mitigation on heritage assets during the construction, operation, and maintenance, and decommissioning phases of the Offshore Project.

290. There are no known seabed prehistory sites within the windfarm site. A sequence of one Quaternary Unit and two Pre-Quaternary Bedrock reflectors have been identified within the Offshore Export Cable Corridor. Within the Windfarm Site, a sequence of one Quaternary Unit and four Pre-Quaternary Units. The interpreted sedimentary Units and reflectors are largely of limited/very limited archaeological potential. However, there is some potential for Unit E to hold evidence of glacial sediments (associated with the Western Irish Sea or Cardigan Bay Formations), Pleistocene and Holocene fluvial and related features, Holocene organic sediments laid down prior to marine inundation by c.5k BP and Marine sediments post-dating the Holocene marine transgression.

291. The potential for fluvial deposits or sediments laid down under sub-aerial conditions in association with the Surface Sands Formation and other coastal formations indicates some archaeological and palaeoenvironmental potential may be associated with Unit E. This Unit should therefore be investigated further, focused on the areas where it is thickest (shown on **Figure 27** of **Appendix 16.A**) as intervening areas are interpreted as modern marine sediments.

292. A total of 58 seabed features have been identified within the Offshore Development Area, while two have been identified within the 500m buffer. Of these

features two have been interpreted as being of high archaeological potential, three of medium archaeological potential and 55 of low archaeological potential.

293. A total of 481 magnetic anomalies ranging between 5 nT and 373.3 nT have been identified across the Offshore Development Area. Of these 439 do not relate to identified archaeological anomalies or known infrastructure. 8 of these magnetic anomalies have readings greater than 200nT, 22 have readings ranging from 100nT – 200nT, 33 have readings ranging from 50nT – 100nT, while 376 have readings ranging between 5nT – 50nT. The two highest concentrations of magnetic anomalies are within the nearshore area of the Offshore Export Cable Corridor and from c.35km from the Windfarms Site to c.20km from shore.

294. The nearshore magnetic anomalies are likely to be associated with the US Assault Training Centre (MDV57283). Should any of these be associated with loss of life, they could fall under the Protection of Military Remains Act 1986, however, no loss of life is known to have occurred at Saunton Sands. This is the only Historic Environment record within the intertidal zone.

295. In addition to the identified anomalies described above, there is also potential for the presence of further maritime and aviation archaeological material to be present, which has not been seen in the geophysical data. This may comprise isolated finds of material, or wrecks or aircraft crash sites, potentially buried and concealed within or beneath marine seabed sediments.

296. Within the Offshore Development Area there are four UKHO records, two within the Windfarm Site and two within the Offshore Cable Corridor. Three of the records are recorded as foul ground, while the other 72153 is wreck WC22_0063S.

297. Similarly, there are 42 maritime records maintained by Historic England within the Offshore Export Cable Corridor. These are all Reported Losses, these are arbitrary positions, the point of which is deemed to be closest to the position of a wrecking event. The positions may have originated from several sources, including documentary records, and accounts of sinking (either from the crew or third parties). It is usual for several records to be assigned to same location.

298. Whilst the positions, and extents of the polygons, are reviewed within the geophysical datasets typically no remains are expected at the given locations. The presentation of named locations serves to characterise the potential within the area for remains of wrecks, and/or, aircraft to be present on the seabed.

299. With the application of mitigation measures, it is anticipated that all direct impacts to known heritage assets resulting from the Offshore Project will be avoided. The

approach to the implementation of these mitigation measures is in the Outline WSI (Offshore) which will submitted alongside the application (**Appendix 16.B**). This has been prepared in accordance with industry standards and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

300. Subject to approval from Historic England, AEZs will be implemented around the high and medium potential seabed features, with a TAEZ applied to 24 high amplitude magnetic anomalies

301. The AEZs will likely be retained for the lifetime of Offshore Project as they relate to wrecks and potential wrecks. AEZS may also, however, be removed or reduced in size following further geophysical investigations and ROV investigations during UXO investigations. Any amendments to AEZs may only take place in consultation with Historic England.

302. TAEZs may be removed with the approval of Historic England once more detailed further information become available. By the time of construction it is anticipated that the majority of TAEZs will have been removed, however, some may be formalised as AEZs.

303. AEZs are not recommended at this time for features of low archaeological potential or low amplitude magnetic anomalies. The positions of these features will be avoided by means of micro-siting during detailed Offshore Project design, where possible.

304. The archaeological assessment of pre-construction survey data, including high resolution geophysical data undertaken for the purposes of UXO identification, will further clarify the nature and extent of these anomalies and the scheme design will be modified to avoid heritage assets where possible. If features cannot be avoided, then additional work may be required to establish the archaeological interest of the feature (e.g., investigation of individual anomalies (ground truthing) through ROV and/or diver survey) and to record features prior to removal, as appropriate.

305. It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). To minimise this potential impact, further archaeological assessment of high-resolution geophysical data and geoarchaeological assessment of geotechnical data will be undertaken post-application/ post-consent. This will reduce, as far as possible, the potential for unintended impacts during construction. In the event of an unexpected discovery, this will be reported using a formal PAD which will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures where necessary.

306. Through the PAD, any possible *in situ* heritage assets encountered on the seabed will be immediately provided with a temporary exclusion zone to prevent further impacts from taking place until advice had been received. Following confirmation of the presence of archaeological material, additional mitigation measures to record or conserve the site will be agreed in consultation with Historic England.

307. Potentially beneficial effects have also been identified in relation to cumulative through the contribution of data to academic and scientific objectives, and public outreach and engagement. The approach to delivering these objectives will be established post-consent in consultation with key stakeholders, including Historic England, and are set out in the Outline WSI (**Appendix 16.B**).

Table 16.37 Summary of potential impacts on archaeology and cultural heritage

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Mitigation measure	Residual impact	Cumulative residual effect
Construction							
Impact 1: Direct impact to known heritage assets	Wrecks and anomalies of archaeological interest (seabed features identified as high and medium archaeological potential	High	No change due to application of AEZs	No change due to application of AEZs	No change due to application of AEZs	No change	No change
Impact 1: Direct impact to known heritage assets	Historic wrecks for which remains have yet been to be identified	High	No change due to application of AEZs	No change due to application of AEZs	No change due to application of AEZs	No change	No change
Impact 1: Direct impact to known heritage assets	Additional anomalies of possible archaeological interest	High	High	Major adverse	Avoid location	No change	No change
Impact 1: Direct impact to known heritage assets	Additional anomalies of possible archaeological interest	High	High	Major adverse	Additional mitigation to reduce or offset impacts (see **Section 16.3.7**.	Minor adverse	No change
Impact 2: Direct impact to	*In situ* prehistoric,	High	High	Major adverse	Further assessment and	No change	Potential beneficial effect (described but currently not

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Mitigation measure	Residual impact	Cumulative residual effect
potential heritage assets	maritime or aviation sites				investigation and additional mitigation to avoid, reduce or offset impacts (see **Section 16.3.7**).		quantifiable, to be realised through regional mapping of accessible data and provision of publicly accessible data post-consent).
	Isolated finds	Medium	Low	Minor adverse	PAD supported by an archaeological watching brief or archaeological monitoring if open and cut trenching is used for the nearshore cable installation.	Minor adverse	Potential beneficial effect (currently not quantifiable, to be realised through the archaeological recording and publication of previously unknown archaeological remains)
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	Low	No Change	N/A	No Change	No Change
Impact 4: Impacts to	Known and potential	Medium to High	Low	No Change	N/A	No Change	No Change

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Mitigation measure	Residual impact	Cumulative residual effect
the setting of heritage assets	heritage assets						
Operation and Maintenance							
Impact 1: Direct impact to known heritage assets	Known heritage assets	Medium to High	No Change due to application of AEZs			No Change	No Change
Impact 2: Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment of geophysical and geotechnical data (see **Section 16.3.7**).	Minor adverse	Potential beneficial effect (described but currently not quantifiable, to be realised through regional mapping of accessible data and provision of publicly accessible data post-consent)
	Isolated finds	Medium	Low	Minor adverse	PAD.		
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No Change. **Chapter 8: Marine Geology, Oceanography and Physical Processes** concludes there would be no significant effect resulting from the Offshore Project.			No Change	No Change
Impact 4: Impacts to the setting	Known and potential	Medium to High	Negligible	Minor adverse	N/A	Minor adverse	Minor adverse

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Mitigation measure	Residual impact	Cumulative residual effect
of heritage assets	heritage assets						
Decommissioning							
Impact 1: Direct impact to known heritage assets	Known heritage assets	Medium to High	No Change due to application of AEZs			No Change	No Change
Impact 2: Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment of geophysical and geotechnical data (see **Section 16.3.7**).	Minor adverse	Potential beneficial effect (described but currently not quantifiable, to be realised through regional mapping of accessible data and provision of publicly accessible data post-consent)
	Isolated finds	Medium	Low	Minor adverse	PAD.		
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No Change. Effects comparable to those assessed for Construction Impact 1.			No Change	No Change
Impact 4: Impacts to the setting	Known and potential heritage assets	Medium to High	No Change	No Change	N/A		

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Mitigation measure	Residual impact	Cumulative residual effect
of heritage assets							

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WHITE CROSS

White Cross Offshore Windfarm Environmental Statement

Appendix 16.A: Archaeological Assessment of Geophysical and Hydrographic Data

White Cross Offshore Windfarm

Archaeological Assessment of Geophysical and Hydrographic Data

Produced for Royal Haskoning DHV

MSDS Marine

2022/MSDS22232/1

White Cross Offshore Windfarm

Archaeological Assessment of Geophysical and Hydrographic Data

Project Name	White Cross Offshore Windfarm. Archaeological Assessment of Geophysical and Hydrographic Data	
Client	Royal Haskoning DHV	
Client Project Number	PC2978	
MSDS Marine Project Number	MSDS22232	
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Origination date	12/12/2022	
Reviser (s)	Mark James and Sally Evans	
Date of last revision	09/01/2023	
Quality Assurance Approval	Alison James	
Version number:	1.2	
Summary of changes	Addressing client comments	

Contents

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1.0 Introduction

1.0.1 MSDS Marine Limited (MSDS Marine) have been contracted by Royal Haskoning DHV (RHDHV) to undertake an archaeological assessment of geophysical and hydrographic survey data collected within the Windfarm Site, and the Offshore Export Cable Corridor (collectively referred to as the Offshore Development Area) of White Cross Offshore Windfarm in the Celtic Sea. The Offshore Export Cable Corridor makes land fall on the North Devon Coast, on Saunton Sands, with the Windfarm Site lying approximately 75 km to the west. The Offshore Export Cable Corridor runs approximately 3.5 km to the south of Lundy Island.

1.0.2 The survey was conducted by N-SEA and Ultrabeam Hydrographic (Ultrabeam) between May and August 2022, and consisted of Sidescan Sonar (SSS), Multibeam Bathymetry (MBES), Magnetometer, and Sub-bottom Profiler (SBP). The assessment is being undertaken to inform the Environmental Impact Assessment (EIA) process.

1.0.3 This document forms the archaeological assessment of the geophysical and hydrographic survey data, and outlines the specification of the data, the method of archaeological assessment, the presentation of the results, and recommendations for mitigation strategies.

2.0 Project location and status

2.0.1 The project is a proposed floating offshore windfarm located in the Celtic Sea, this report pertains to the Windfarm Site and the Offshore Export Cable Corridor. The windfarm was selected in early 2021 as part of The Crown Estate's Test and Demonstration leasing opportunity. The Project was secured by Offshore Wind Ltd (OWL) and is a joint venture between Flotation Energy plc (Flotation Energy) and their Spanish joint venture Partner Cobra Instalaciones Servicios (Cobra) (part of the ACS Group).

2.0.2 The Windfarm Site is located over 52 km off the North Cornwall and North Devon coast (west-north-west of Hartland Point). The Offshore Export Cable Corridor will connect the Offshore Substation Platform to shore. Onshore, the grid connection is confirmed as East Yelland. The Export Cable will come ashore at a Landfall and then be routed underground to the Onshore Substation where it connects into the Western Power Distribution Network.

2.0.3 When fully operational, The Project will have an anticipated nominal capacity of 100 megawatts (MW) and will have the potential to generate renewable power for over 135,000 homes in the United Kingdom (UK).

2.0.4 The Offshore Scoping Report[1] was submitted on the 18th January 2022 in support of the request for a formal Scoping Opinion.

2.0.5 The location of White Cross Offshore Windfarm is shown in Figure 1.

[1] White Cross, 2022. *White Cross Offshore Windfarm EIA Scoping Report*.

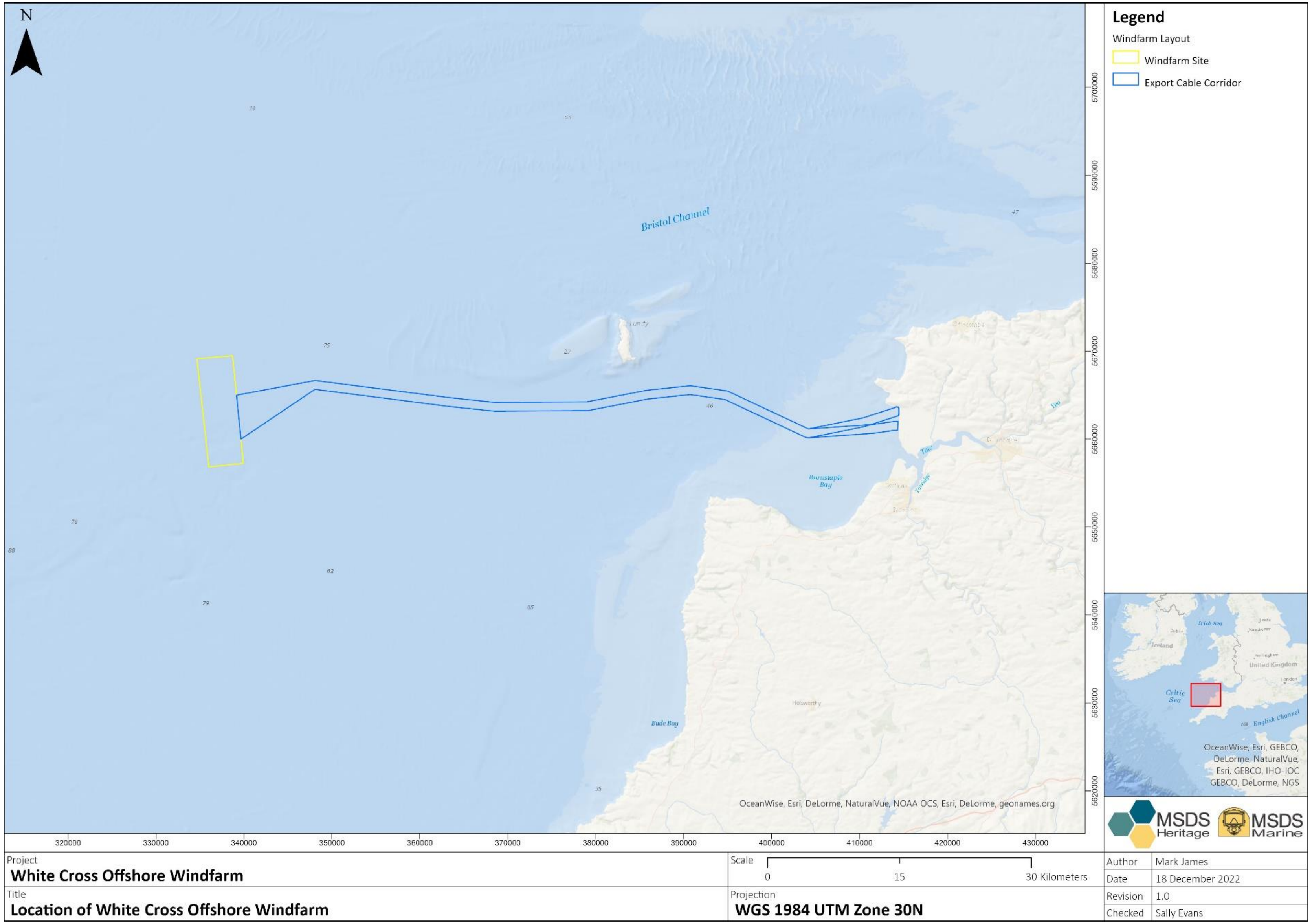


Figure 1: Location of White Cross Offshore Windfarm

3.0 Aims and objectives

3.1 Archaeological review of geophysical and hydrographic data

3.1.1 The principle aim of the archaeological review of geophysical and hydrographic data is to establish the presence of material of potential archaeological significance on the seabed, and the potential for submerged prehistoric remains laid down during different climatic and environmental conditions in the past. The identification of material and geological horizons allows for strategies to be recommended to mitigate against any negative effects that may be caused by the development process.

3.1.2 The objectives of the archaeological interpretation can be summarised as follows;

- To establish the presence of anthropogenic material of archaeological potential;
- To interpret the identified anomalies as to their potential to be of archaeological significance;
- To recommend mitigation strategies for the anomalies appropriate to their archaeological potential;
- To establish the palaeolandscape potential;
- To recommend mitigation strategies in relation to the palaeolandscape and palaeoenvironment; and
- To recommend further works that may be required and their specifications.

4.0 Existing infrastructure

4.0.1 Existing third party infrastructure within the Offshore Development Area is limited to four telecoms cables, all of which run through the Offshore Export Cable Corridor. Two cables, UK to Ireland 2 and TAT 11, run north-west, south-east, and north-east, south-west respectively, towards the western end of the Offshore Export Cable Corridor. The remaining two cables, TATA Atlantic South and TATA West Europe UK-Spain, run east, west, crossing the Offshore Export Cable Corridor towards the eastern end and making landfall to the north of, and within, the Offshore Export Cable Corridor.

4.0.2 The majority of the cables were visible in the geophysical data, in particular the magnetometer data. Where geophysical anomalies, in particular magnetic anomalies, were attributed to infrastructure they were removed from the dataset.

4.0.3 The locations of the cables are presented in Figure 2, and summarised in Table 1 below

Infrastructure Type	Name	Notes
Telecoms cable	UK-Ireland 2 Crossing	Active, permanent
Telecoms cable	TAT 11	Not in use
Telecoms cable	TATA Atlantic South	Active, permanent
Telecoms cable	TATA W. Europe UK-Spain	Active, permanent

Table 1: Infrastructure within the Offshore Development Area

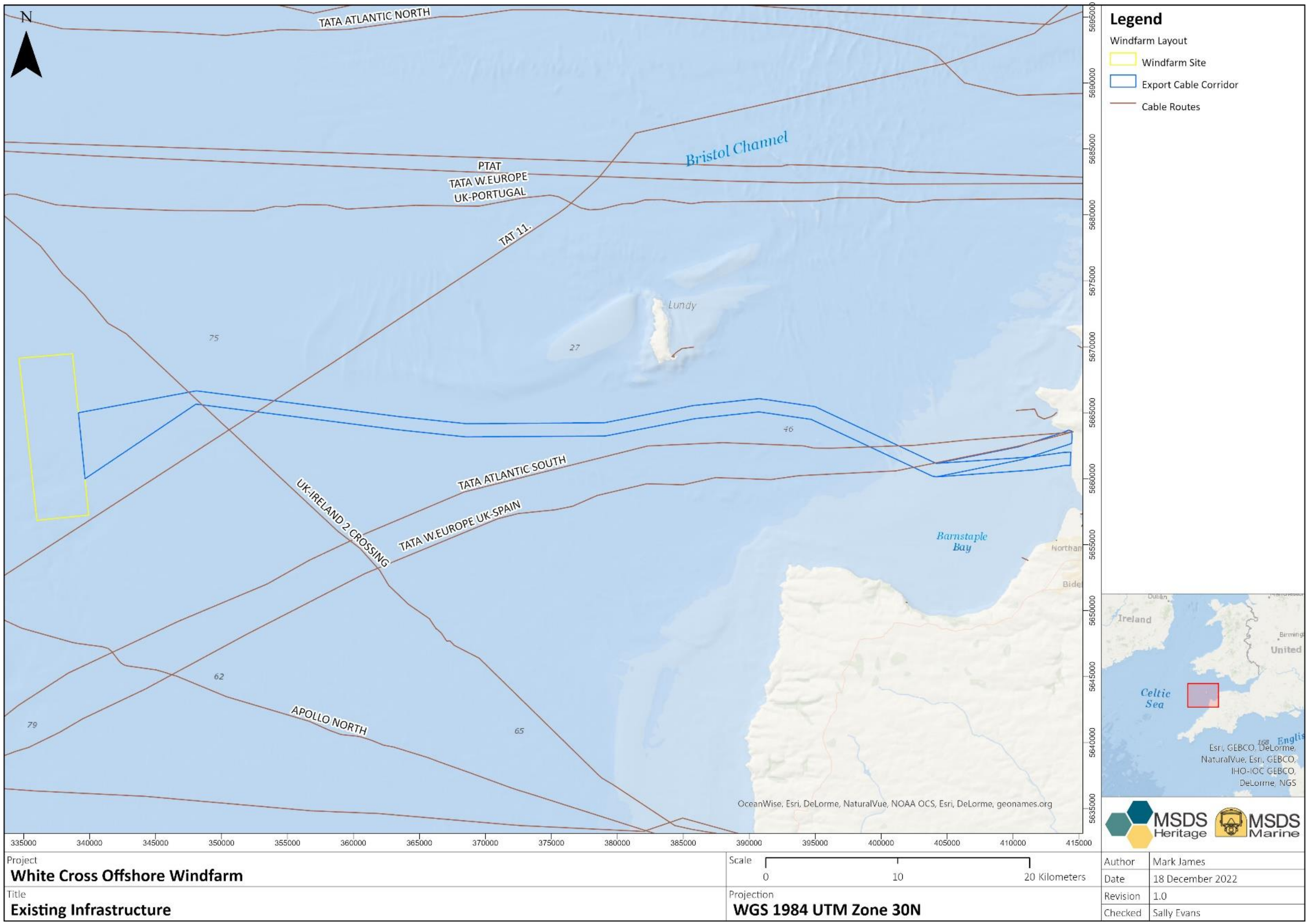


Figure 2: Existing infrastructure within the Offshore Development Area

5.0 Methodology

5.1 Data collection

5.1.1 The survey was conducted in two lots; the Windfarm Site and the Offshore Export Cable Corridor to -10 m Lowest Astronomical Tide (LAT) (offshore) by N-SEA between 27th May and 6th August 2022, and the Offshore Export Cable Corridor between -13 m and +3 m LAT (nearshore) by Ultrabeam between 30th July and 15th August 2022. Both surveys were mobilised with a Multibeam Echo Sounder (MBES), a Sidescan Sonar (SSS), and two magnetometers configured as a Transverse Gradiometer (TVG). The offshore survey mobilised two Sub-bottom Profilers (SBP), a Parametric SBP and a Sparker, the nearshore survey mobilised a Pinger.

5.1.2 The SSS, TVG, and the Sparker and Pinger SBPs were towed behind the vessel, the MBES and Parametric SBP were mounted to the vessels.

5.1.3 Survey operations were undertaken within a pre-defined boundary of approximately 145 km^2, referred to as the Offshore Development Area within this report.

5.1.4 The offshore survey was planned with a line spacing of 75 m for the main lines, and 5 km for the cross lines, the nearshore survey was planned with a line spacing of 45 m for the main lines, and 500 m for the cross lines. The line planning ensured 100% coverage of SSS data was achieved, including the nadir (@ 100 m and 50 m range respectively), typically referred to as 200% coverage. The MBES swathe sector angle was set between 80-120° to produce a full coverage dataset, with 10% overlap, in the depth of water over the survey areas.

5.1.5 In addition, SBP and TVG data were collected along each of the survey lines, the TVG separation was 1.5 m, and the maximum altitude was 8 m. The survey navigation tracklines are presented in Figure 3, the SSS coverage in Figure 4, and the MBES coverage in Figure 5.

5.1.6 The survey achieved 100% SSS and MBES coverage of the Offshore Development Area, with TVG and SBP collected to the line plan specification as outlined above. The equipment specification for the offshore survey is shown in Table 2, and the nearshore survey in Table 3.

Sensor	Manufacturer	Model	Frequency
Sidescan Sonar	EdgeTech	4205 FS	300 / 600 kHz 100 m range
Multibeam	Kongsberg	EM2040 MKII	200 to 400 kHz
TVG (magnetometer)	Geometrics	G-882 x 2	10 Hz sample rate
Parametric SBP	Innomar	SES-2000 Medium	4 to 15 kHz Actual 6 kHz
Sparker SBP	GSO	360	1 kHz

Table 2: Offshore geophysical and hydrographic sensor specifications

Sensor	Manufacturer	Model	Frequency
Sidescan Sonar	EdgeTech	4205 FS	300 / 600 kHz 50 m range
Multibeam	Norbit	WMBS	400 kHz
TVG (magnetometer)	Geometrics	G-882 x 2	10 Hz sample rate
Pinger SBP	Geoacoustic	Geopulse 5430A	2 to 12 kHz

Table 3: Nearshore geophysical and hydrographic sensor specifications

5.1.7 The data were collected to a specification appropriate to achieve the following interpretation requirements:

- Sidescan Sonar: ensonification of anomalies > 0.5 m
- Multibeam Bathymetry: ensonification of anomalies > 1.0 m offshore and 0.2 m nearshore
- Magnetometer (TVG): 5 nT threshold for anomaly picking
- Sub-bottom Profiler (SBP): penetration of up to 16m was achieved
- Single Channel Sparker (SCS): penetration of up to 60 m was achieved

5.2 Positioning

5.2.1 All data were collected with reference to the World Geodetic System 1984 (WGS84) datum and Universal Transverse Mercator (UTM) Zone 30 North projection (WGS84 Z30N). All vertical depths are relative to LAT and were reduced to LAT using Vertical Offshore Reference Frames (VORF).

5.2.2 Towed sensors were positioned using an Ultra Short Baseline (USBL) positioning system to ensure positional accuracy throughout the survey. USBL ensures the actual position of the sensor is recorded, as opposed to when the position is estimated based upon the direction of the vessel and the amount of cable out (layback).

5.2.3 Although the accuracy of the USBL system is dependent on the angle, and the distance of the beacon from the transceiver, tolerances of between 0.5 m and 2.0 m can be achieved. Positional accuracy is further increased through the correlation of the SSS dataset with the MBES dataset.

5.2.4 Surface and sub-sea position sensors specifications are detailed below in Table 4 and Table 5.

Sensor	Manufacturer	Model	Accuracy
Surface positioning	iXBlue	Hydrins	Roll / pitch 0.01° Heave 5 cm or 5% Heading 0.01° Position 0.006 m
Sub-sea positioning	Kongsberg	HiPAP 501	0.15 m

Table 4: Offshore position sensor specifications

Sensor	Manufacturer	Model	Accuracy
Surface positioning	Applanix	POSMV Wavemaster II	Roll / pitch 0.01° Heave 5 cm or 5% Heading 0.02° Position 0.02 - 0.1 m
Sub-sea positioning	Sonardyne	Mini Ranger	0.2% slant range

Table 5: Nearshore position sensor specifications

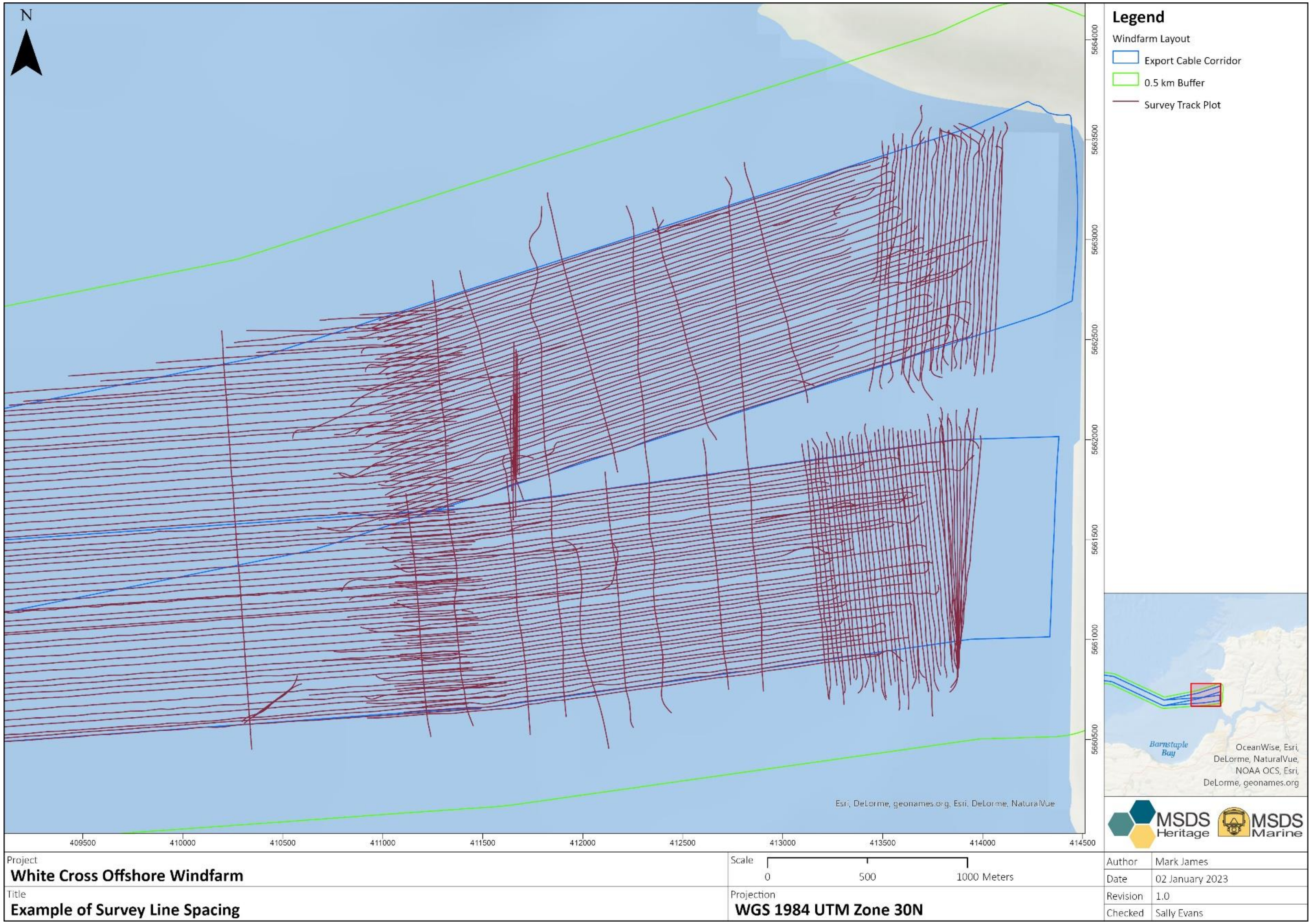


Figure 3: Geophysical survey tracklines

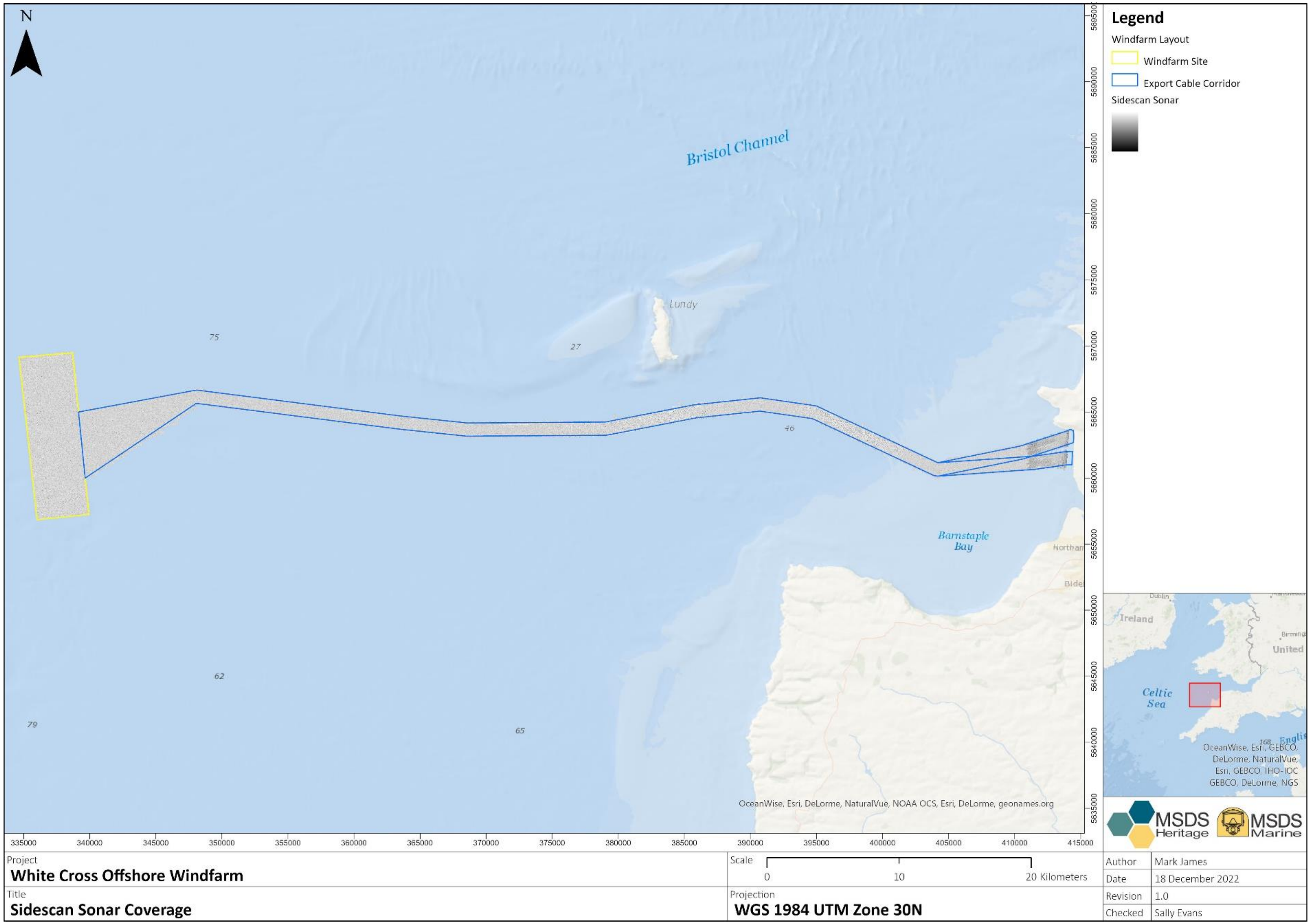
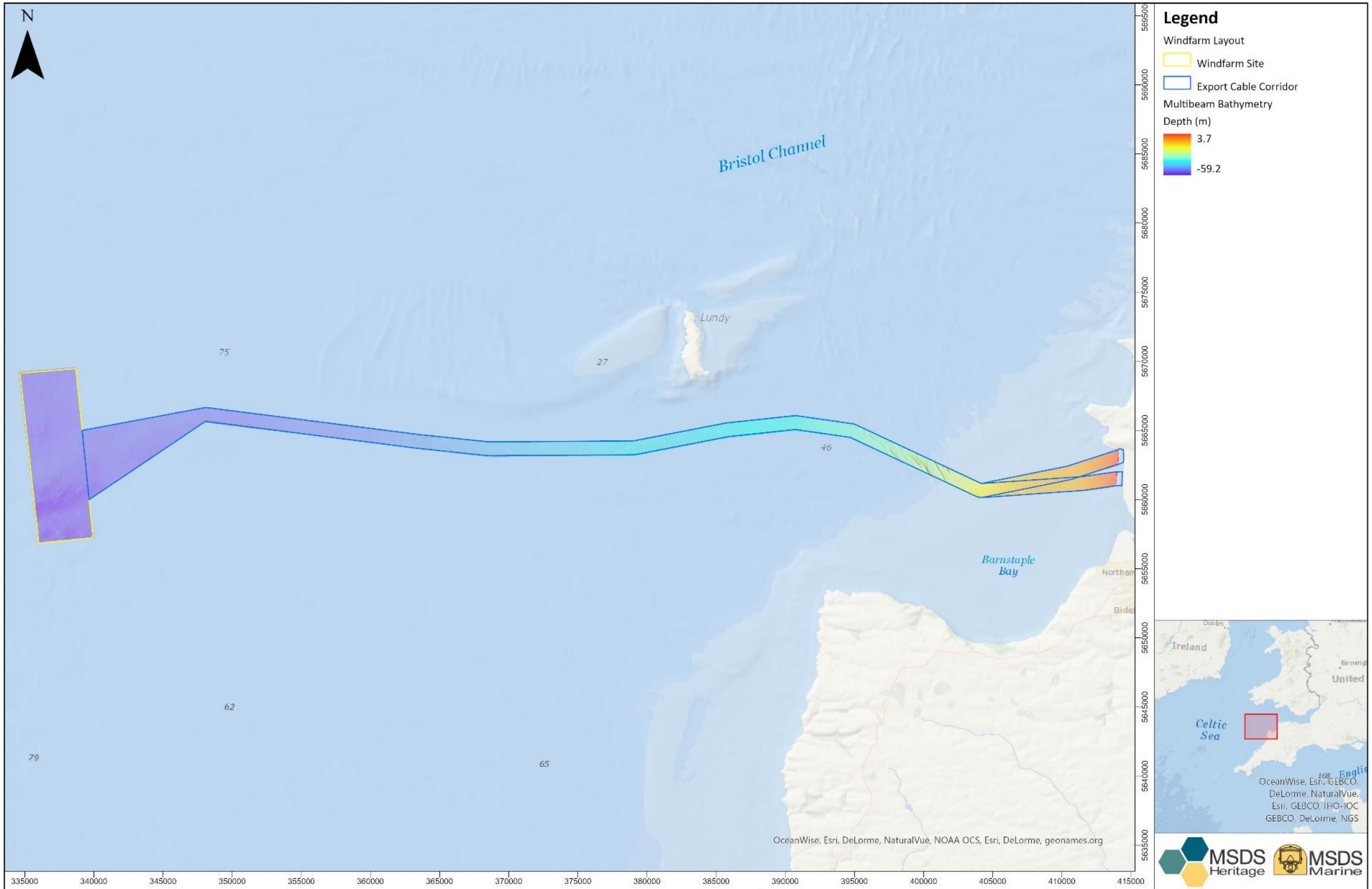


Figure 4: Sidescan Sonar coverage



Project **White Cross Offshore Windfarm**	Scale 0 10 20 Kilometers	Author	Mark James
		Date	18 December 2022
Title **Multibeam Bathymetry Coverage**	Projection **WGS 1984 UTM Zone 30N**	Revision	1.0
		Checked	Sally Evans

Figure 5: Multibeam Bathymetry coverage

5.3 Data deliverables to MSDS Marine

5.3.1 MSDS Marine were provided with the survey deliverables by N-SEA, on behalf of OWL, including both raw and processed data, alongside interpretations and reports. The primary deliverables are detailed in Table 6 below.

Sensor	Data type	Format
Sidescan Sonar	Raw lines (LF and HF)	.xtf
	Processed lines (HF)	.xtf
	Mosaic (HF) 0.2 ppm	.tif
	Contacts	.shp
Sub-bottom profiler (both)	Raw lines	.sgy
	Processed lines	.sgy
	Isopach	.shp
	Horizons	.tif
Magnetometer (TVG)	Raw lines	.csv
	Grids (residual and altitude)	.tif
	Mosaic (residual and altitude)	.tif
	Contacts	.csv
Multibeam bathymetry	Raw lines	.xyz
	Grids (at 0.2 and 1.0 m)	.xyz
	Mosaic (at 1.0 m)	.tiff
GIS	Geodatabase	.gdb
Reports	Survey report	.pdf
	Operations report	.pdf

Table 6: Data deliverables to MSDS Marine

5.4 Data quality and limitations

Sidescan Sonar (SSS)

5.4.1 The SSS data covered the extents of the Offshore Development Area to +3.0 m LAT, providing 100% seafloor coverage including the nadir. The data were generally of good quality, with minimal interference or data degradation caused by environmental factors, or the simultaneous use of different sensors. Some slight data degradation due to motion was noted in places, however, this was not significant and does not affect the overall quality of the data and the suitability for archaeological interpretation.

5.4.2 Horizontal offsets of up to 15 m were noted in places between the SSS and MBES data, although only in certain areas. However, the positions of medium and high potential (and a large number of low potential) anomalies were taken from the MBES data.

5.4.3 The Offshore Development Area seabed is characterised across a significant area by sand, manifesting as small ripples to the west of the Offshore Export Cable Corridor, with larger sand waves noted towards the east of the Offshore Export Cable Corridor. Large sand waves can cause obstructions to the sonar data, in particular the SSS, the data from which is collected closer to the seabed, although none of significant size to impact overall interpretation were identified. The seabed within the Windfarm Site is interspersed with areas of coarser sediment (Figure 6).

5.4.4 Approximately 15 km of the Offshore Export Cable Corridor is characterised by exposed, and prominent, bedrock. These features obscure the line of sight of the SSS creating acoustic shadow which can mask the presence of anomalies. This is to some degree mitigated by the collection of 100% coverage data including the nadir, as this equates to 200% coverage excluding the nadir. Further mitigation is provided through the assessment of MBES data which is collected above features reducing the acoustic shadow.

Multibeam Bathymetry (MBES)

5.4.5 The MBES data covered the extents of the Offshore Development Area to +3.0 m LAT, providing 100% coverage. A review of the un-gridded point cloud data shows that the quality is good with no significant height or positioning errors that effect the overall dataset. The data density is good, and the data is able to be gridded to 1.0 m in the offshore area and 0.2 m in the nearshore area, increasing the ability to identify smaller features. Features identified within the MBES data correlate with those identified in the SSS data, although as detailed above offsets were noted. MBES data is considered to provide the most accurate positioning due to the direct, and fixed, correlation between the sensor, the DGPS antennas, and the Motion Reference Unit (MRU).

Magnetometer (TVG)

5.4.6 The TVG data covered the extents of the Offshore Development Area and was collected along the pre-defined survey line plan. The data were sampled at 10 Hz, at a maximum altitude of 8 m (3.5 m in most of the nearshore area). The specification was designed to be able to detect the presence of ferrous materials >25 kg along the tracklines. The threshold for detection of 2 nT was met, and that the data were suitable to identify anomalies with a peak-to-peak amplitude of 5 nT.

Sub-bottom profiler

5.4.7 The SBP and SCS data were processed using Moga Software/ SeaView 4.2. The SBP data were collected across the Offshore Export Cable Corridor and Windfarm Site, while the SCS data were collected within the Windfarm Site only. However, due to the limits of penetration of the SBP data within the Windfarm Site, only the SCS data was interpreted in this area, though the SBP data was used for verification. Thus, the Offshore Export Cable Corridor interpretation is based on SBP data, while the Windfarm Site interpretation is based on SCS data, verified by the SBP data. The datasets were interpreted, and significant reflectors picked. Interpretations within the N-SEA report[2] were made with reference to Lundy Sheet 51°N-06°W Solid Geology and Seabed Sediments, BGS. The depth of penetration achieved by the SCS was 60 m. Interpretation of the data indicates that the Windfarm Site is underlain by bedrock from a maximum depth of 16 m below seabed (and in most areas much shallower), indicating that the SCS achieved full penetration of the Quaternary sequence across the Windfarm Site.

5.4.8 In the Offshore Export Cable Corridor penetration of the SBP was limited in some areas, and continuous interpretation of reflectors was not possible. Separate reflectors were therefore identified, and tops picked. Sand waves in the Offshore Export Cable Corridor (location shown on Figure 29) influenced the ability to pick underlying reflectors and the uppermost reflector (R1) which was picked in the inshore part of the Offshore Export Cable Corridor was not observed in the area of the sand waves, likely due to the limited penetration. Additionally, in areas where rock outcrops were detected by other sensors (e.g., MBES and SSS), SBP penetration was low (c. 2 m), likely caused by the hard substrate. The interpretation report notes that the rock outcrops in the area are not distinguishable from other reflectors (e.g., sandy substrate) in the SBP data[2]. Penetration of the SBP data in the Offshore Export Cable Corridor was c. 16 m at most.

5.4.9 SBP data is collected directly beneath the sensor, in general terms, and outside the identification of the palaeolandscape, SBP is not suited to the prospection for buried material of potential anthropogenic origin due to the wide line spacing. It can however be useful for the corroboration of other datasets where a trackline passes directly over a magnetic anomaly, or a potentially buried feature, visible in the SSS or MBES data.

Summary

5.4.10 The data collected across the Offshore Development Area are of good quality overall, and in the case of SSS and MBES provided 100% coverage. SBP data were collected to a pre-determined line plan, largely providing suitable coverage and penetration for the interpretation of the palaeoenvironment. Recommendations for further work have been made in areas where penetration did not extend to the base of the Quaternary sequence. The TVG data were collected to pre-determined line plan suitable for the identification of ferrous material >25 kg along the tracklines, with the minimum detection size increasing with distance from the tracklines.

5.4.11 The data is considered of an appropriate specification, coverage, and quality, to undertake a robust archaeological assessment to inform the EIA process.

[2] NSea (2022). *Offshore and nearshore survey: White Cross wind farm: Geophysical survey results*. DOC NO: NSW-PJ00285-RR-DC-SUR-001

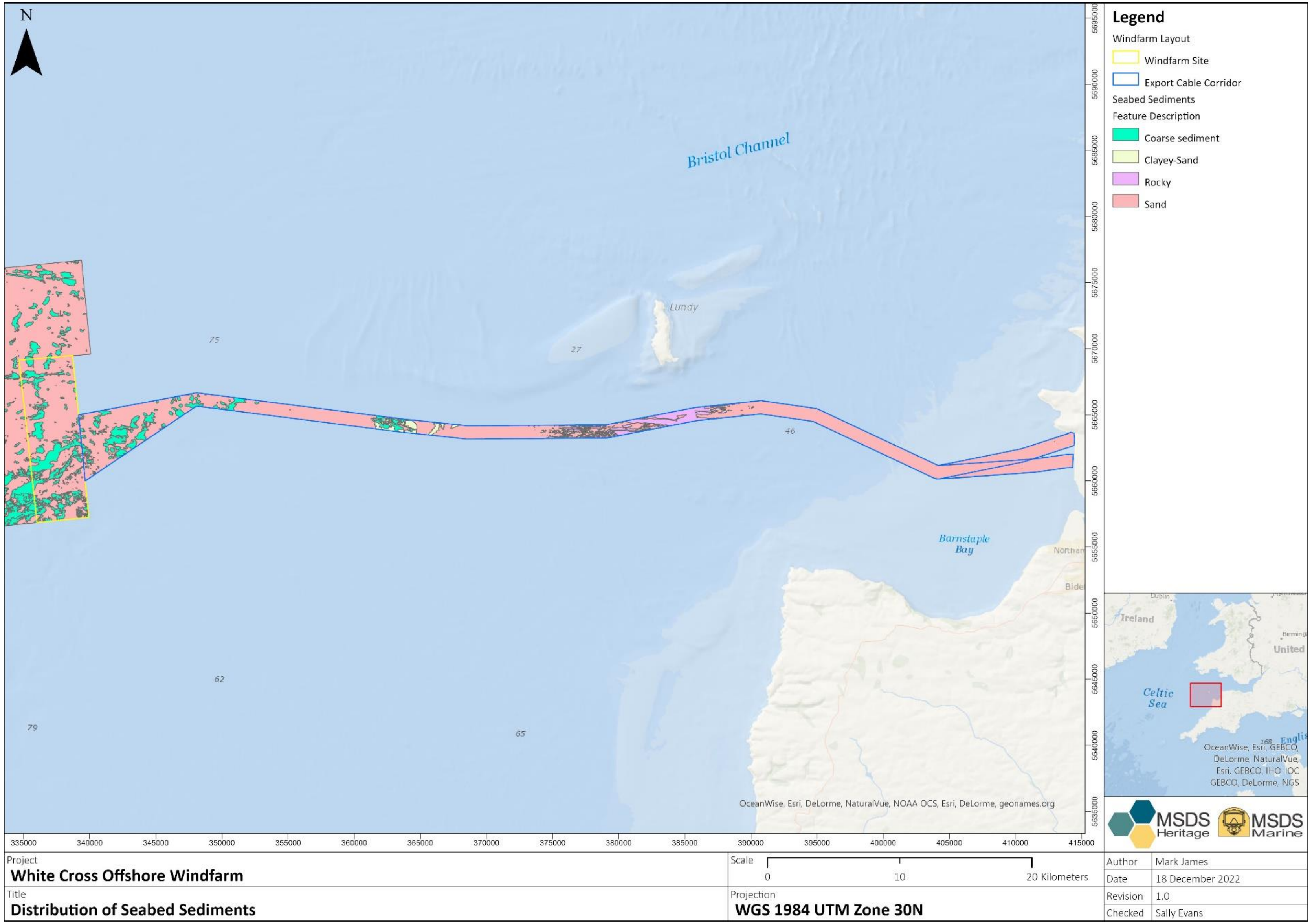


Figure 6: Distribution of Seabed Sediments

5.5 Archaeological assessment of data

5.5.1 The archaeological assessment of data was undertaken by a qualified and experienced maritime archaeologist with a background in geophysical and hydrographic data acquisition, processing, and interpretation.

5.5.2 Following delivery of the required datasets, an initial review was undertaken to gain an understanding of the geological and topographic make-up of the survey area. Within the extent of the survey area the potential for variations in the seabed are high and can affect the interpretation of anomalies.

5.5.3 The assessment considers the full extents of the survey data which includes full coverage of the Offshore Development Area. The assessment of United Kingdom Hydrographic Office (UKHO), National Record of the Historic Environment (NRHE), and Devon HER data was undertaken within the Offshore Development Area and a 0.5 km buffer.

5.5.4 Whilst some of the data extends beyond the Offshore Development Area, the purpose of the assessment is to characterise the historic environment and therefore data from the wider area were considered. The focus of the mitigation measures is, however, on anomalies within the Offshore Development Area, or where mitigation measures would impact within the Offshore Development Area. The assessment area is presented in Figure 7.

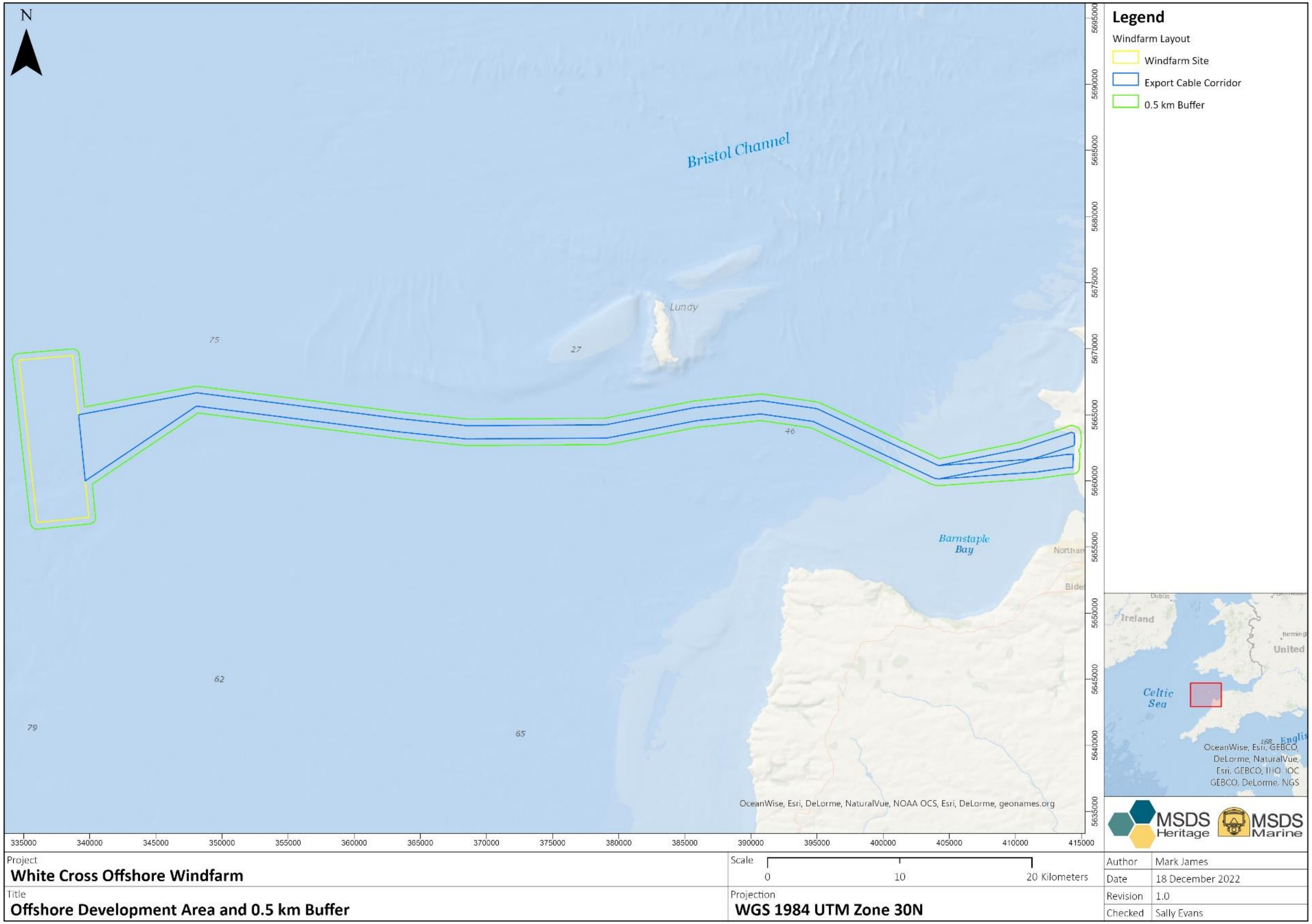


Figure 7: Assessment Area

Sidescan Sonar

5.5.5 SSS is considered the best tool for the identification of anthropogenic anomalies on the seabed due to the ability to ensonify small features and as such forms the basis of any archaeological assessment of data. SSS data in .xtf format were imported into Chesapeake SonarWiz 7.10 software, navigation and positioning were checked and corrected where required, and optimal gains were applied to ensure the consistent presentation of data.

5.5.6 Data were reviewed on a line-by-line basis, and all anomalies of potential anthropogenic origin identified and recorded. Records include at a minimum an image of the anomaly, dimensions, and a description. Whilst typically only images of medium and high potential anomalies are presented with the assessment report, images of all anomalies are recorded as interpretations can change as the data assessment progresses. A rating of archaeological potential was assigned to the anomaly following the criteria outlined in Table 7 below.

5.5.7 Following assessment of the individual lines, a mosaic was created and a Geotiff exported to allow for the checking of positional accuracy against the MBES data and to identify the extents of any anomalies that may have extended past the limits of individual lines.

Magnetometer

5.5.8 Magnetometer data indicates the presence of ferrous, and thus usually anthropogenic, material both on, and under the seabed. Where line spacing allows, typically to a specification for the detection of potential UXO, magnetometer data can provide accurate positions of buried ferrous anomalies. The survey line spacing for White Cross Offshore Windfarm is c.45 to 75 m which is too great for the accurate positioning of magnetic anomalies at distances away from the tracklines but can indicate areas of archaeological potential. Where possible, magnetic anomalies were correlated with anomalies visible on the seabed.

5.5.9 Magnetometry data were provided as .csv files and as a gazetteer detailing all anomalies greater than 3 nT. An assessment was made by MSDS Marine as to the suitability of the gazetteer for archaeological interpretation. Where required the .csv magnetometer data was imported into either Geometrics MagPick or Chesapeake SonarWiz 7.10 software where the data was smoothed, and a 'baseline' identified and removed from the data to highlight ferrous anomalies whilst taking into account geological variations in the data.

5.5.10 Magnetic anomalies identified within the data had the position, intensity and dimensions recorded. A rating of archaeological potential was assigned to the anomaly following the criteria outlined in Table 7 below. The data were gridded to visually identify areas where the distribution of anomalies may represent a wider feature such a buried but dispersed wreck, or modern features such as buried cable or chain.

Multibeam Bathymetry

5.5.11 Due to the minimum anomaly detection size of MBES data being larger than that of SSS data, the primary use during archaeological assessment, outside of seabed characterisation, is the corroboration of anomalies identified within other datasets and the visualisation of anomalies that may otherwise be obscured by shadow.

5.5.12 Navigation corrected, but unprocessed, MBES data were provide to MSDS Marine as .xyz files, the data were imported into QPS Fledermaus where it was gridded and exported as a floating point raster, the raster was imported into ArcGIS Pro 3.0.3 and a hill-shaded surface applied, shading was adjusted to ensure the optimal presentation of data. The resulting 3-Dimensional image was viewed on a block-by-block basis, and all anomalies of potential anthropogenic origin identified and recorded.

5.5.13 Records include, at a minimum, an image of the anomaly, dimensions, and a description. A rating of archaeological potential was assigned to the anomaly following the criteria outlined in Table 7 below. Where the interpretation of an anomaly was unclear, the data were imported into point cloud visualisation software such as Cloud Compare, in order to view the un-gridded data. The gridded surface image was exported as a Geotiff to allow further assessment alongside other datasets.

Potential	Criteria
Low	An anomaly potentially of anthropogenic origin but that is unlikely to be of archaeological significance – Examples may include discarded modern debris such as rope, cable, chain, or fishing gear; small, isolated anomalies with no wider context; or small boulder-like features with associated magnetometer readings.
Medium	An anomaly believed to be of anthropogenic origin but that would require further investigation to establish its archaeological significance – Examples may include larger unidentifiable debris or clusters of debris, unidentifiable structures, or significant magnetic anomalies.
High	An anomaly almost certainly of anthropogenic origin and with a high potential of being of archaeological significance – high potential anomalies tend to be the remains of wrecks, the suspected remains of wrecks, or known structures of archaeological significance.

Table 7: Criteria for the assessment of archaeological potential

Combined assessment

5.5.14 Following the assessment of all datasets the results were loaded into ESRI ArcGIS Pro 3.0.3, a Geographical Information System (GIS), and reviewed alongside each other, along with Geotiffs of the SSS, MBES, and Magnetometer data. The concurrent review allows the amalgamation of duplicate anomalies, the assessment of the wider context, and an understanding of the extents of a feature that may be partially buried, or span across two or more lines of data.

5.5.15 Data from the United Kingdom Hydrographic Office (UKHO), including the positions of wrecks and obstructions, and the relevant Historic Environment Records (HER) and the National Record of the Historic Environment (NRHE), as well as all other relevant data such as third-party assets were assessed to ensure that any additional information is drawn upon, but also that anomalies are not unnecessarily identified as having archaeological potential when the origination can be identified. The resultant remaining anomalies assessed as having archaeological potential were compiled into a gazetteer and a shapefile.

5.5.16 The interpretation of geophysical and hydrographic data is, by its very nature, subjective. However, with experience and by analysing the form, size, and characteristics of an anomaly, a reasonable degree of certainty as to the origin of an anomaly can be achieved.

5.5.17 Measurements can be taken in most data processing software, and whilst largely accurate, discrepancies can be noted due to a number of factors. Where there is uncertainty as to the potential of an anomaly, or its origin, a precautionary approach is always taken to ensure the most appropriate mitigation for the historic environment.

5.5.18 It should be noted that there may be instances where an anomaly may exist on the seabed but not be visible in the geophysical data. This may be due to being covered by sediment or being obscured from the line of sight of the sonar. The use of both SSS and MBES data mitigates this by visualising anomalies from multiples angles, including from above. Anomalies were named following the standard MSDS Marine convention, [PROJECTYEAR_ID], e.g., WC22_XXX.

5.6 Palaeolandscape and Sub-bottom Profiler sources

5.6.1 A number of data sources were used for the assessment. The principal sources which were reviewed and assessed are set out below, while other published sources are referred to in-text.

5.6.2 The data available for the Offshore Development Area includes:

- MBES Data
- Sub- Bottom Profiler (SBP) and Single Channel Sparker (SCS) data
- Ground model outputs including:
  - N-SEA (2022) Offshore and nearshore survey: White Cross Windfarm: Geophysical survey results. DOC NO: NSW-PJ00285-RR-DC-SUR-001
- Boreholes, cores, and seismic data collected by the BGS (see Figure 8), containing evidence which has fed into their publications and maps;
  - Western side of the Offshore Development Area is covered by the Quaternary sheet: BGS 1991, North Celtic Sea including parts of 1:250 000 series sheets Nymphe Bank 51 N - 08 W; Lundy 51 N - 06 W. Labadie Bank 50 N - 10 W; Haig Fras, 50 N - 08W; and Land's End 50 N - 06 W. Quaternary Geology (extents of this map are shown on Figure 31).
  - The eastern side of the Offshore Development Area (the Offshore Export Cable Corridor) is only depicted on seabed sediments and solid geology sheets, the former BGS 1983, Lundy Sheet 51 N - 06 W Sea Bed Sediments.
  - BGS 1994, The geology of Cardigan Bay and the Bristol Channel. London: HMSO.
- Other studies and research reports including:
  - Fitch, S., and V. Gaffney, 2011. West Coast Palaeolandscapes Survey. University of Birmingham. This study focused in part on the Upper Palaeolithic and Mesolithic landscapes of the Bristol Channel area and included assessment of the inshore portion of the Export Cable Corridor.
  - Grant, M., K. Westley, and F. Sturt, 2019. Rapid Coastal Zone Assessment Survey for South-West England North Coast of Devon (excluding Exmoor) and North Coast of

Cornwall. University of Southampton, report for Historic England. This study focused on the coastline of the South-West, including around the landfall site.

- Gibbard, P. P. D. Hughes, C. J. Rolfe, 2017. New insights into the late Quaternary evolution of the Bristol Channel, UK. Journal of Quaternary Science 32(5) 564–578. This study includes assessment of data from Atlantic Windfarm Site, the Export Cable Corridor assessment area for which crossed that of the current site.

5.6.3 Other sources are referred to within the text where relevant. Boreholes mentioned in text are shown on Figure 8.

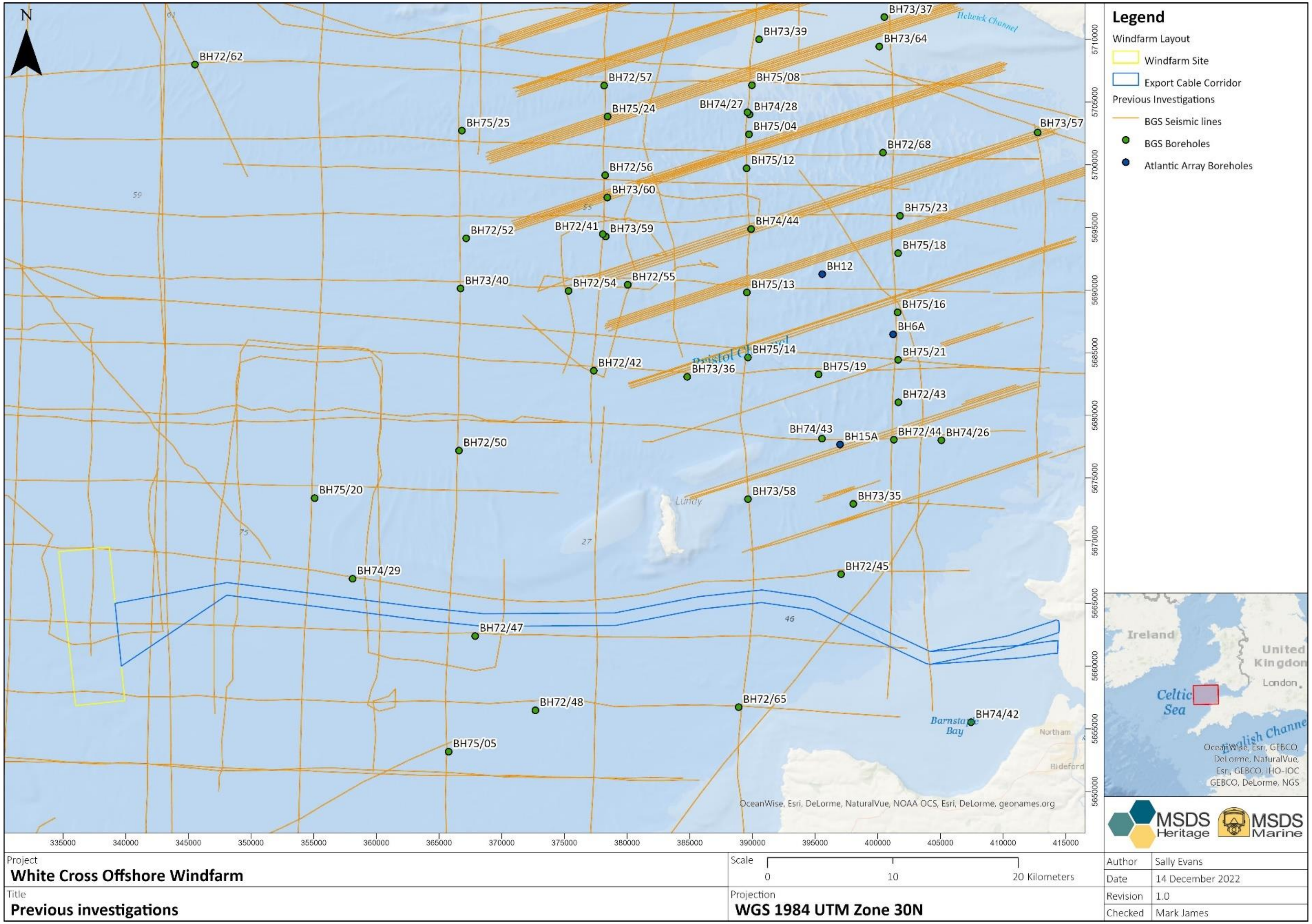


Figure 8: Previous investigations in the surrounding area

5.7 Palaeolandscape and Sub-bottom Profiler interpretation

5.7.1 Whilst the interpretation of the palaeolandscape is based upon the archaeological review of geophysical and hydrographic data, the method of assessment, the assessment criteria and the best practise mitigation strategies differ from those presented in the preceding sections and thus it is detailed separately for clarity.

5.7.2 Sub-surface data acquired from seismic and geotechnical surveys is key to understanding the palaeolandscape potential of the Offshore Development Area. These data are available for the site (see below for data sources) and have been assessed to identify ground conditions within the site. The interpretations of the data feed into the ground model, which incorporates both geological modelling and engineering conditions, knowledge of which is necessary for development design. Sedimentary units have been identified within the seismic data based on their seismic character and likely depositional environment, and tentatively correlated with known geological formations in the area based on the available data. Ground truthing with geotechnical data will be necessary to confirm the current interpretations. The top of each sedimentary unit has been mapped to feed into the ground model, and grids have been exported from the ground model for this assessment. From an archaeological perspective the ground model provides insight into the potential geological formations within the site, and their likely depositional environment. This feeds into the assessment of the palaeolandscape through time, and corresponding archaeological potential.

5.7.3 Sedimentary unit grids and geological maps derived from the interpretation of sub-surface data and the current seabed derived from MBES data were assessed alongside existing studies which contribute to the understanding of the palaeolandscape and prehistoric archaeological potential within the area. An archaeological review of the geophysical survey assessments and ground model covering the windfarm site was conducted by MSDS Marine with input from Professor Richard Bates. This included a review of geophysical survey data reports, select seismic profiles, and ground model outputs including mapped horizons and grids. These sources were reviewed in order to establish an understanding of the geological make-up of the site, formations present, and their palaeoenvironmental and archaeological potential. Information about the wider area has also been used to better contextualise the various environments experienced in the area during the Pleistocene and Holocene.

5.7.4 The site is within the Outer Bristol Channel region (Figure 1). The British Geological Survey (BGS) reports relating to the geology of Cardigan Bay and the Bristol Channel have been used here in conjunction with the results of geophysical surveys undertaken by N-SEA as part of the preliminary site investigation for the Offshore Development Area to identify deposits present within the site. The sources are listed above.

5.7.5 Geological formations and their archaeological potential have been discussed within Section 10.0 of this report.

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5.8 Mitigation

5.8.1 The following section discusses the archaeological mitigation strategies which are considered for White Cross Offshore Windfarm, the proposed mitigation is presented in Section 11.0.

Surface anomalies

5.8.2 To ensure the most appropriate and robust mitigation for the historic environment, whilst being proportional to the requirements of the development, mitigation recommendations are determined on an anomaly-by-anomaly basis, and consider all available data including;

- Potential significance;
- Size;
- Seabed type;
- Seabed dynamics;
- Development type; and
- Potential negative impacts.

5.8.3 Mitigation strategies have been based on the criteria in Table 8 below.

Potential	Criteria
Low	No archaeological significance interpreted. Maintain an operational awareness of the anomaly's location and reporting through the agreed protocol should material of potential archaeological significance be encountered.
Medium	Avoidance of the anomaly's position and where appropriate an archaeological exclusion zone may be recommended. Ground truthing of the anomaly through the use of divers or an ROV would establish the archaeological potential.
High	Archaeological exclusion zones will be recommended based on the size of the anomaly, any outlying debris and the seabed dynamics as interpreted from the SSS and MBES data.

Table 8: Mitigation criteria for archaeological anomalies

5.8.4 Where an anomaly is visible in the MBES data, that position will generally be used for the implementation of mitigation recommendations. The position obtained from the MBES data is generally more accurate due to the sensor and the GPS receiver being fixed to the vessel in known planes. SSS and magnetometer sensors are towed, and thus the margin for error is greater even with USBL, as the positional tolerance can be between 0.5 m and 2.0 m.

5.8.5 A phased approach to mitigation is proposed for White Cross Offshore Windfarm, corresponding with the planned future survey strategy. The survey specification was designed for the purposes of consenting and Front End Engineering Design (FEED) to determine the most appropriate area for development. Future surveys will likely combine an increase in resolution, and the addition of magnetometer data with tighter line spacing (as determined by the pUXO risk), within the development area. With the data resolution and coverage set to increase, the confidence in interpretation and appropriateness of mitigation strategies will also increase. Following the archaeological assessment, recommendations have been made as to the coverage and specification of future surveys to ensure a robust archaeological assessment of the development area at all stages of the development process.

5.8.6 At this phase, differentiation has made between anomalies that are visible and identifiable in the survey data (e.g., SSS and MBES anomalies), and potential anomalies that have not been identified in the survey data but are likely to exist on the seabed (e.g., Live UKHO records).

5.8.7 The mitigation strategies detailed in Table 9 have been used.

Potential	Criteria
Archaeological Exclusion Zones (AEZs)	For archaeologically significant anomalies that are clearly identifiable in the survey data and where the extents are largely known, Archaeological Exclusion Zones (AEZs) will be recommended. AEZs will remain for the life of The Project or until ground truthing or higher resolution data determines a reduction in potential, significance, or extents.
Temporary Archaeological Exclusion Zones (TAEZs)	Where an anomaly is not visible in the survey data but likely to exist on the seabed at a known position or where the extents of an anomaly are not fully identifiable, Temporary Archaeological Exclusion Zones (TAEZs) will be recommended. TAEZs have been identified as highly likely to be altered following higher resolution or full coverage data assessment, however, they will remain in place until alterations have been formally agreed.
Areas of Archaeological Potential (AAP)	Areas of Archaeological Potential (AAP) are primarily reserved for magnetic anomalies where, due to line spacing, positions are not accurately known. AAPs demonstrate that there is potentially an anomaly of archaeological significance around the given position. The anomaly is likely to be identified following higher resolution or full coverage data assessment but as the nature and position is not precisely known, no formal exclusion zone is recommended but instead a general awareness of the position is considered appropriate at this phase.

Table 9: Archaeological mitigation strategies

Palaeolandscape

5.8.8 Dependant on the assessed potential, the process of mitigation in relation to the palaeolandscape and palaeoenvironmental remains typically follows a staged approach of continued assessment aligning with the engineering requirement to undertake geotechnical works. The staged process is broadly outlined within The Crown Estate (2021) guidance on Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects and COWRIE (Gribble and Leather 2011) guidance on Offshore Geotechnical Investigations and Historic Environment Analysis.

5.8.9 Archaeological input into geotechnical core locations can allow for the greatest insights into the palaeolandscape, such as through the sampling of stratified channel deposits, deposits likely to contain organic remains or un-eroded surfaces. Typically, this process involves close collaboration with the Site Investigation team. Round-table discussions and the review of seismic profiles tends to be a conducive method of allowing engineering and archaeological requirements to be taken into consideration when micro-siting geotechnical cores.

5.8.10 Following the collection of geotechnical cores, they will undergo a staged program of geoarchaeological assessment and analysis. In brief the process is as follows;

- Stage 1: Geoarchaeological review of core logs;
- Stage 2: Geoarchaeological recording;
- Stage 3: Geoarchaeological assessment;
- Stage 4: Geoarchaeological analysis, and;
- Stage 5: Final reporting and publication.

6.0 Results of surface geophysical anomalies

6.0.1 For the avoidance of confusion, the results of magnetic anomalies with no surface expression are presented in Section 7.0, UKHO records in Section 8.0, NRHE and HER records in Section 9.0, and the palaeolandscape assessment in Section 10.0.

6.0.2 A total of 63 surface anomalies of potential archaeological interest were identified within the Offshore Development Area, 23 of which fall within the Windfarm Site, and 40 within the Offshore Export Cable Corridor. The anomalies are categorised by potential in Table 10.

Potential	Windfarm Site	Offshore Export Cable Corridor	Total
Low	23	35	58
Medium	0	3	3
High	0	2	2
Total	23	40	63

Table 10: Distribution of archaeological anomalies by potential

6.0.3 The distribution of anomalies is shown in Figure 9, as can be noted the distribution is fairly uniform across the surveyed area. The ratios of high, medium, and low potential anomalies are relatively consistent with a typical archaeological assessment of data.

6.0.4 The distribution of anomalies within the geophysical data shows a consistent approach to the assessment. The high, medium, and low potential anomalies are discussed below according to their assessed potential.

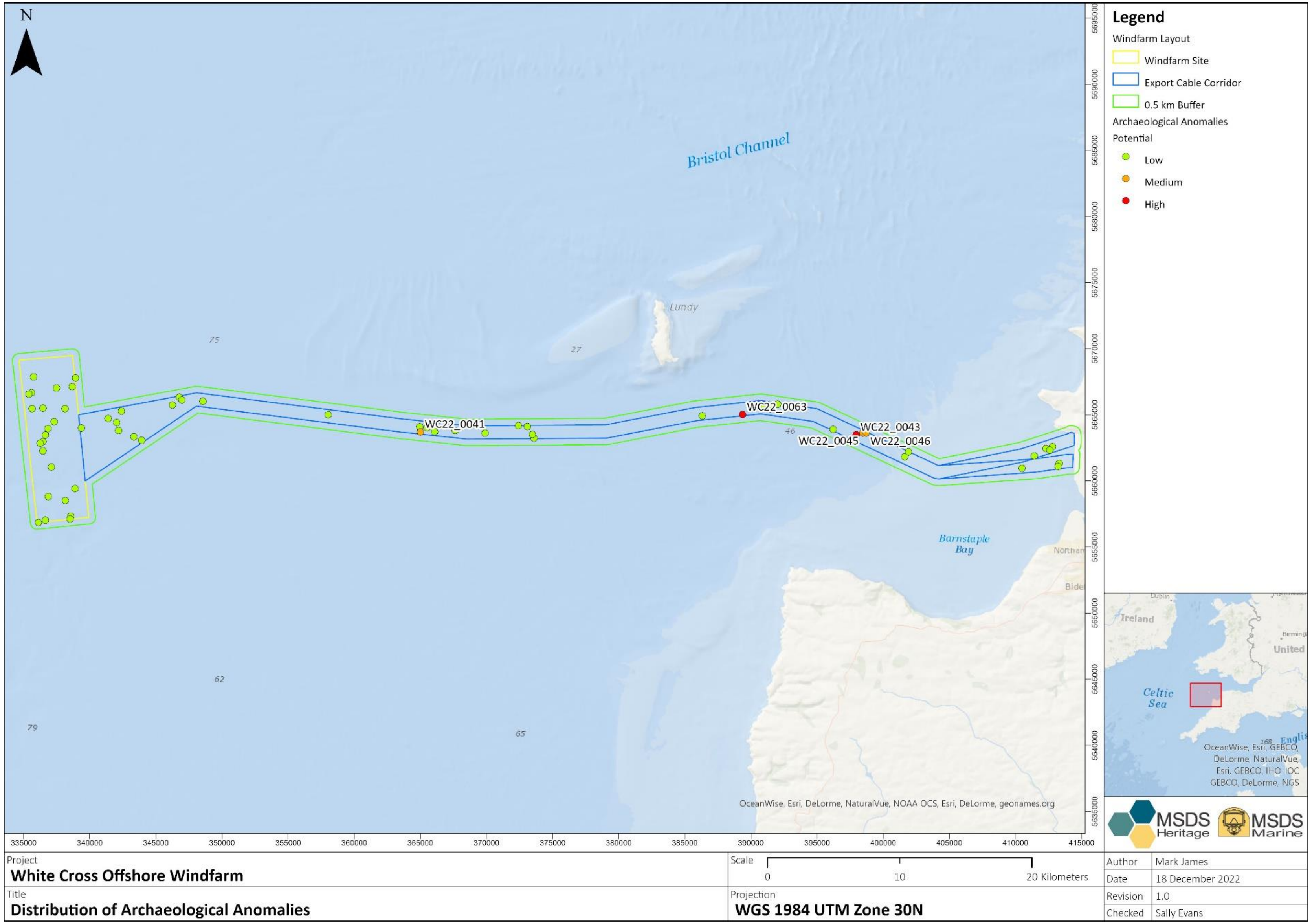


Figure 9: Distribution of Archaeological Anomalies

6.1 Low potential anomalies

6.1.1 58 anomalies interpreted as of low archaeological potential were identified within the Offshore Development Area, 23 of which fall within the Windfarm Site, and 35 within the Offshore Export Cable Corridor. The anomalies can be categorised as follows in Table 11.

Anomaly category	Windfarm Site	Offshore Export Cable Corridor	Total
Chain, cable, or rope	0	2[3]	2
Likely geological	10[4]	7[5]	17
Potential debris	11[6]	20[7]	31
Seabed disturbance	1[8]	0	1
Linear Feature	1[9]	4[10]	5
Fishing gear	0	2[11]	2
Total	23	35	58

Table 11: Low potential anomaly categories

6.1.2 The anomalies interpreted as of low archaeological potential (see Table 7) are a mixture of small features, often boulder-like, or likely to represent modern debris such as chain, cable, or rope, or small items of debris with no features indicating archaeological potential. Each anomaly was reviewed and interpreted to be of low archaeological potential. A further review was undertaken following the assessment of the survey area extents.

6.1.3 Table 12 below provides a brief justification for the interpretation of each category of low potential anomalies. To note, the descriptions below are generalised, and each anomaly is interpreted based on individual characteristics, other anomalies within the wider area, seabed characterisation, etc.

[3] WC22_0065, and WC22_0069
[4] WC22_0002, WC22_0005, WC22_0009, WC22_0015, WC22_0016, WC22_0019, WC22_0020, WC22_0022, WC22_0023, and WC22_0029
[5] WC22_0031, WC22_0034, WC22_0042, WC22_0051, WC22_0064, WC22_0068, and WC22_0073
[6] WC22_0003, WC22_0014, WC22_0008, WC22_0010, WC22_0012, WC22_0013, WC22_0014, WC22_0021, WC22_0026, WC22_0027, and WC22_0028
[7] WC22_0032, WC22_0033, WC22_0036, WC22_0038, WC22_0039, WC22_0044, WC22_0049, WC22_0052, WC22_0054, WC22_0055, WC22_0056, WC22_0059, WC22_0060, WC22_0061, WC22_0062, WC22_0066, WC22_0067, WC22_0070, WC22_0072, and WC22_0074
[8] WC22_0025
[9] WC22_0011
[10] WC22_0035, WC22_0047, WC22_0058, and WC22_0071
[11] WC22_0040, and WC22_0048

Anomaly category	Windfarm Site
Chain, cable, or rope	Features identified as chain, cable, or rope are generally identified as long, linear, or curvilinear features with little or no measurable height. The length and form will generally preclude their assessment as of a higher archaeological potential.
Likely geological	Features identified as likely geological, are generally precautionary identifications where the form is indictive of a geological feature but may be of a size, or form, which is unusual in the surrounding area.
Potential debris	Features identified as potential debris will generally display characteristics indicating anthropogenic origin, such as straight or angular edges. Boulder like features, with associated magnetic anomalies can also be categorised as potential debris.
Seabed disturbance	Features identified as seabed disturbances are where the main characteristic is a change in the seabed surface that may indicate either low lying material, or partially buried material. The potential will be determined based on the size, associated magnetic anomalies, and the surrounding environment.
Linear Feature	Linear features are anomalies which primarily consist of a single linear element, but that don't appear to be chain cable of rope. A single isolated linear feature, whilst potentially indicative of anthropogenic debris, may not warrant an interpretation of higher archaeological interest.
Fishing gear	Features identified as fishing gear may include pot strings where small features are linked by rope like features, features with a mid-water component indicating snagged nets, or features associated with trawl scars.

Table 12: Low potential anomaly descriptions

6.1.4 Low potential anomalies have been assessed against all available evidence and are deemed unlikely to be of archaeological significance and as such are not discussed further within the results section of this report. The identification of an anomaly as of low archaeological potential is commensurate with the mitigation for this category - *Maintain an operational awareness of the anomaly's location and reporting through the agreed protocol should material of potential archaeological significance be encountered*.

6.1.5 The distribution of low potential anomalies is shown in Figure 10. Further information regarding mitigation can be found in Section 11.0, and a gazetteer of low potential anomalies, including positions and dimensions, can be found in Annex A – *Anomalies of archaeological potential*.

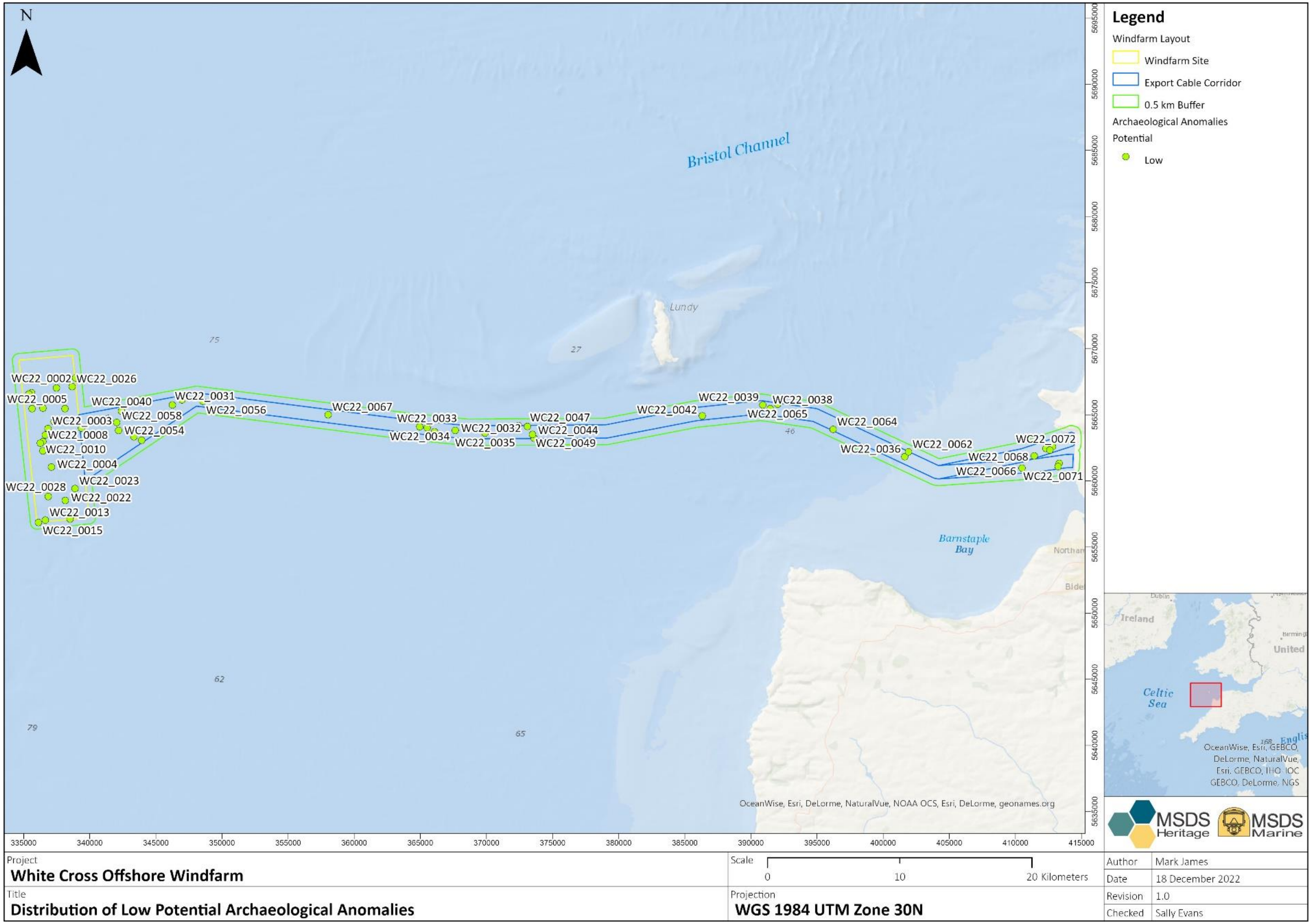


Figure 10: Distribution of Low Potential Archaeological Anomalies

6.2 Medium potential anomalies

6.2.1 Three anomalies interpreted as of medium archaeological potential were identified within the Offshore Development Area, all three of which fall within the Offshore Export Cable Corridor. The anomalies can be categorised as follows in Table 13, the distribution is presented in Figure 11.

Anomaly category	Offshore Export Cable Corridor
Potential wreck	1
Potential debris	1
Likely geological	1
Total	3

Table 13: Medium potential anomaly categories

6.2.2 The anomalies interpreted as of medium archaeological potential have characteristics that indicate a likelihood of representing anthropogenic material that has the potential to be of archaeological interest, or where a precautionary approach has been taken for anomalies where the identification isn't clear.

6.2.3 The identification of an anomaly as of medium archaeological potential is commensurate with the mitigation for this category - *Avoidance of the anomaly's position and where appropriate an archaeological exclusion zone may be recommended. Ground truthing of the anomaly through the use of divers or an ROV would establish the archaeological potential*.

6.2.4 Each medium potential anomaly is discussed, along with an image, within this section of this report. Further information regarding mitigation can be found in Section 11.0, and a gazetteer of medium potential anomalies, including positions and dimensions can be found in Annex A – *Anomalies of archaeological potential*.

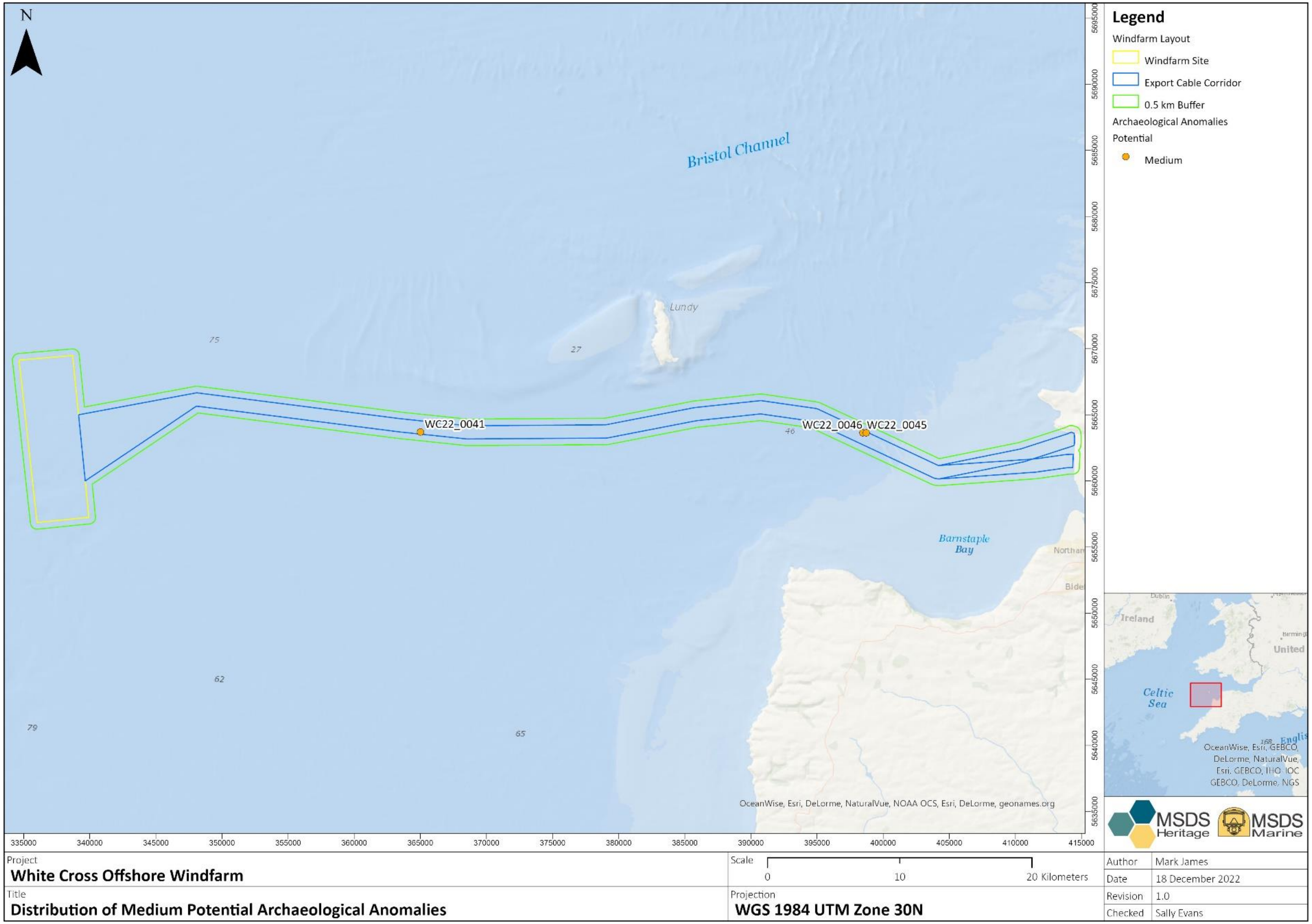


Figure 11: Distribution of Medium Potential Archaeological Anomalies

Medium potential WC22_0041

6.2.5 WC22_0041 (Figure 12) lies within, and to the south of, the Offshore Export Cable Corridor approximately 25.7 km east of the Windfarm Site. The anomaly is visible in the both the SSS and MBES data, has no associated magnetic anomaly and does not correspond with any UKHO, HER, or NRHE records, the nearest being UKHO record 12218 c. 1.4 km to the north-east.

6.2.6 The anomaly is visible as a prominent, elongated, feature measuring 11.8 m x 3.9 m with a protrusion to the north measuring 3.4 m x 2.5 m. The anomaly is orientated east, west, with a measurable height of 0.7 m and with slight scour to the western edge.

6.2.7 The form of the anomaly is geological; however, it is isolated, unusual, and prominent within the surrounding seabed, the nearest potentially comparable feature lies nearly 9 km to the east and is associated with the area of exposed bedrock. The assessment as of medium potential is precautionary, based primarily on the visible size and the uniqueness in the surrounding seabed. Further assessment of Remotely Operated Vehicle (ROV) data would be required to better understand the origin, and therefore the archaeological potential.

Medium potential WS22_0045

6.2.8 WC22_0045 (Figure 13) lies within, and to the north of, the Offshore Export Cable Corridor approximately 15.5 km west of the shore. The anomaly is visible in both the SSS and MBES data and has an associated magnetic anomaly of 117.1 nT. The position does not correspond with any UKHO, HER, or NRHE records, the nearest being NRHE record 1518044 c. 2.8 km to the south-east.

6.2.9 Within the MBES data the anomaly appears as a relatively featureless, large, mound measuring 15.0 m x 4.7 m with a measurable height of 2.9 m, the feature disrupts the surrounding sand ripples to the south, south-east, and the north-east. Within the SSS data the anomaly is visible as an oblong feature, angled to a point at the north-west. To the south-east the end is irregular and appears to slope off to the seabed, a similar form can be observed to the north of the anomaly. Based on the form visible in the SSS data, and the associated magnetic anomaly, the anomaly has been interpreted as a potential wreck. The interpretation is however very precautionary, and the anomaly could represent a large geological feature, or a glacial erratic (see Section 10.3.14). Thus, the assigning of a medium potential rating is considered appropriate.

Medium potential WC22_0046

6.2.10 WC22_0046 (Figure 14) lies within, and to the north of, the Offshore Export Cable Corridor approximately 15.3 km west of the shore. The anomaly is visible in both the SSS and MBES data and has an associated magnetic anomaly of 48.5 nT. The position does not correspond with any UKHO, HER, or NRHE records, the nearest being NRHE record 1518044 c. 2.6 km to the south-east.

6.2.11 Within both the MBES and SSS data the anomaly is visible as a large, 5.5 m x 5.2 m, feature, with a measurable height of 1.2 m. The form is not dissimilar to that of a boulder. Scour is visible on all sides. With the exception of WC22_0045, 280 m to the west, the anomaly is unusual in the surrounding environment. The anomaly has been assigned a precautionary medium potential rating due to the size of the feature, the uniqueness in the surrounding environment, and the association with a magnetic anomaly. However, the anomaly could represent a geological feature, or a glacial erratic (see Section 10.3.14).

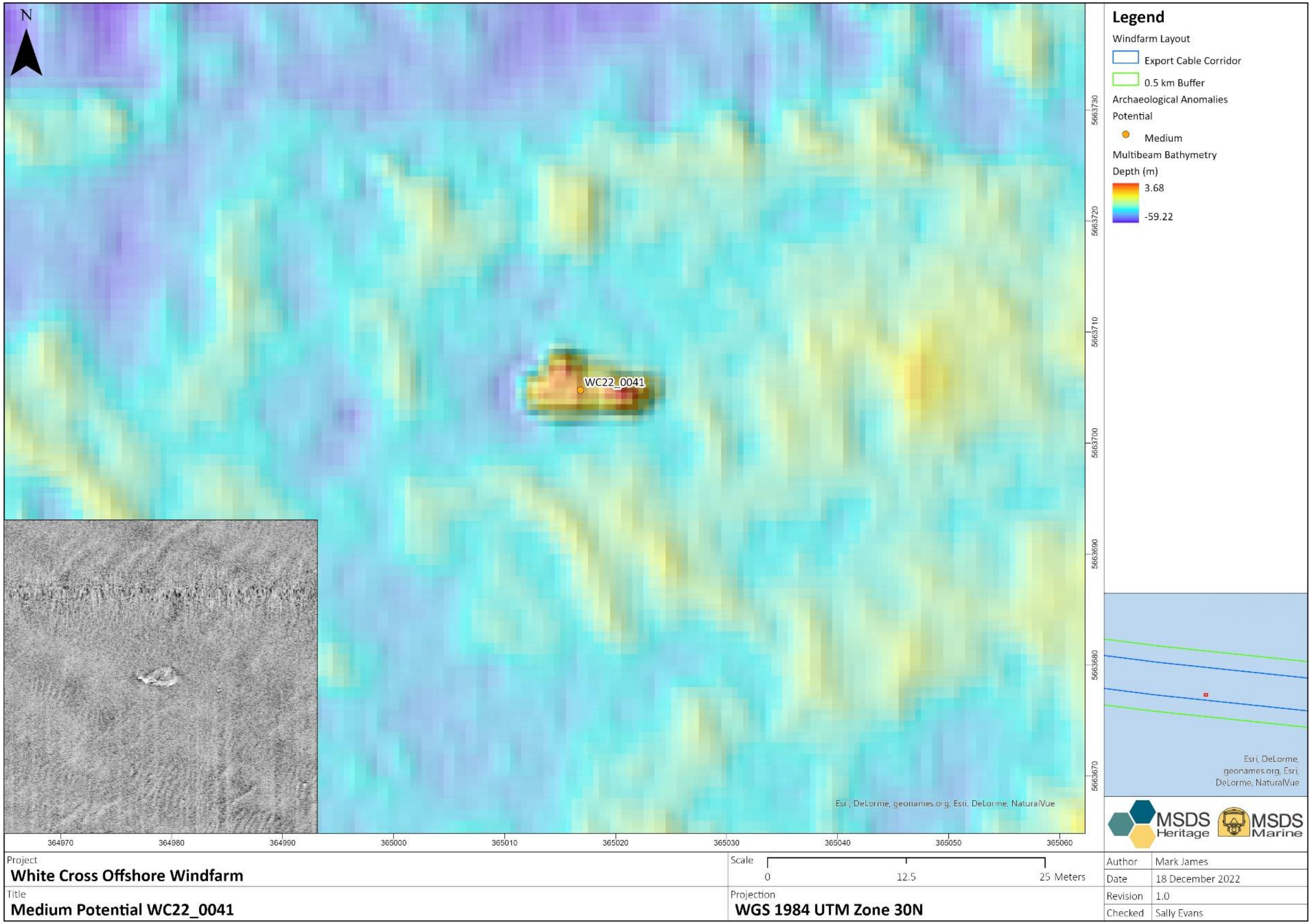


Figure 12: Medium Potential WC22_0041

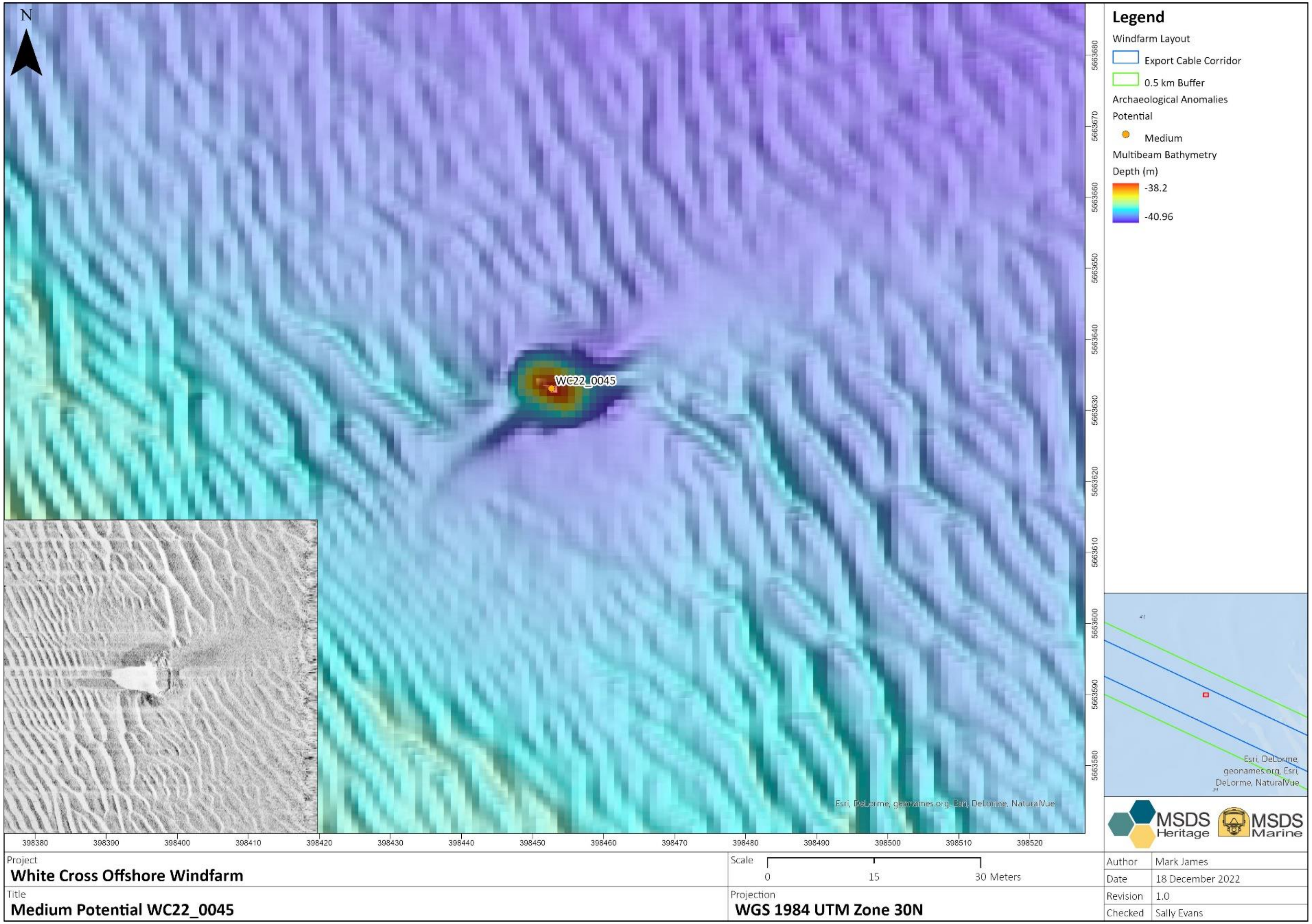
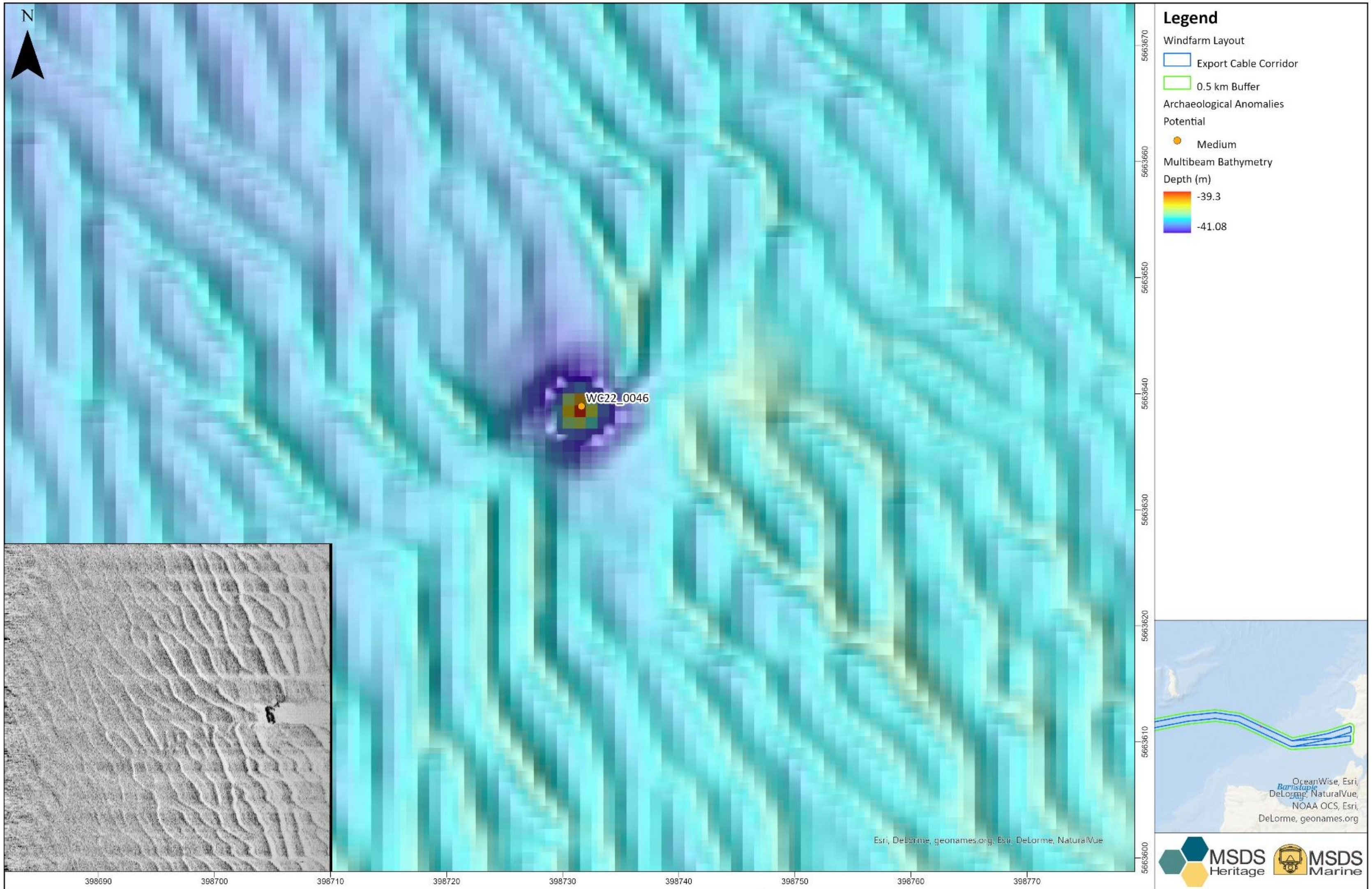


Figure 13: Medium Potential WC22_0045



Project **White Cross Offshore Windfarm**	Scale 0 12.5 25 Meters	Author	Mark James
		Date	09 January 2023
Title **Medium Potential WC22_0046**	Projection **WGS 1984 UTM Zone 30N**	Revision	1.0
		Checked	Sally Evans

Figure 14: Medium Potential WC22_0046

6.3 High potential anomalies

6.3.1 Two anomalies interpreted as of high archaeological potential were identified within the Offshore Development Area, both of which fall within the Offshore Export Cable Corridor. The anomalies can be categorised as follows in Table 14, the distribution is presented in Figure 15.

Anomaly category	Offshore Export Cable Corridor
Wreck	1
Potential wreck	1
Total	2

Table 14: High potential anomaly categories

6.3.2 The anomalies interpreted as of high archaeological potential have characteristics that indicate a high likelihood of representing anthropogenic material that has a high potential to be of archaeological interest, or where a precautionary approach has been taken for anomalies where the identification isn't clear.

6.3.3 The identification of an anomaly as of high archaeological potential is commensurate with the mitigation for this category - *Archaeological exclusion zones will be recommended based on the size of the anomaly, any outlying debris and the seabed dynamics as interpreted from the SSS and MBES data*.

6.3.4 Each high potential anomaly is discussed, along with an image, within this section of this report. Further information regarding mitigation can be found in Section 11.0, and a gazetteer of high potential anomalies, including positions and dimensions can be found in Annex A – *Anomalies of archaeological potential*.

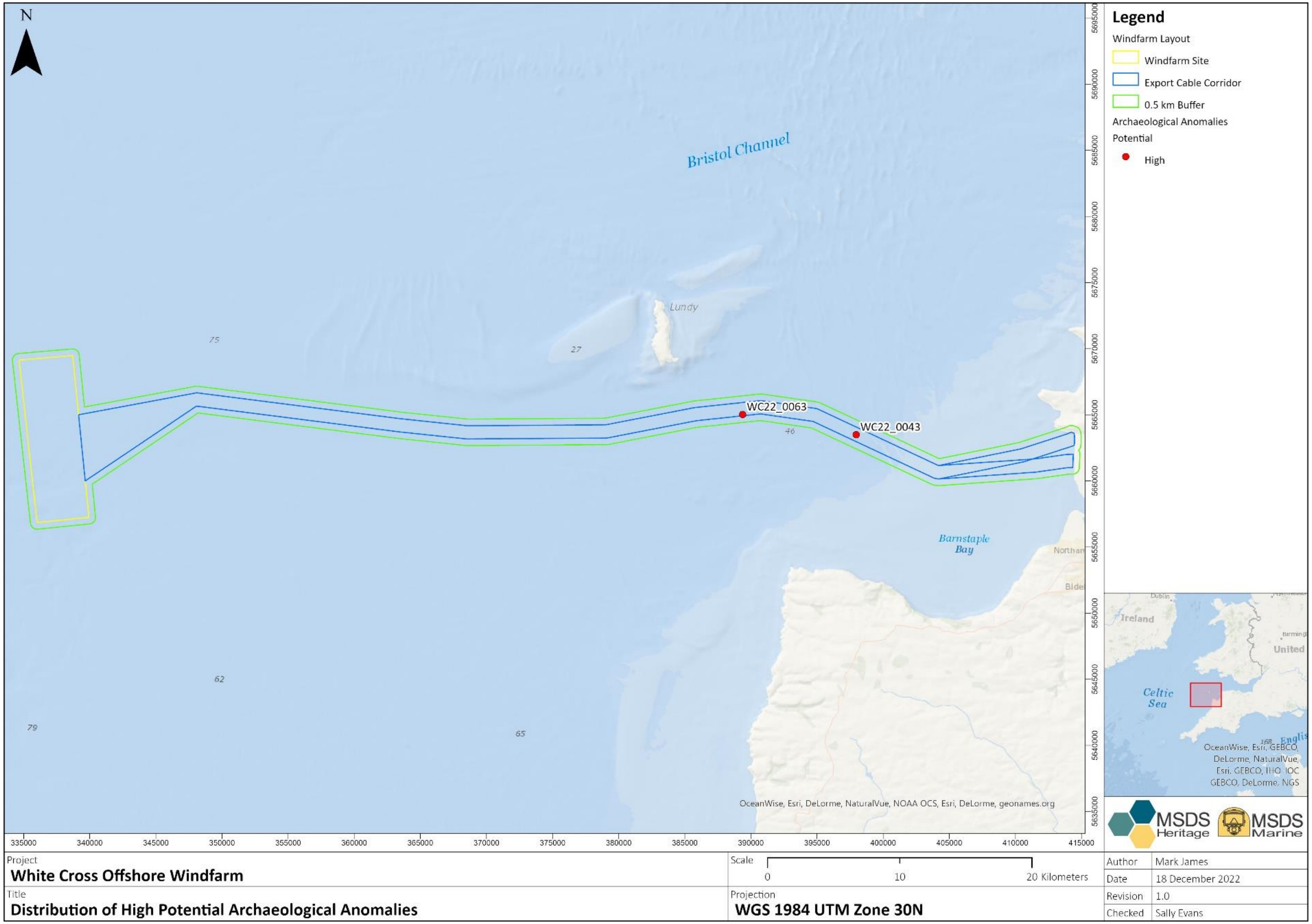


Figure 15: Distribution of High Potential Archaeological Anomalies

High potential WC22_0043

6.3.5 WC22_0043 (Figure 16) lies within, and to the south of, the Offshore Export Cable Corridor approximately 16.5 km west of the shore. The anomaly is visible in both the SSS and MBES data and has an associated magnetic anomaly of 25.3 nT. The position does not correspond with any UKHO, HER, or NRHE records, the nearest being NRHE record 1518044 c. 3.2 km to the south-east.

6.3.6 The anomaly is visible within the SSS data as a spread of features over an area 19.8 m x 8.3 m. A prominent feature towards the centre has a measurable height of 1.7 m. The anomaly is within an area of sand waves with smaller features visible within them to the south-east, suggesting a level of burial beneath them. A smaller (2.5 m) linear feature lies to the north-east of the main feature. Within the MBES data the anomaly is characterised by a small depression between two sand waves to the west, and a mound covered by sand waves to the east.

6.3.7 The form of the features, and the associated magnetic anomaly, potentially indicate the presence of anthropogenic material, the distribution of which could potentially represent the remains of a partially buried wreck or other concentration of debris. Thus, a high potential rating is considered appropriate.

High potential WC22_0063

6.3.8 WC22_0063 (Figure 17) lies within, and to the south of, the Offshore Export Cable Corridor approximately 25 km from the shore. The anomaly is visible in both the SSS and MBES data and has an associated magnetic anomaly of 1,011.6 nT. A UKHO record (72153) is located at the position of the anomaly.

6.3.9 The anomaly is visible within the SSS data as the remains of a wrecked vessel, measuring 52.6 m x 14.0 m, with a maximum measurable height of 2.3 m, and orientated north-west, south-east. The wreck is characterised by incoherent linear features towards the centre, with an upstanding feature comprising linear elements towards the south-east, and a larger upstanding feature towards the north-west. Whilst the features are broadly identifiable as structure, it is not possible to provide any great level of interpretation other than the wreck is likely constructed of iron, or steel. Along the eastern edge debris can be identified extending up to 29 m from the main area of wreck, however, it appears largely contained elsewhere.

6.3.10 The MBES data confirms the presence of upstanding features to the north-west and south-east, and lower lying material towards the centre. Scour, although slight, can be identified most of the way around the wreck.

6.3.11 The UKHO record the anomaly under record 72153 as an obstruction first identified in 2007, noting a probable seabed feature. The interpretation of the anomaly as an unknown wreck, of unknown origin, means that a high potential rating is appropriate.

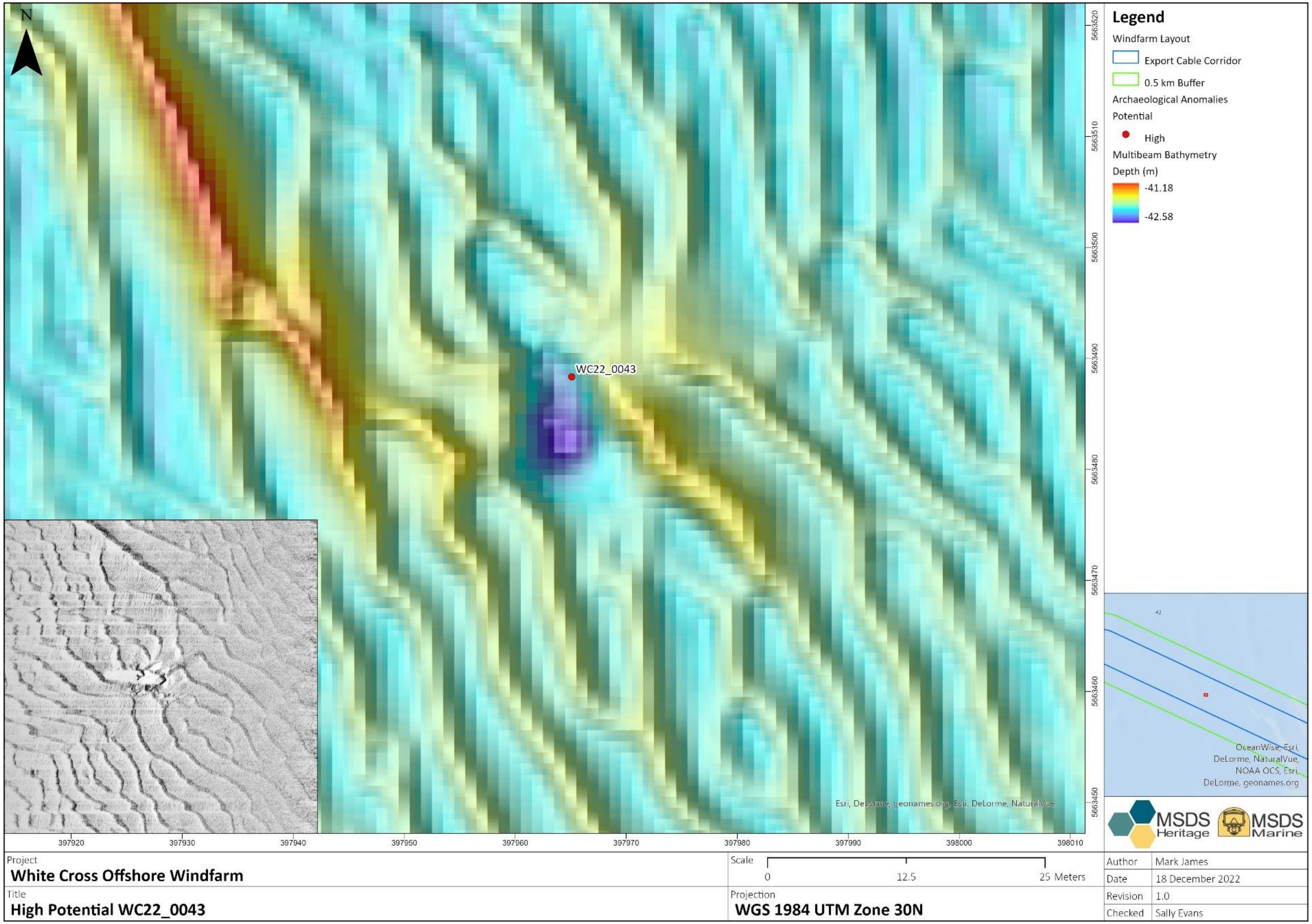


Figure 16: High Potential WC22_0043

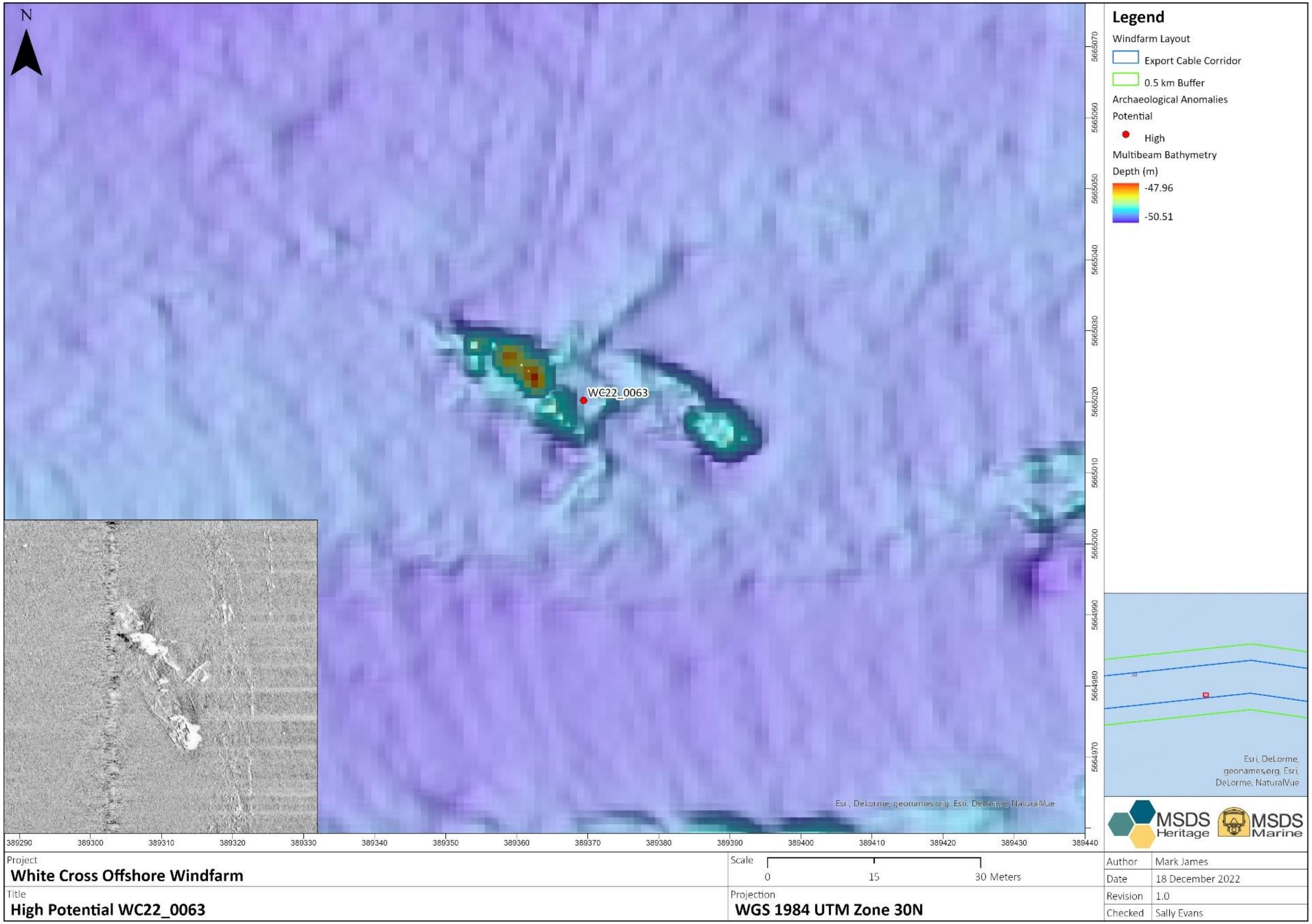


Figure 17: High Potential WC22_0063

7.0 Magnetic anomalies

7.0.1 662 magnetic anomalies, ranging between 5 nT and 17,749 nT, were identified within the Offshore Development Area, of these 619 do not correlate with known, or visible, features or infrastructure. 52 magnetic anomalies fall within the Windfarm Site, and 567 within the Offshore Export Cable Corridor. The distribution of anomalies by amplitude is shown below in Table 15 with their spatial distribution presented in Figure 18.

Intensity (nT)	Windfarm Site	Offshore Export Cable Corridor	Total
5 to 50	52	476	528
50 to 100	0	45	45
100 to 200	0	26	26
200 +	0	20	20
Total	52	567	619

Table 15: Magnetic anomalies

7.0.2 Anomalies identified from the magnetometer data are ferrous and thus generally anthropogenic in origin although they can be associated with geological features, however, there is no visual interpretation as with other geophysical data.

7.0.3 The magnetometer data collection methodology across the White Cross Offshore Windfarm survey area was to run lines concurrently with the SSS and MBES (or in the case of the nearshore area, along the same lines but independently), thus the line spacing is not sufficient for the detailed assessment of small, ferrous features on or below the seabed. The position for a magnetic anomaly can only be determined from directly below a single sensor, or where lines are run close enough together to be able to confidently position an anomaly seen on two, or more, lines. However, in combination with SSS and MBES data the magnetometer specification is considered sufficient to develop a broad understanding of the potential of the survey area, and to identify larger features of potential archaeological significance.

7.0.4 The positions of magnetic anomalies were viewed in the available datasets and where there was a strong correlation with a seabed anomaly, they were assessed for archaeological potential. All remaining anomalies have been included within this section.

7.0.5 All isolated magnetic anomalies of 50 nT or less are considered to be of limited potential to be of archaeological significance.

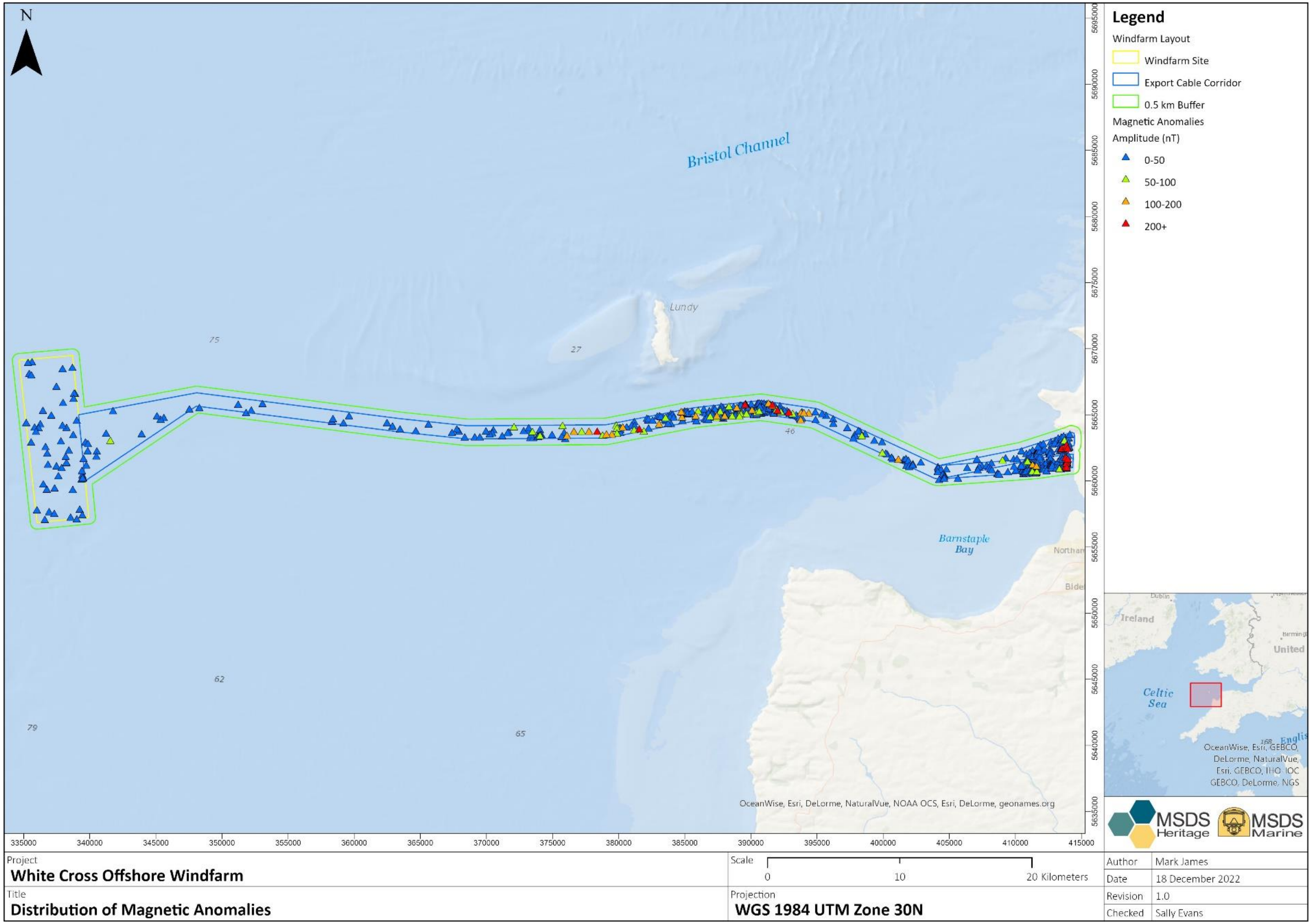


Figure 18: Distribution of Magnetic Anomalies

7.1 Overview of magnetic anomaly distribution

7.1.1 The distribution of magnetic anomalies is not uniform throughout the Offshore Development Area and is not what would be considered typical. The Windfarm Site, and the Offshore Export Cable Corridor extending c. 35 km towards the shore has a fairly uniform distribution of primarily small magnetic anomalies (<50 nT). These anomalies likely represent small pieces of debris, steel cable, fishing gear, etc. that are either buried or of a size not visible within the SSS or MBES datasets.

7.1.2 Within the Offshore Export Cable Corridor, from c. 35 km from the Windfarm Site to c. 20 km from the shore the density of anomalies increases notably, with an increase of anomalies >50 nT, including a number >200 nT. This area does encompass a large area of exposed, and protruding, bedrock and coarse sediments which may to some degree be masking features visible on the surface (Figure 19). However, due to the unlikeliness of significant burial of anomalies within this area it is unlikely that these anomalies represent material of medium or high archaeological potential as they are not visible within the SSS or MBES dataset. Within areas of rocky seabed, the potential for general marine debris will increase due to items such as anchors and chain, pots, fishing gear, etc. becoming snagged, broken, and discarded. The protruding nature of seabed also has the potential to 'catch' debris that may be mobile on the seabed.

7.1.3 Within the Offshore Export Cable Corridor, from c. 20 km from the shore to 4 km from the shore the density of anomalies decreases significantly, more akin to that seen within the Windfarm Site and the c. 35 km of Offshore Export Cable Corridor to the west. The seabed is predominantly sandy, with sand waves in the western section. The seabed may indicate the potential for burial of material, although to note none of the large magnetic anomalies are beneath sand waves. As per the Windfarm Site, these anomalies likely represent small pieces of debris, steel cable, fishing gear, etc. that are either buried or of a size not visible within the SSS or MBES datasets.

7.1.4 The density of anomaly increases in the nearshore area of the Offshore Export Cable Corridor (c. 4 km from the shore to the shore), with two notable concentrations. The first being to the west, and predominantly anomalies <50 nT, the second being to the east close into shore where there is a significant number of large anomalies >200 nT (Figure 20) on a largely featureless sandy seabed. To some degree the increase in anomalies in this area can be attributed to the towing altitude of the magnetometer which was c. 3.5 m within the nearshore area, and 8 m across the remainder of the Offshore Development Area, this decrease in altitude will decrease the minimum detection size and increase the recorded amplitude of a given object. In addition, the line spacing in the nearshore area was 45 m, but 75 m across the remainder of the Offshore Development Area which will increase the identification of smaller anomalies that may otherwise have been located between lines and not identified. However, whilst this may account for some of the increase in density, particularly to the east close into shore, this does not account for the significant number of large anomalies, this is discussed in the following section.

7.1.5 Two large anomalies lie within 0.5 km of UKHO, NRHE (points), or HER records; WC22M_0228 which lies c. 497 m from NRHE record 1518044, and WC22M_1061 which lies c. 127 m from

HER records MDV57845, MDV57854, MDV58186, and MDV80614. As discussed in Section 9.0 the positions are arbitrary and unlikely to represent material on the seabed. No other correlation between UKHO, NRHE (points), or HER records was noted.

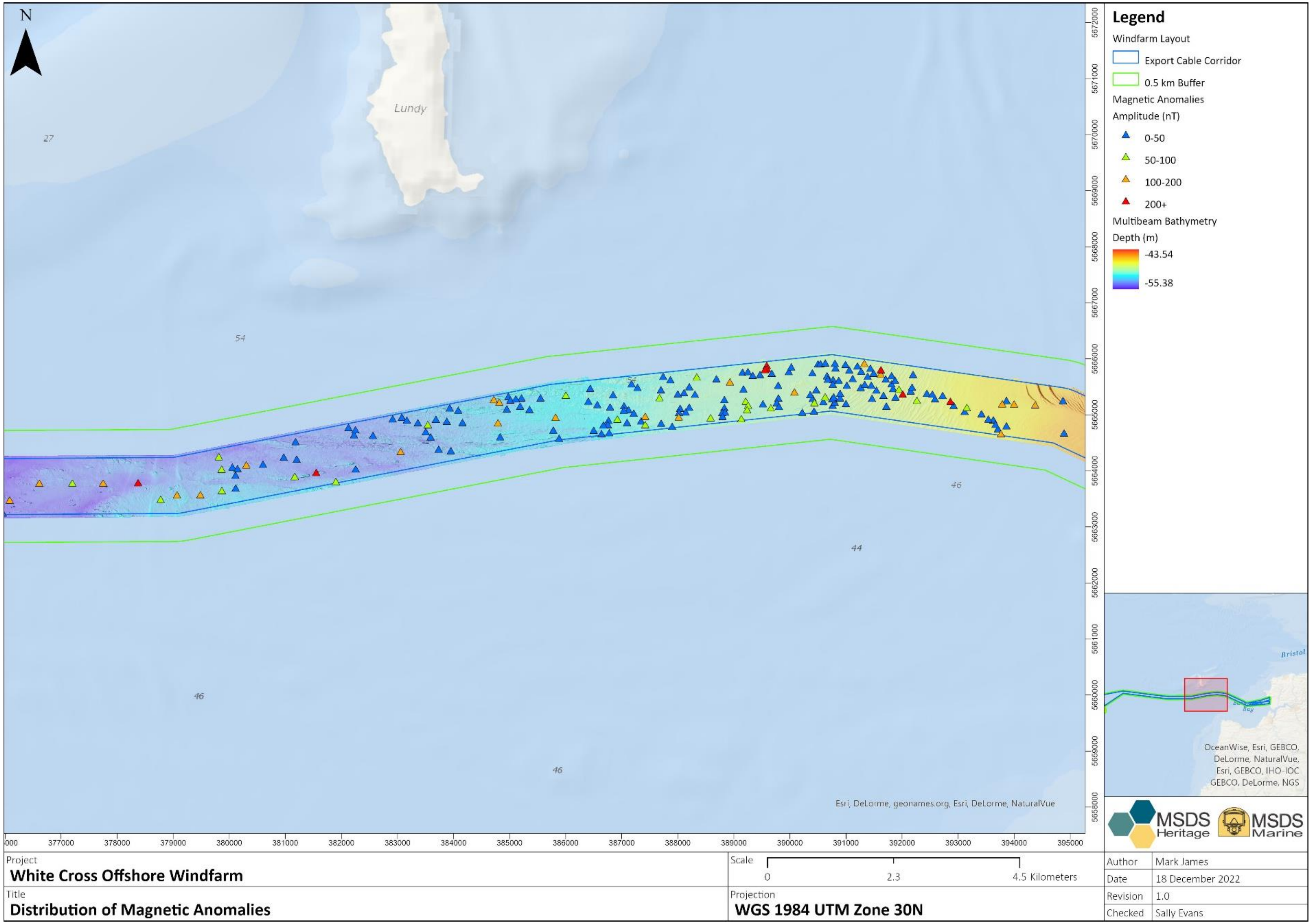


Figure 19: Distribution of magnetic anomalies

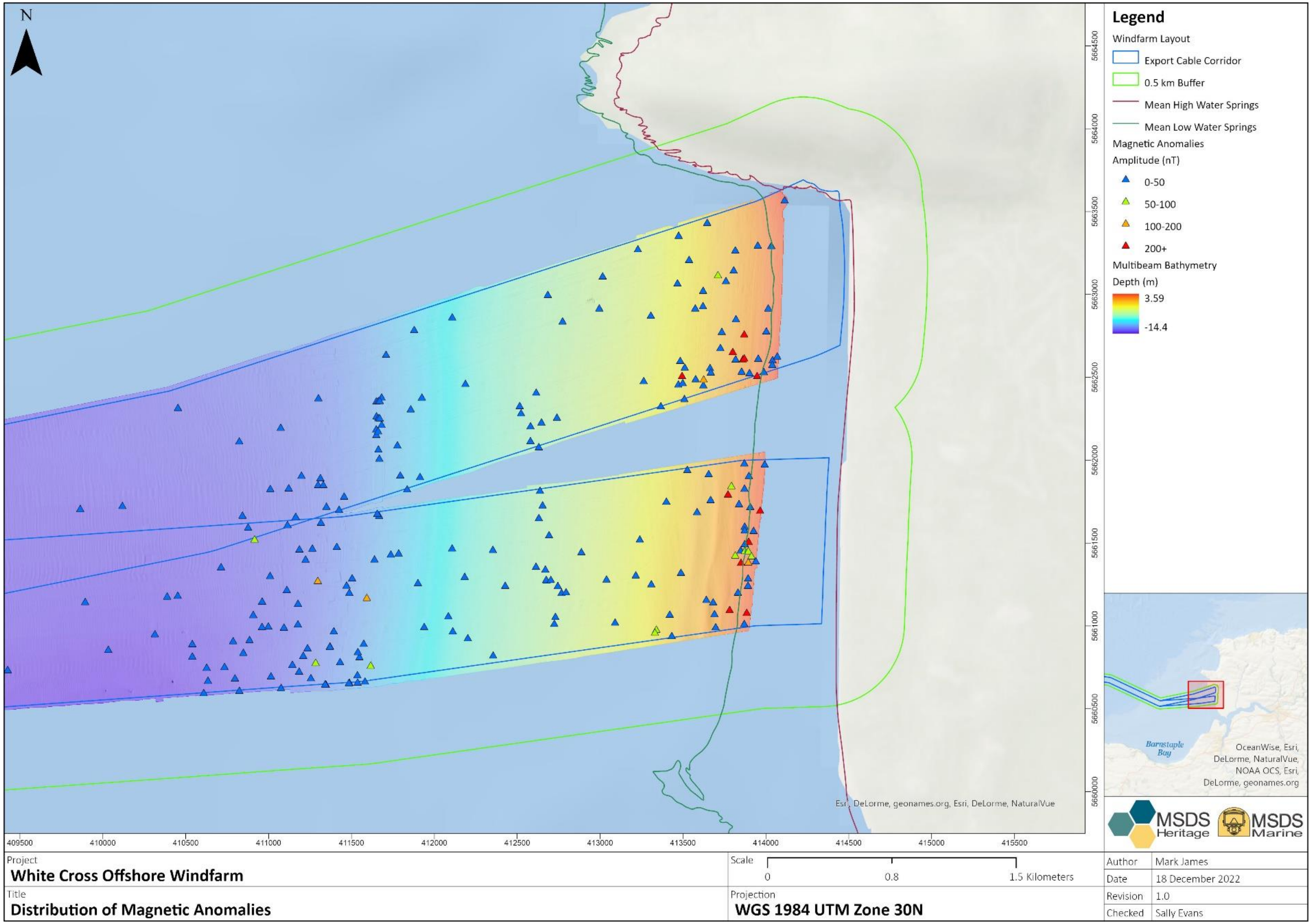


Figure 20: Distribution of magnetic anomalies within the nearshore area

7.2 Nearshore magnetic anomalies

7.2.1 The density, and amplitude, of the nearshore magnetic anomalies is notable. Whilst the nearshore area can often have a higher density of anomalies due in part to events such as vessels beaching during bad weather, mobile debris washing in, structures such as groins, and moorings, etc., it is likely that the anomalies identified are, at least in part, related to military activities during World War II. Whilst a comprehensive Desk Based Assessment (DBA) of these activities is outside the scope of this assessment the following, based on limited sources, and the author's knowledge of the area, is provided for context.

7.2.2 Saunton Sands where the Offshore Export Cable Corridor makes landfall, formed part of the American Army's Assault Training Centre during World War II in preparation for the D-Day landings[12], the locations of which are shown on Figure 21[13]. Exercises including the use of live ammunition, explosives, boats, tanks, artillery, and air support were all undertaken[14,15], this included the reconstruction of the expected defences that would be encountered during the D-Day landings. This was alongside strategic coastal defences implemented to protect the area from enemy incursions from the sea. The area is still used for training by the military today[16].

7.2.3 Following the end of the war much of the military infrastructure on the beaches was removed, this included the removal of a double row of 25 lb anti-tank mines above the high water mark. It is notable that these mines had to be water jetted out as approximately 15 ft of sand had accumulated on top of them, likely as a result of blown sand. After location and detonation, the remains of the mines were bulldozed past the high water line and out to sea[17].

7.2.4 The ferrous remains of other infrastructure can still be found today buried close to the surface of the beaches, including barbed wire, metal posts, etc. In 2021 the Dynamic Dunescape Project, in partnership with the MOD's 29 Explosive Ordnance Clearance (EOC) Group, undertook clearance works within the Braunton Burrows, adjacent to the east of the Offshore Export Cable Corridor landfall. The clearance works located, and excavated, 362 items of expended ordnance and 17 live items of ordnance and included rockets, Sherman tank shells, landmines, mortar shells, rifle grenades, and explosives. Therefore, given the previous use of the nearshore area and the adjacent beach, it is highly likely that a significant proportion of the nearshore magnetic anomalies relate to remnants of World War II military activity, both from the use as a training ground, and defence, particularly those along the low water line (Figure 21).

7.2.5 As will be discussed in Section 9.3, 33 NRHE Named Locations are located in the intertidal zone of the southern arm of the Offshore Export Cable Corridor, although these are not believed to be accurate locations of loses, there is potential for some of the magnetic anomalies to represent material from these records.

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[12] University of Southampton, 2019. *Rapid Coastal Zone Assessment Survey for South-West England North Coast of Devon (excluding Exmoor) and North Coast of Cornwall Phase One Desk-Based Assessment*. Historic England Project 6047

[13] Devon HER Monument ID MDV57283

[14] http://www.explorebraunton.org/burrows-world-war-ii.aspx

[15] https://d-dayinfo.org/en/preparation/braunton-burrows/#video

[16] https://insidedio.blog.gov.uk/2019/06/05/from-d-day-to-today-braunton-burrows-training-area/

[17] Personal account of Major (retired) Mike Inglis at http://www.explorebraunton.org/burrows-world-war-ii.aspx

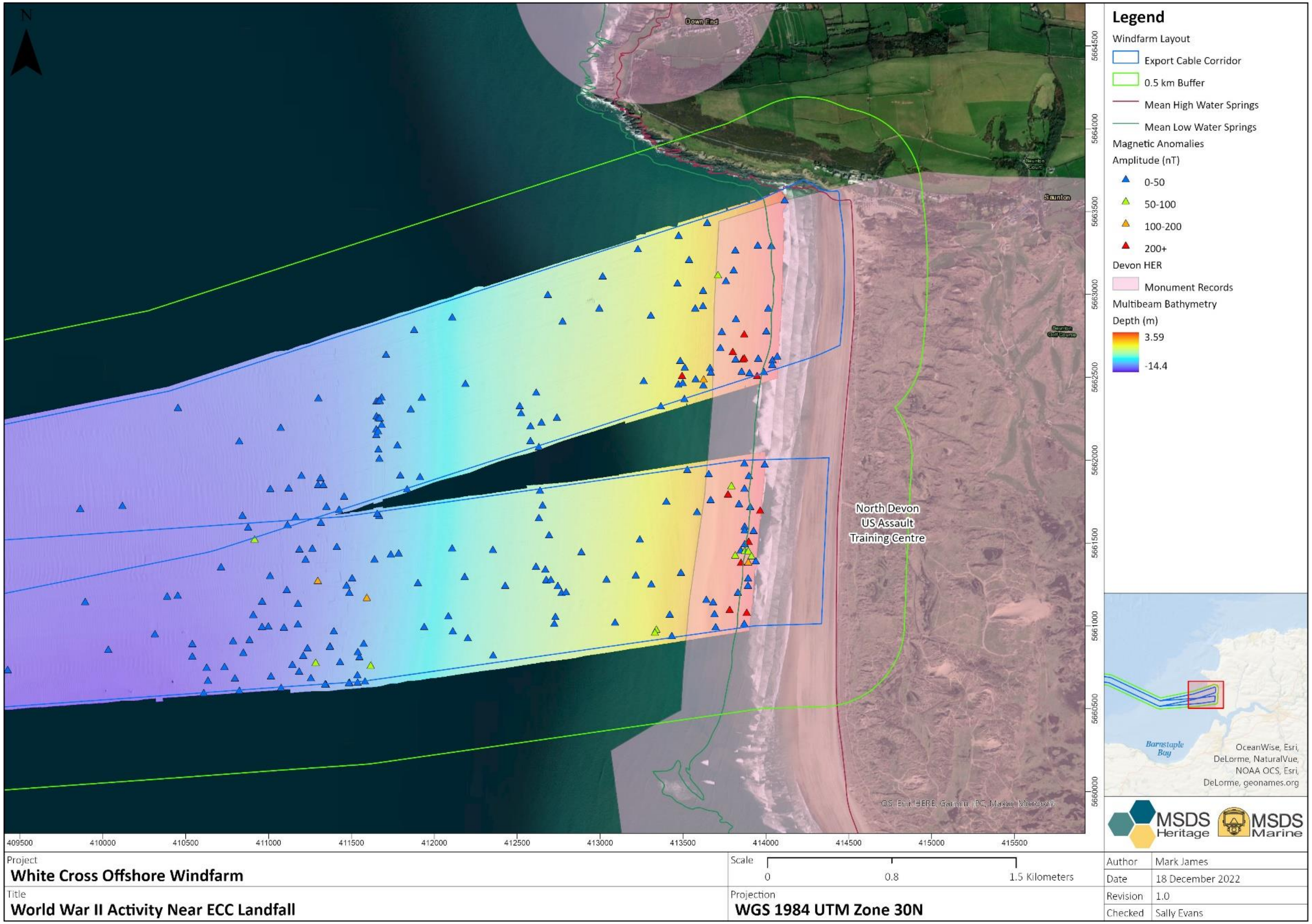


Figure 21: World War II activity near Offshore Export Cable Corridor landfall

7.3 Discussion of potential

7.3.1 Magnetic anomalies >100 nT are typically described as large and have the potential to be of archaeological significance. It should be noted that these anomalies, and any interpretations, are based on a magnetic signature rather than a visible image of the anomaly on the seabed. It is often the case that during intrusive investigations these anomalies are identified as modern marine debris, including cable, chain, modern anchors, fishing gear, and parts of modern vessels such as outboard engines, and other detritus either deliberately or accidentally, put overboard. Where anomalies are largely isolated, or relating to a single feature, the most commonly identified material of archaeological interest are isolated anchors, often of indeterminate age. The difficulties in determining the age of concreted anchors, and the lack of a wider context means these are often classed as of low or medium potential to be of archaeological significance. However, whilst the chances of isolated magnetic anomalies being of archaeological interest is potentially low, this does not reduce the potential of anomalies to be of archaeological significance, and both must be considered during the recommendation of mitigation (Section 11.0).

7.3.2 The greatest potential for magnetic anomalies to be of archaeological potential is within areas of seabed where there is potential for material to be buried. Within the Offshore Development Area this is the area encompassing the Windfarm Site and the Offshore Export Cable Corridor to 35 km from the Windfarm Site, and the Offshore Export Cable Corridor from shore to 24 km. The remainder of the Offshore Export Cable Corridor is characterised by exposed bedrock, and any material of potential medium or high archaeological potential would likely be visible within the SSS and MBES datasets, with the exception of areas of sandy infill.

7.3.3 The nearshore area holds the highest potential for magnetic anomalies to represent material of archaeological interest, given the previous use of the area as a training ground prior to D-Day. D-Day, or Operation Overlord, was one of the largest military operations ever conducted, and was a turning point in the course of World War II.

7.3.4 The magnetic anomalies considered be of medium and high archaeological potential are detailed in Table 16 and presented in Figure 22 below.

Anomaly ID	Amplitude	Potential
WC22M_0202	139.9	Medium
WC22M_0228	160.5	Medium
WC22M_0271	168.5	Medium
WC22M_0273	201.9	Medium
WC22M_0302	138.9	Medium
WC22M_0326	165.6	Medium
WC22M_0421	156.8	Medium

Anomaly ID	Amplitude	Potential
WC22M_0554	170.3	Medium
WC22M_0569	108.1	Medium
WC22M_0616	133.6	Medium
WC22M_0617	116.4	Medium
WC22M_0618	137.6	Medium
WC22M_0628	238.0	Medium
WC22M_0633	256.7	Medium
WC22M_0651	184.1	High
WC22M_0652	239.7	High
WC22M_0653	129.8	Medium
WC22M_0696	268.4	High
WC22M_0697	373.3	High
WC22M_0698	260.3	High
WC22M_0735	104.0	Medium
WC22M_1197	182.8	Medium
WC22M_1212	114.2	Medium
WC22M_0739	109.0	Medium
WC22M_1061	17,749	High (nearshore)
WC22M_1067	377.4	High (nearshore)
WC22M_1070	1,167.5	High (nearshore)
WC22M_1073	10,417.1	High (nearshore)
WC22M_1084	2,435	High (nearshore)
WC22M_1085	643.6	High (nearshore)
WC22M_1088	194.2	High (nearshore)
WC22M_1145	1,267.1	High (nearshore)

Anomaly ID	Amplitude	Potential
WC22M_1154	212.7	High (nearshore)
WC22M_1166	1,018.5	High (nearshore)
WC22M_1184	126.2	High (nearshore)
WC22M_1185	512.3	High (nearshore)
WC22M_1219	1,338.1	High (nearshore)
WC22M_1220	309.5	High (nearshore)

Table 16: Magnetic anomalies interpreted as of archaeological potential

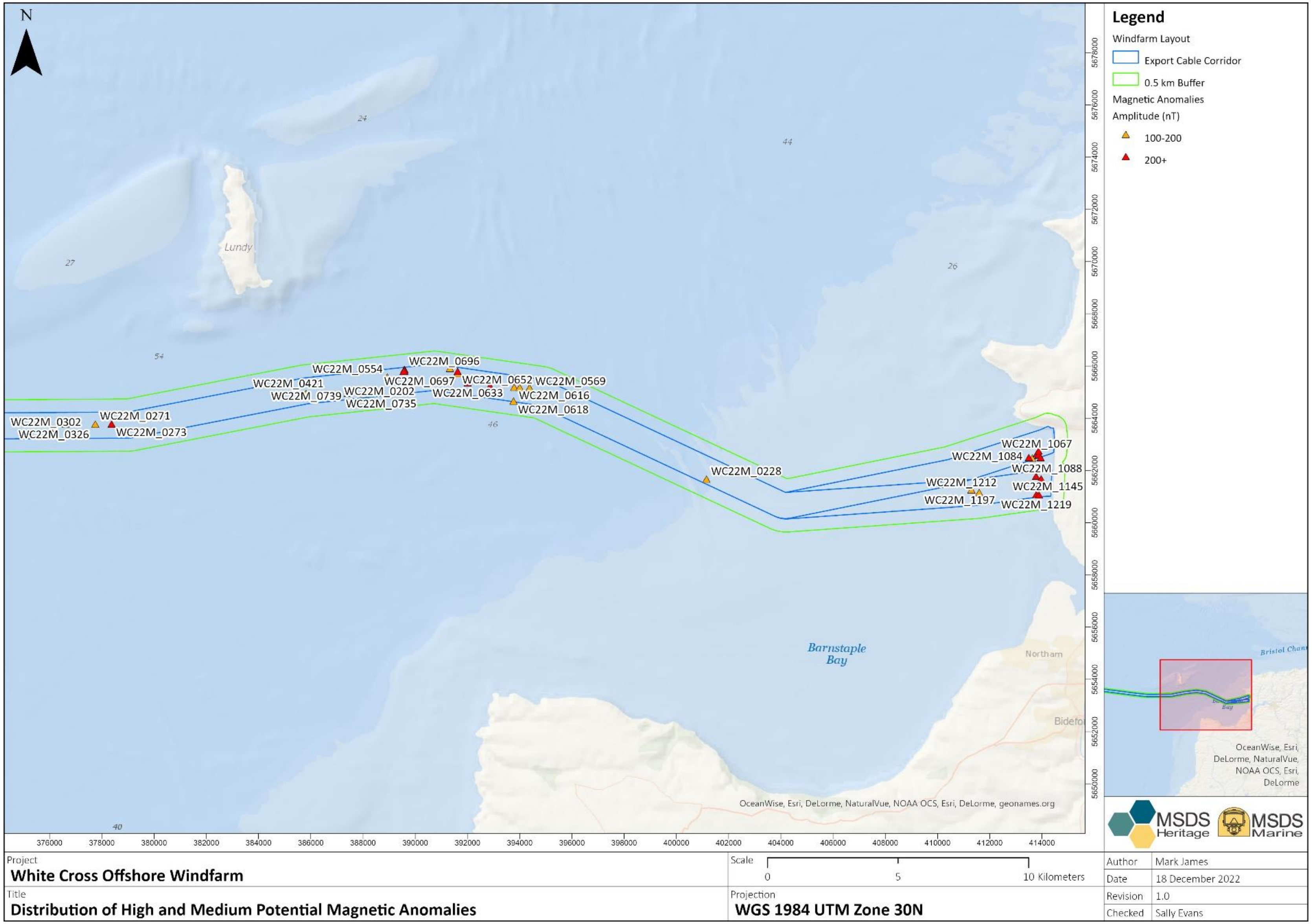


Figure 22: Distribution of high and medium potential magnetic anomalies

8.0 United Kingdom Hydrographic Office (UKHO) Data

8.0.1 United Kingdom Hydrographic Office (UKHO) data from 2022 was obtained for the assessment area for correlation with anomalies identified within the geophysical data, and the establishment of TAEZs.

8.0.2 Seven UKHO records were identified within the extents of the Offshore Development Area, two within the Windfarm Site and five within the Offshore Export Cable Corridor. A further 13 records were identified within the 0.5 km buffer.

8.0.3 The categories of records, along with record counts, are detailed in Table 17, and the distribution presented in Figure 23.

Record type	Windfarm Site	Offshore Export Cable Corridor	0.5 km buffer	Total
Foul ground	2	4	6	12
Obstruction	0	1	2	3
Wreck	0	0	5	5
Total	2	5	13	20

Table 17: UKHO records by type within the White Cross Offshore Windfarm assessment area

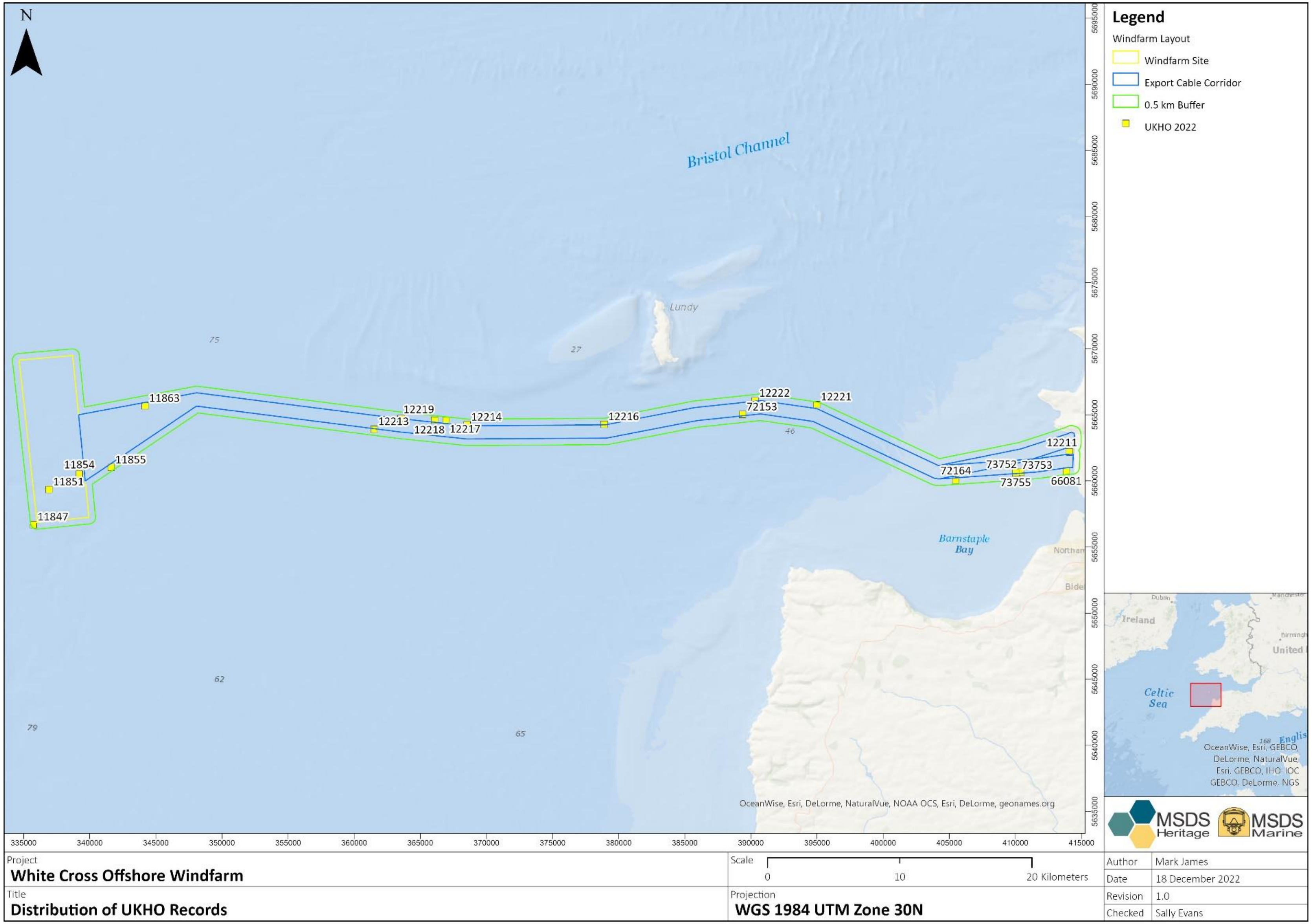


Figure 23: Distribution of United Kingdom Hydrographic Office (UKHO) Records

8.1 UKHO Records of Wreck

8.1.1 Of the 20 UKHO records identified, five are records of wrecks. UKHO data typically, where known, lists information about the wreck, the circumstances of its loss, surveying details, and whether the record is considered live or dead. A dead record is one which has *not been detected by repeated surveys, therefore considered not to exist*[18]. Whilst the decision to amend a wreck to dead is based on data available from repeat surveys, records can be amended for a number of reasons including:

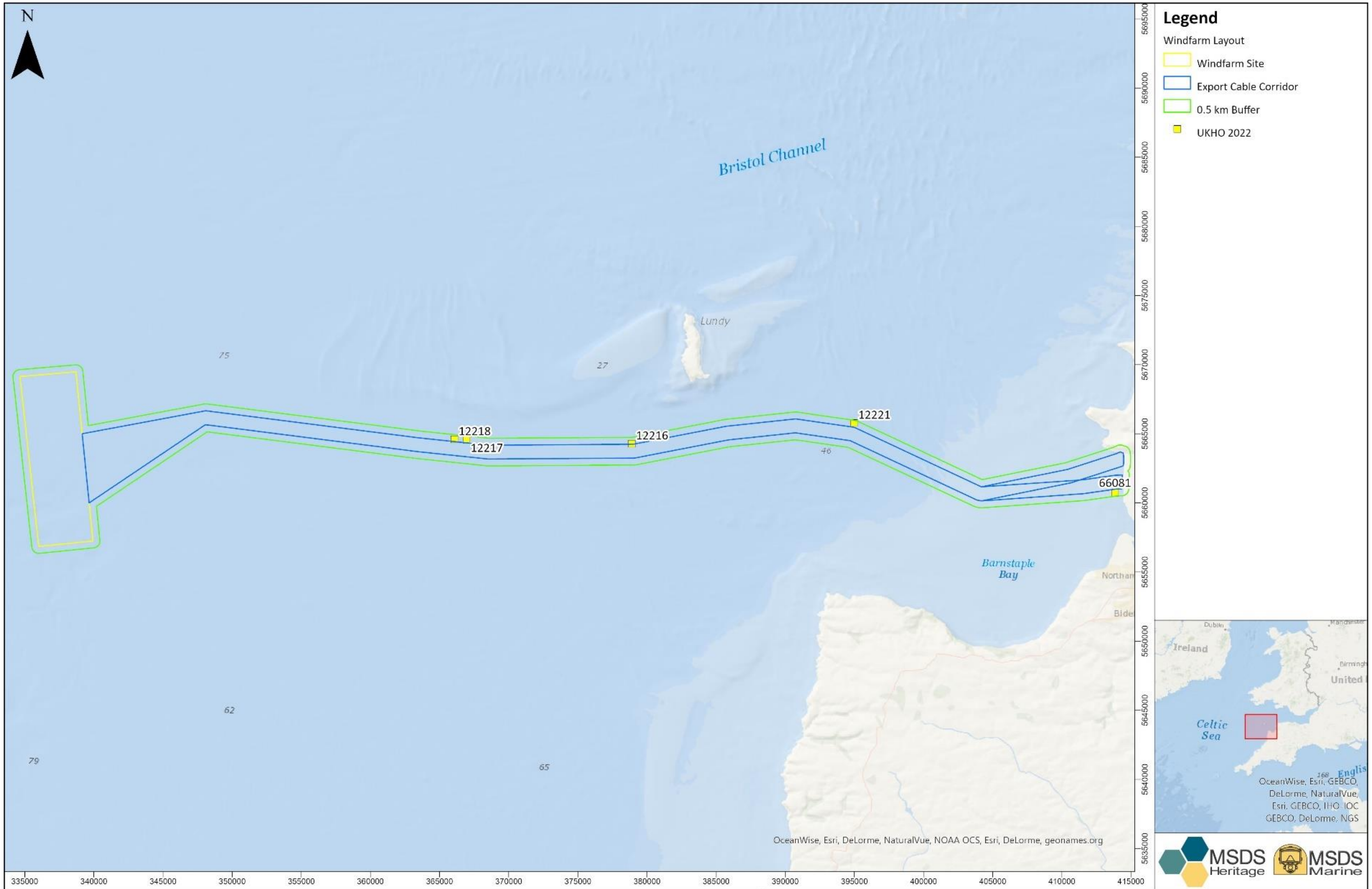
- Deterioration of the wreck to such a degree that it no longer exists on the seabed;
- Continual burial of the wreck so that the presence is not detected over repeat surveys;
- The identification of the wreck as a natural feature; or perhaps most commonly,
- The wreck not existing at the listed location due to inaccurate reporting or positioning at the period of identification.

8.1.2 The position of the UKHO records were reviewed in the data, where there was coverage, and an assessment made as to whether they were visible, or likely to exist on the seabed. The UKHO records relating to wreck are summarised in Table 18 and presented in Figure 24, and a description of each wreck provided below. To note, all records of wreck are outside the Offshore Development Area and only the position of UKHO record 12216 is within the data extents.

Record	Status	Name	Date sank	Date recorded	Last detected	Visible in data
12216	Dead	*City of Exeter*	1887	1887	Not detected	No
12217	Dead	*Glenart Castle*	1918	1918	Not detected	Outside
12218	Dead	*Bessie Stevens*	1918	1918	Not detected	Outside
12221	Dead	HMS *Annie Smith*	1918	1918	Not detected	Outside
66081	Live	Unknown	-	2002	2005	Outside

Table 18: UKHO records of wreck within the White Cross Offshore Windfarm assessment area

[18] https://www.wrecksite.eu/ukhoAbbrev.aspx



Project **White Cross Offshore Windfarm**	Scale 0 10 20 Kilometers	Author	Mark James
		Date	18 December 2022
Title **Distribution of UKHO Wreck Records**	Projection **WGS 1984 UTM Zone 30N**	Revision	1.0
		Checked	Sally Evans

Figure 24: Distribution of United Kingdom Hydrographic Office (UKHO) wreck records

UKHO record 12216

8.1.3 UKHO record 12216 lies c. 35 m to the north of the Offshore Export Cable Corridor, approximately mid-way between the Windfarm Site and the shore. The record relates to the wreck of the *City of Exeter*, a British steam ship with a cargo of coal that was reported sinking on 11th March 1887 whilst on passage from Cardiff to St Nazaire. The *City of Exeter* was built in 1870 with dimensions of 69.5 m x 8.8 m.

8.1.4 The UKHO recorded the position, for filling only, based on a report of the ship foundering 4 miles south-west of Lundy Island. The wreck has not been identified during surveys, the last being MBES and Magnetometer in 2008, and the record was amended to dead.

8.1.5 The position lies at the outer extents of the SSS and MBES data, and no wreck is visible at, or close to the location. Given the vagaries of the given location, the difficulties in obtaining an accurate position for a sinking vessel (especially in the 19th Century), no identification during the 2008 survey, and the lack of any evidence of the wreck within the geophysical data, it is highly likely the wreck does not lie at the given location.

UKHO record 12217

8.1.6 UKHO record 12217 lies c. 215 m to the north of the Offshore Export Cable Corridor, approximately 28 km east of the Windfarm Site. The record relates to the wreck of the *Glenart Castle*, a British hospital ship reported sinking on the 26th February 1918 after being torpedoed by Submarine UC-56 whilst enroute from Newport to Brest. The *Glenart Castle* was built with dimensions of 134.1 m x 16.2 m, although no date of build is given.

8.1.7 The position was originally obtained from a report by Milford Haven Port, amended to Non Dangerous Wreck Position Approximate (NDWPA) in 1920, and amended to Unsurveyed wreck with Safe Clearance depth Position Approximate (USCPA). In 1999 the wreck was still not located, and the record amended to dead. A fisherman's fastener reported in 1977 (UKHO record 11859) was dived in 2001 and 2003 and was confirmed as the *Glenart Castle* following the recovery of crockery. UKHO record lies c. 1 km south of the Offshore Export Cable Corridor and c. 17.4 km east of the Windfarm Site.

8.1.8 Given the record originated from a reported sinking, no wreck being identified at the location during surveys, and the wreck to which the record relates being identified at a location outside of the Offshore Development Area, it is highly that no remains are present on the seabed at the location of the record.

UKHO record 12218

8.1.9 UKHO record 12218 lies c. 150 m to the north of the Offshore Export Cable Corridor, approximately 27 km east of the Windfarm Site. The record relates to the wreck of the *Bessie Stephens*, a British sailing vessel reported sinking on the 14th February 1918 after being captured and sunk by a submarine. The position of the sinking was reported in three separate locations in 1918. The wreck has not been located and the record was amended to dead in 1999. No further details are available about the vessel.

8.1.10 Given the vagaries surrounding the position of the sinking, and no detection during routine surveys, it is highly likely that no remains are present on the seabed at the location of the record.

UKHO record 12221

8.1.11 UKHO record 12221 lies c. 300m to the north of the Offshore Export Cable Corridor, approximately 19.5 km west of the shore. The record relates to the wreck of HMS *Annie Smith*, a British steam drifter built in 1907 and reported sinking on the 9th April 1918 following a collision. The record was created in 1974 with the position for filing only. The wreck was not identified in MBES or magnetometer survey in 2008 and the record was amended to dead.

8.1.12 Given that the record was created in 1974 with a position for filing only, and the wreck not being identified during routine surveys, it is likely that no remains are present on the seabed at the location of the record.

UKHO record 66081

8.1.13 UKHO record 66081 lies c. 275 south of the Offshore Export Cable Corridor, approximately 450 m west of the shore. The record relates to the wreck of an unknown sailing vessel surveyed in 1855 and shown on British Admiralty Chart 1160 (Edition IX.08), the wreck was not shown on British Admiralty chart 1164 (Edition VI dated 3rd October 2002). The wreck was identified at the record location in January 2005 and described as the lower planks of a wooden sailing vessel. The wreck was virtually covered again in February 2005.

8.1.14 Due to the location of the wreck in the intertidal area, and the relatively recent identification and positioning, it is likely that remains are present at the location of the record. Whilst little is known about the wreck, it potentially holds some potential to be of archaeological interest due to the date of wrecking being prior to 1855, however, the wreck is at a distance from the Offshore Export Cable Corridor sufficient for it to not be impacted by the development.

8.2 UKHO Records of Modern Features

8.2.1 No records of modern features were identified within the assessment area.

8.3 UKHO Records of Non Submarine Contacts (NSC)

8.3.1 No records of Non Submarine Contacts (NSC) were identified within the assessment area.

8.4 UKHO Records of Obstructions and Foul Ground

8.4.1 Obstructions and foul ground are records of seabed features which in the case of the former present a danger to safe navigation. The scope of the category can be broad and can, in practise, represent features from large pieces of debris through to large geological features. The records can originate from a number of sources including hydrographic survey (including sweeps), geophysical survey, or from reported fisherman's fasteners. To note; fisherman's fasteners are records of net snags identified during the course of fishing activity.

8.4.2 Of the 20 records identified within the 0.5 km buffer, the UKHO record 12 as foul ground, eight of which originated from fisherman's fasteners, and three as obstructions. Of the 12 records of foul ground, seven are considered dead, two lie within the Windfarm Site (both considered dead), four within the Offshore Export Cable Corridor (one considered dead), and six within the 0.5 km buffer (four considered dead). Where the record positions were within the extents of the survey data the positions were reviewed, all records either related to geological features, or no feature was identifiable.

8.4.3 Of the three records of obstructions, two lie within the 0.5 km buffer and are both considered dead, one (72153) lies within the Offshore Export Cable Corridor and is considered live. The record was identified as high potential WC22_0063, a wreck, and is discussed in detail in Section 6.3.

General note about obstructions and foul ground

8.4.4 Whilst a number of the obstruction and foul records within the Offshore Development Area are now considered dead there remains the possibility in some instances that material may remain on the seabed, either buried, not visible in the geophysical data, or having been moved through, for example, fishing nets snagging.

9.0 Historic Environment Records

9.1 National Record of the Historic Environment

9.1.1 Data were obtained from the National Record of the Historic Environment (NRHE) in England for the Offshore Development Area and a 0.5 km buffer. These records are used for correlation with anomalies identified within the geophysical data, in particular where the identity of an anomaly may be subject to uncertainty.

9.2 NRHE monument point records

9.2.1 Eight monument point records were identified within the 0.5 km buffer, of which one falls within the Offshore Export Cable Corridor. The NRHE monument records are presented in Table 19 and in Figure 25.

NRHE ID	UKHO ID	Type	Summary
1440146	12217	Wreck	Remains of wreck, originally thought to be the *Glenart Castle* although now disproved
1033917	12218	Wreck	Remains of wreck, potentially the *Bessie Stevens*
1033913	12214	Wreck	Remains of identified wreck
1518044		Wreck	Wreck of the *Monte Gurugu* a Spanish steam vessel which foundered at the approximate location
1033912	12213	Wreck	Remains of identified wreck
1033918	12219	Obstruction	Unidentified obstruction originating from fisherman's fastener
1189200		WWII Pillbox	WWII Pillbox located on the cliff face
1429442		WWII Pillbox	WWII Pillbox located on Saunton Sands

Table 19: NRHE monument point records within the 0.5 km buffer

9.2.2 The two records of Pillboxes (1189200, 1429442) relate to physical features located landward of Mean High Water Springs (MHWS), thus falling outside the scope of this assessment. Five records (1440146, 1033917, 1033913, 1033912, and 1033918), correlate with, and originate from UKHO records and are discussed in Section 8.0. The remaining record is discussed below.

NRHE record 1518044

9.2.3 NRHE record 1518044 lies within the Offshore Export Cable Corridor, c. 13.5 km from the shore, and is the record of the wreck of the *Monte Gurugu*, a Spanish steam ship which sunk in 1949 following damage due to poor weather, and a subsequent explosion. The position is approximate, based on a description of 12 miles north-north-west of Hartland Point and 8.5 miles south-east of Rat island. There is no evidence of a wreck within the geophysical dataset and the NRHE records the possible remains of the vessel as record 1518052 outside of the 0.5 km buffer, and c. 7.8 km to the north-west.

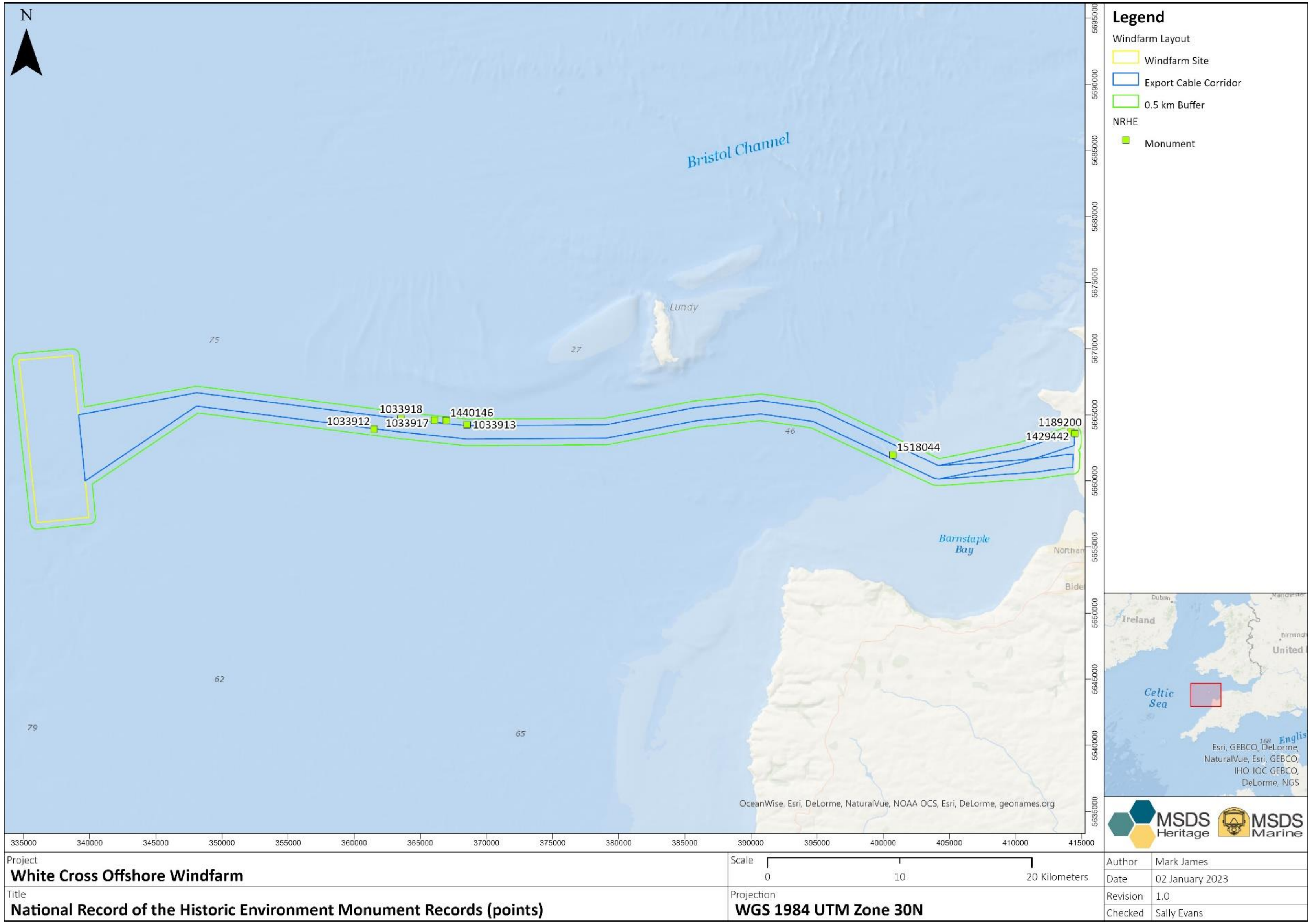


Figure 25: National Record of the Historic Environment Monument Records (points)

9.3 NRHE monument polygon records

9.3.1 90 NRHE monument records presented as polygons were identified within the 0.5 km buffer, of which 46 are within (or are bisected by) the Offshore Export Cable Corridor and 44 are within (or are bisected by) the 0.5 km buffer. The positions of the polygons are presented in Figure 26. Please note, the labels refer only to the three records not relating to Named Locations.

Named Locations

9.3.2 Of the 90 records, 87 relate to Named Locations (NLO) of wrecks or aircraft. NLOs are arbitrary positions, the point of which is deemed to be closest to the position of a wrecking event. The positions may have originated from a number of sources, including documentary records, and accounts of sinking (either from the crew or third parties). It is usual for a number of records to be assigned to same location.

9.3.3 Whilst the positions, and extents of the polygons, are reviewed within the geophysical datasets typically no remains are expected at the given locations. The presentation of NLOs serves to characterise the potential within the area for remains of wrecks, and/or, aircraft to be present on the seabed.

9.3.4 To summarise the 87 NLOs identified; five relate to British aircraft lost in 1941 and 1943, 70 relate to named wrecks dating from the *Jesus*, a wooden sailing vessel with a cargo of sherry which sunk in 1541, to the *My Diane*, a British fishing vessel which capsized and sank in 1976, and 12 relate to unnamed, but dated, vessels ranging from 1668 to 1997.

9.3.5 33 NLO records (including the five aircraft) are located on the beach at Saunton Sands, to the east and adjacent to the southern arm of the Offshore Export Cable Corridor. There does remain the possibility that some of the magnetic anomalies within this area could be related to these records, however, this does not alter the previously interpreted significance of these anomalies.

Other records

9.3.6 In addition to the 87 NLO records, three other records were identified within the NRHE dataset, two of which are within (or bisected by) the 0.5 km buffer but outside the Offshore Export Cable Corridor, and one which is bisected by the Offshore Export Cable Corridor. The records are summarised in Table 20 below.

NRHE ID	UKHO ID	Type	Summary
33269		Lynchets	Five lynchets identified on aerial photographs below Saunton Down. Now overgrown
1094903	12216	Wreck	Approximate position of the 1887 wreck of the English cargo vessel the *City of Exeter*
1518314	12373	Wreck	Approximate position of the wreck of the *Hodd* (or *Hodo*) – unknow date or type

Table 20: NRHE monument polygon records within the 0.5 km buffer

9.3.7 The record of the Lynchets (33269) relates to a physical feature located landward of Mean High

Water Springs (MHWS), thus falling outside the scope of this assessment.

9.3.8 Of the two records of wreck, both are considered approximate positions. Record 1094903 (*City of Exeter*) is centred on, and originates from, UKHO record 12216 which is discussed in Section 8.0. The remaining record is discussed below.

NRHE record 1518314

9.3.9 NHRE record 1518314 is bisected by the northern limits of the 0.5 km buffer, c. 6.2 km from the shore. The record relates to a wreck, possibly the *Hodd* or *Hodo*. The wreck is of unknown date or type and was first reported in 1992 with the position obtained using DECCA, and measurements of 35.4 m x 12.6 m. The wreck is described as a shell in a scour pit which periodically covers and uncovers. The position of the record originates from UKHO record 12373.

9.3.10 Following a survey undertaken in 2007 the position of the wreck was amended. The UKHO now report the wreck c. 525 m to the north-west, c. 420 m north of the 0.5 km buffer. As such, it is not believed that any remains lie on the seabed at the location of the NRHE record.

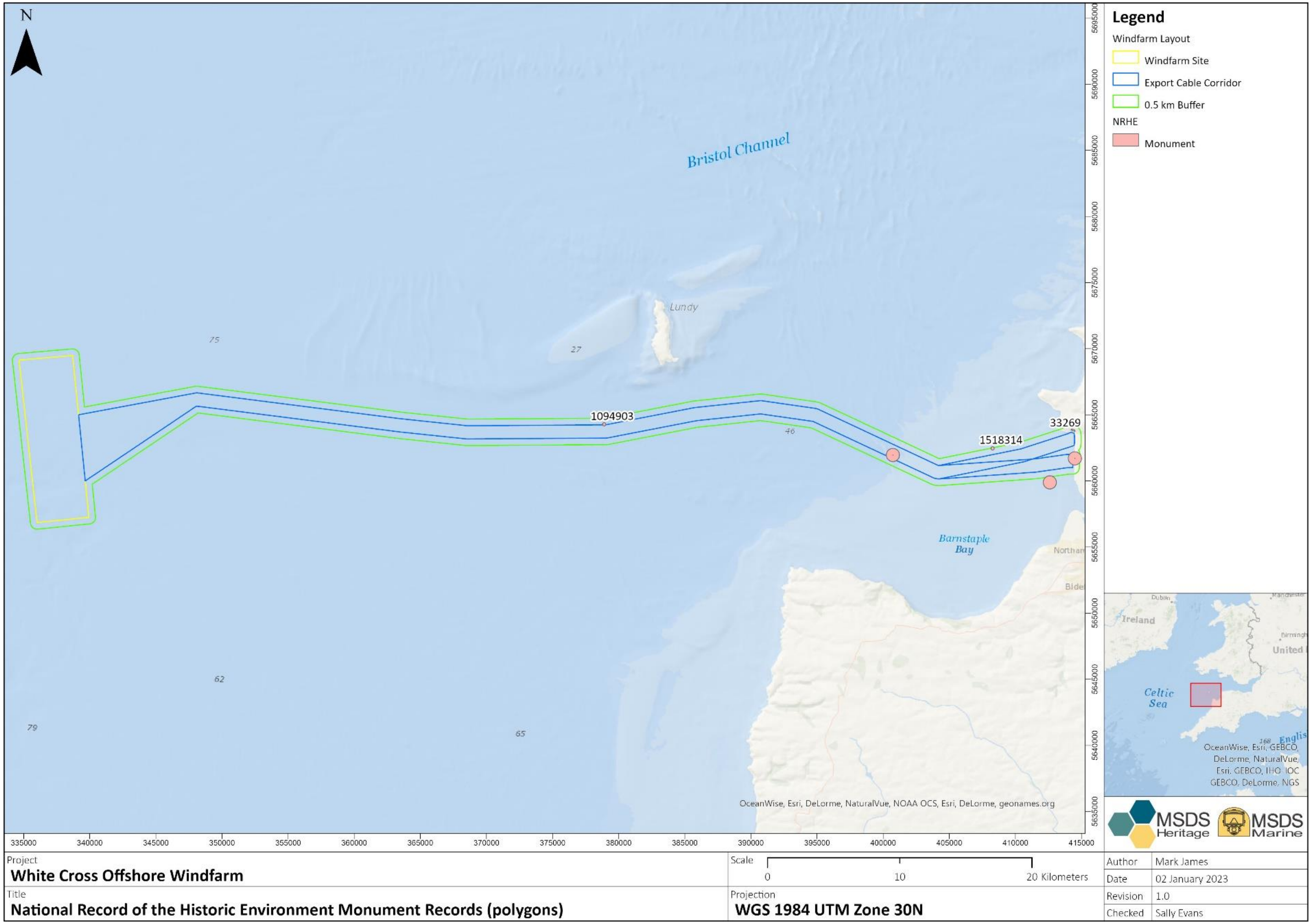


Figure 26: National Record of the Historic Environment Monument Records (polygons)

9.4 Devon Historic Environment Record

9.4.1 Data were obtained from Devon Historic Environment Record (HER) for the Offshore Development Area and a 0.5 km buffer. These records are used for correlation with anomalies identified within the geophysical data, in particular where the identity of an anomaly may be subject to uncertainty.

9.4.2 12 HER records were identified within the 0.5 km buffer, of which five lie within the Offshore Export Cable Corridor. The HER records are summarised in Table 21 and presented in Figure 27.

HER ID	Type	Summary
MDV124752	Ford	Site of a ford marked on the 1889 first edition 25 inch Ordnance Survey map[19]
MDV124757	Well	Well at Down House. Down House itself is now a ruin[20]
MDV131111	Pillbox	World War II structure likely to be a training pillbox located on the cliff face at Saunton Sands[21]
MDV31608	Reservoir	Reservoir to south of Down House Cottages marked on early 20th century map, exact location not indicated[22]
MDV57776	Lifeboat station	Lifeboat House shown on early 20th century map on the western edge of Braunton Burrows[23]
MDV57845	Wreck	Site of the wreck of the *John and Lilly*, a West African trading vessel which was wrecked near Saunton in 1843 after having been blown back and forth across the Bristol Channel. The captain and crew were saved[24]
MDV57854	Wreck	Site of the wreck of the *Ranee* which was stranded at Saunton Sands in 1881[25]
MDV58186	Wreck	The *Scourrier*, bound from Cork to Bristol, was stranded at 'Bramston Sands' in 1816. The identification of Branston with Braunton or Saunton is tentative[26]
MDV74017	Flagpole	Flagpole between the Northern Boundary Track and Partridge Slack[27]

19 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV124752&resourceID=104
20 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV124757&resourceID=104
21 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV131111&resourceID=104
22 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV31608&resourceID=104
23 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV57776&resourceID=104
24 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV57845&resourceID=104
25 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV57854&resourceID=104
26 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV58186&resourceID=104
27 http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV74017&resourceID=104

HER ID	Type	Summary
MDV77602	Structure	Remains of reinforced shuttered concrete structure. Good example, showing shuttering (and rebuilding) and reinforcing bars[28]
MDV77634	Mound	Mound forming Training Aid 14. There are many mounds in the vicinity that could represent the site or be natural dunes[29]
MDV80614	Wreck	Possible ship's timbers reported to have emerged from the sand at the low tide point, about 0.25 mile south of the car park[30]

Table 21: Devon HER records within the 0.5 km buffer

9.4.3 With the exception of the four records of wreck (MDV57845, MDV57854, MDV58186, and MDV80614) all the records relate to physical features located landward of Mean High Water Springs (MHWS), thus falling outside the scope of this assessment.

9.4.4 The four records of wreck are all recorded at the same location, within the Offshore Export Cable Corridor and c. 130 m seaward of MLWS. Three (MDV57845, MDV57854, and MDV58186) are reports of strandings of vessels on Saunton Sands (or potentially on Saunton Sands in the case of MDV58186) and with the records given an arbitrary position. No evidence of the wrecks were identified on the seabed within the SSS and MBES data at the recorded locations, although a large magnetic anomaly lies c. 127 m to the south. However, it is likely that the given the arbitrary positions of the wrecks the remains are not located at the record location.

9.4.5 The record of possible ships timbers (MDV80614) originated from a report of timbers emerging from the low tide point, c. 0.25 miles south of the car park in 1998. The position of the record is not believed to be accurate, the record lies c. 0.57 miles, south-west, of the car park. The record does, however, highlight the potential for buried wreck material to be present within the general vicinity.

[28] http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV77602&resourceID=104
[29] http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV77634&resourceID=104
[30] http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MDV80614&resourceID=104

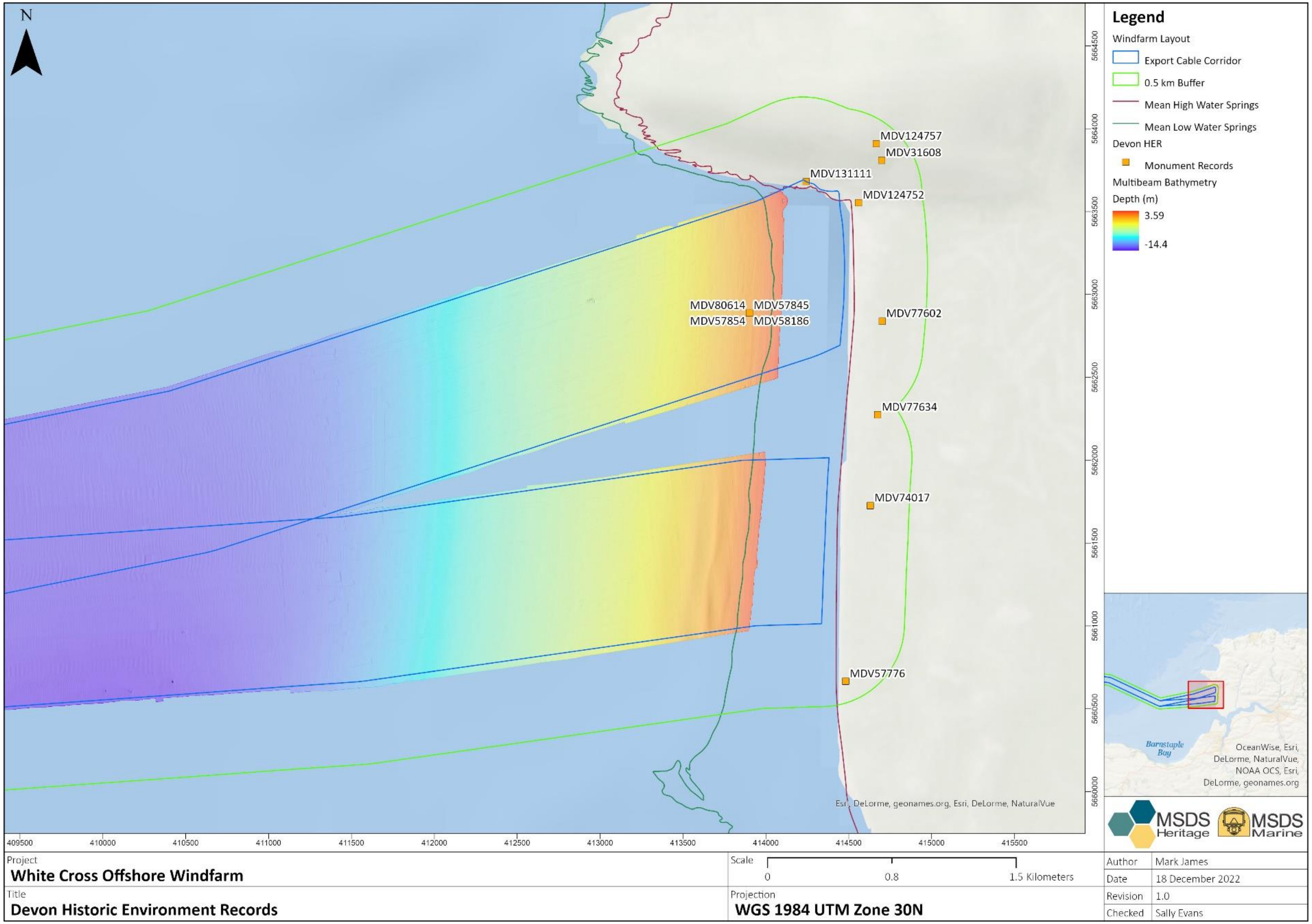


Figure 27: Distribution of Devon Historic Environment Records (HER)

10.0 Palaeolandscapes

10.0.1 This section provides a geological summary and assessment of the palaeoenvironmental and prehistoric archaeological potential of the Offshore Development Area, taking into account the depositional environment, date, nature, and post-depositional processes of the Quaternary sequence, which may have influenced this potential. Unit names follow those set out within the N-SEA interpretation report[36].

10.0.2 Quaternary sediments present within the Bristol Channel and wider region represent a series of Pleistocene and Holocene environments, though nowhere within the region is this sequence complete, and the extent and nature of deposits differ in association with key palaeolandscape features in the region which include troughs, incised deeps, and platforms[31]. The majority of the sediments present within the area represent cold climate deposits, and recent studies have noted evidence of at least three glacial phases within the area[32]. Evidence of interglacial phases are also present, and Holocene sediments are well represented around the coastal zone. The palaeolandscape features and Quaternary sediments are discussed below in relation to the Offshore Development Area and the ground model.

10.1 Units

10.1.1 The units identified within the Offshore Development Area are set out within Table 22 and Table 23 below. As the data from different sensors were interpreted the results are given separately for the Windfarm Site and Offshore Export Cable Corridor.

10.1.2 The geophysical survey report[36] identified five units within the Windfarm Site area, and two reflectors below an upper unit within the Offshore Export Cable Corridor. The report indicated Unit A and Reflector 1 as bedrock or assumed bedrock. The bedrock in the area is complex, with formations of different periods and characters including Devonian, Triassic, Jurassic, Cretaceous, Palaeogene, and Ogliocene rocks present (Figure 28). Bedrock within the area includes sedimentary units (mudstones, sandstones, etc.)[33], which correlates with the bedding seen within the SCS data for the Windfarm Site (e.g., within Unit A and B). Folding identified within Unit A, and the visible presence of a syncline within the unit, supports the interpretation of bedrock.

10.1.3 Unit D has been interpreted as a fault, and it aligns with a fault recorded by the BGS (see Figure 28). Faulting is common within the region, and the Offshore Export Cable Corridor crosses both the Sticklepath-Lustleigh Fault Zone and the West Lundy Fault Zone[35]. The southern parts of the Windfarm Site lie within the Bristol Channel Marginal Basin, marked by a fault which intersects the Windfarm Site (Unit D) resulting in markedly different geology to the south and north of this line[35]. These features are evident within the SCS data for the Windfarm Site, with the fault picked as Unit D, and with Unit A lying to the north, and Unit B, overlying Unit C, to the south. The relationship with the fault identified in the Windfarm Site and the units to the

[31] BGS 1991, North Celtic Sea including parts of 1:250 000 series sheets Nymphe Bank 51 N - 08 W; Lundy 51 N - 06 W;Labadie Bank 50 N - 10 W; Haig Fras, 50 N - 08W; and Land's End 50 N - 06 W. Quaternary Geology.
[32] Gibbard, P. P. D. Hughes, C. J. Rolfe, 2017. *New insights into the late Quaternary evolution of the Bristol Channel*, UK. Journal of Quaternary Science.
[33] BGS GeoIndex, BGS Offshore Bedrock 250k. https://mapapps2.bgs.ac.uk/geoindex_offshore/home.html

south (Unit B, overlying Unit C), also supports the interpretation of bedrock for these units. Unit B has been correlated to reflector R2, also supporting the interpretation of this reflector as bedrock. Thus, with the exception of Unit E, all reflectors and units identified are thought to represent bedrock.

10.1.4 The uppermost unit (Unit E) is interpreted as Holocene sediments. This unit is relatively shallow across the Offshore Development Area, with deeper areas restricted to localised patches (see discussion of thickness below).

10.1.5 Interpretations were considered with reference to nearby cores. BGS borehole BH72/47 (Figure 8), collected from c. 750 m to the south of the Export Cable Corridor, identified c. 2.5 m of gravels, shells, and sand, directly overlying mudstone, supporting the presence of shallow sedimentary bedrock. Shallow bedrock (mudstone and shale) is also indicated in BH 72/42, 5 km south of the Offshore Export Cable Corridor. Areas of deepened Quaternary sediment are recorded elsewhere (e.g., BGS borehole 74/29), c. 1.5 km to the north of the Offshore Export Cable Corridor (Figure 8), however, this borehole was taken from an infilled incision, explaining the presence of a thicker Quaternary sequence. Thus, coring from the wider area supports the presence of shallow sedimentary bedrock units.

10.1.6 The interpretation of Unit E as Holocene sediment may not be strictly accurate, and subdivision may be possible within this unit. It is likely that the unit represents all Quaternary sediment, with deepened areas in this unit potentially reflecting infilled incisions similar to those mapped by the BGS[31]. The below discussion principally focuses on the interpretation, and potential, of Unit E. Other units have been interpreted as bedrock and are not discussed further.

Age	Units and Reflectors	Seismic character	Interpretation	Thickness/Depth	Archaeological potential
Quaternary sediments	Unit E	Continuous parallel reflectors, with one internal reflector near to landfall.	N-SEA indicate Holocene sediments, mainly fine sand. Interpreted by N-SEA as Holocene but may contain earlier sediments. See in-text discussion.	Varied, absent in some areas, up to 16m in other areas. Thickest in the nearshore area.	Potential (unit may contain a range of Quaternary sediments)
Pre-Quaternary bedrock	Reflector 2	Erratic and discontinuous reflector in the east, and more continuous and wavey in the west.	Correlated with the top of Unit B in the Windfarm Site. Interpreted here as bedrock.	1m below the seabed midway along the Export Cable Corridor increasing to 15m BSB at the fan area.	None (bedrock)
	Reflector 1	Reflector not described, but underlying reflector (thought to be within bedrock) described as localised and irregular.	Top of bedrock (Pilton Shales Formation). Could not be correlated with any other reflectors.	Depth varied and reflector not observed under sand waves and reflector likely at seabed to the south of Lundy indicating outcropping bedrock.	None (bedrock)

Table 22: Units and reflectors identified in the Export Cable Corridor

Age	Units	Seismic character	Interpretation	Thickness/Depth	Archaeological potential
Quaternary sediments	Unit E	Horizontal layered reflectors evident within depressions in Unit B which represent erosion areas	Holocene sediments deposited on top of Unit A in the north of the Windfarm Site, and atop unit B in the east (also above the fault, unit D). This unit infills erosional depressions in the surface of the bedrock and could contain pre-marine deposits. Interpreted by N-SEA as Holocene but may contain earlier sediments.	Ranging from a few centimetres to c. 16 m. Local areas of greater thickness where Unit B has erosional depressions in surface.	Potential (unit may contain a range of Quaternary sediments)
Pre-Quaternary bedrock	Unit D	No clear strata defined	Deformation zone. Fault which separates the strata in the north and south of the Windfarm Site area. Unit A present to the north, and B and C to the south.	Extending to at least 60 m below seabed (BSB) (below penetration level)	None (bedrock)
	Unit B	Continuous parallel and sub horizontal reflectors with some evidence of deformation, and shallow depressions	Clay and lignite sequence. Based on BGS records for this area the unit may represent Palaeogene sediments.	Not described	None (bedrock)
	Unit C	Discontinuous seismic reflectors. Some discontinuous layering	Sandy sequence. May relate to Unit A. Layering evident but not continuous, Overlain by Unit B.	Extending to at least 60 m BSB (below penetration level)	None (bedrock)
	Unit A	Major west-plunging syncline present within the northern part of the Windfarm Site. Other folding also evident. Top marked by an erosion surface	Sedimentary rock (primarily clays, sandstone, mudstone) of Cretaceous, Jurassic, and Triassic age	Extending to at least 60 m BSB (below penetration level)	None (bedrock)

Table 23: Units and reflectors identified in the Windfarm Site

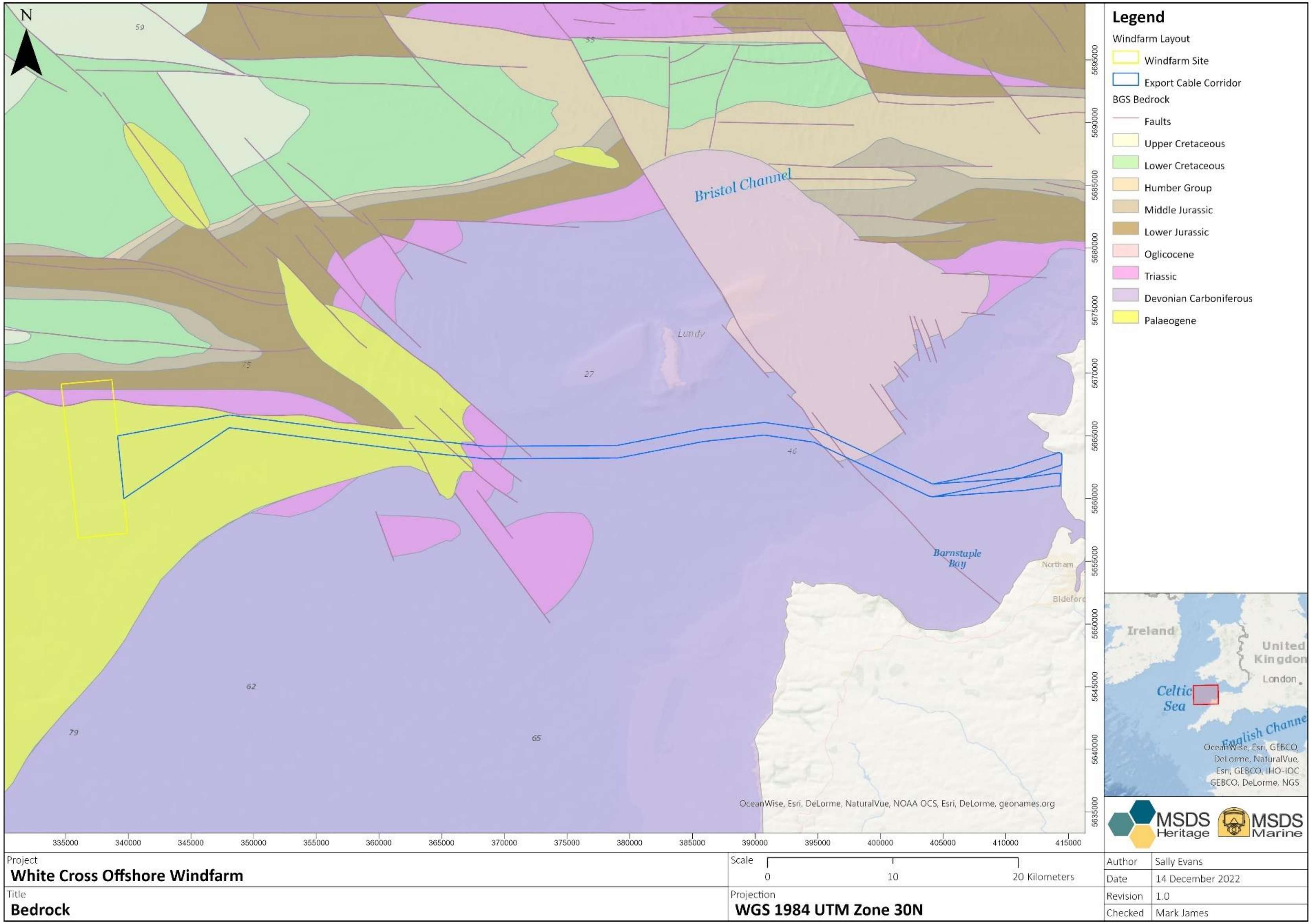


Figure 28: Bedrock geology (from BGS)

10.2 Geomorphology

10.2.1 The Offshore Development Area has been subject to varied conditions during the Quaternary, with a number of erosive events that have affected the geomorphology of the area. Key features are:

- Platforms: The Offshore Development Area lies on the Lundy Platform[34]. This is well represented within the Offshore Export Cable Corridor, where exposed bedrock demonstrates a platform character.

- Incised deeps and palaeochannels[34] some of which are infilled, though in others infill is incomplete and the features have surface expression[35]. Major incisions (those over 100 m deep) and minor incisions are present within the region. The incisions are attributed to at least four different phases, the earliest of which may pre-date the Anglian[35]. The tops of the pre-Quaternary bedrock are scored with depressions which may reflect incisions of this nature. While those within the Offshore Development Area are generally not deeply filled (less than 16m of Quaternary sediment, see below) their orientations match other incisions mapped by the BGS.

- Infilled kettleholes which lie within the late Devensian sediment infills of incisions[34]. As the current interpretation of the SBP and SCS data groups Quaternary sediments within a single unit (Unit E, see below) infills within earlier Quaternary sediment are not discernible at present, though features such as these may be present within the Offshore Development Area and incisions (discussed above) are thought to be present.

- Sandwaves are also present within the area, with the largest mapped as mega ripples, visible in both the MBES and SSS data (Figure 5).

10.3 Quaternary deposits

Thickness of Quaternary Deposits

10.3.1 The thickness of Quaternary sediments is varied within the region. To the west there are extensive Quaternary deposits associated with St George's Channel and Celtic Deep troughs, extending to up to 375 m in thickness[35]. Quaternary sediments are thinner on the platforms which bound the troughs. On the Lundy Platform, on which the Offshore Development Area lies, Quaternary sediments are generally less than c. 50 m in thickness[35], though restricted areas of thicker sediments (up to 250 m) are present, primarily focused on infilled major incisions. However, in some areas, in particular around the coast and islands such as Lundy, Quaternary sediments are thin or absent and bedrock outcrops on the seabed. This can be observed within the MBES and SSS data; with an area devoid of Quaternary sediments present within the central part of the Export Cable Corridor (Figure 29, depicted as 'area of outcropping bedrock').

10.3.2 While deeper areas are present within the wider region, Quaternary sediments within the Offshore Development Area are no thicker than 16 m, and in many areas, they are much thinner. The thickness of Unit E is shown on Figure 29. While the general thickness is relatively limited, thicker areas are present, in particular in the nearshore area and in portions of the

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[34] BGS 1991, North Celtic Sea including parts of 1:250 000 series sheets Nymphe Bank 51 N - 08 W; Lundy 51 N - 06 W;Labadie Bank 50 N - 10 W; Haig Fras, 50 N - 08W; and Land's End 50 N - 06 W. Quaternary Geology.
[35] BGS 1994, *The geology of Cardigan Bay and the Bristol Channel*. London: HMSO

Windfarm Site. There are also areas of uncertain thickness in the Offshore Export Cable Corridor, where the SBP did not penetrate beyond sand waves (marked on Figure 29 as mega ripples). In these areas the base of the Quaternary sequence is at an unknown depth.

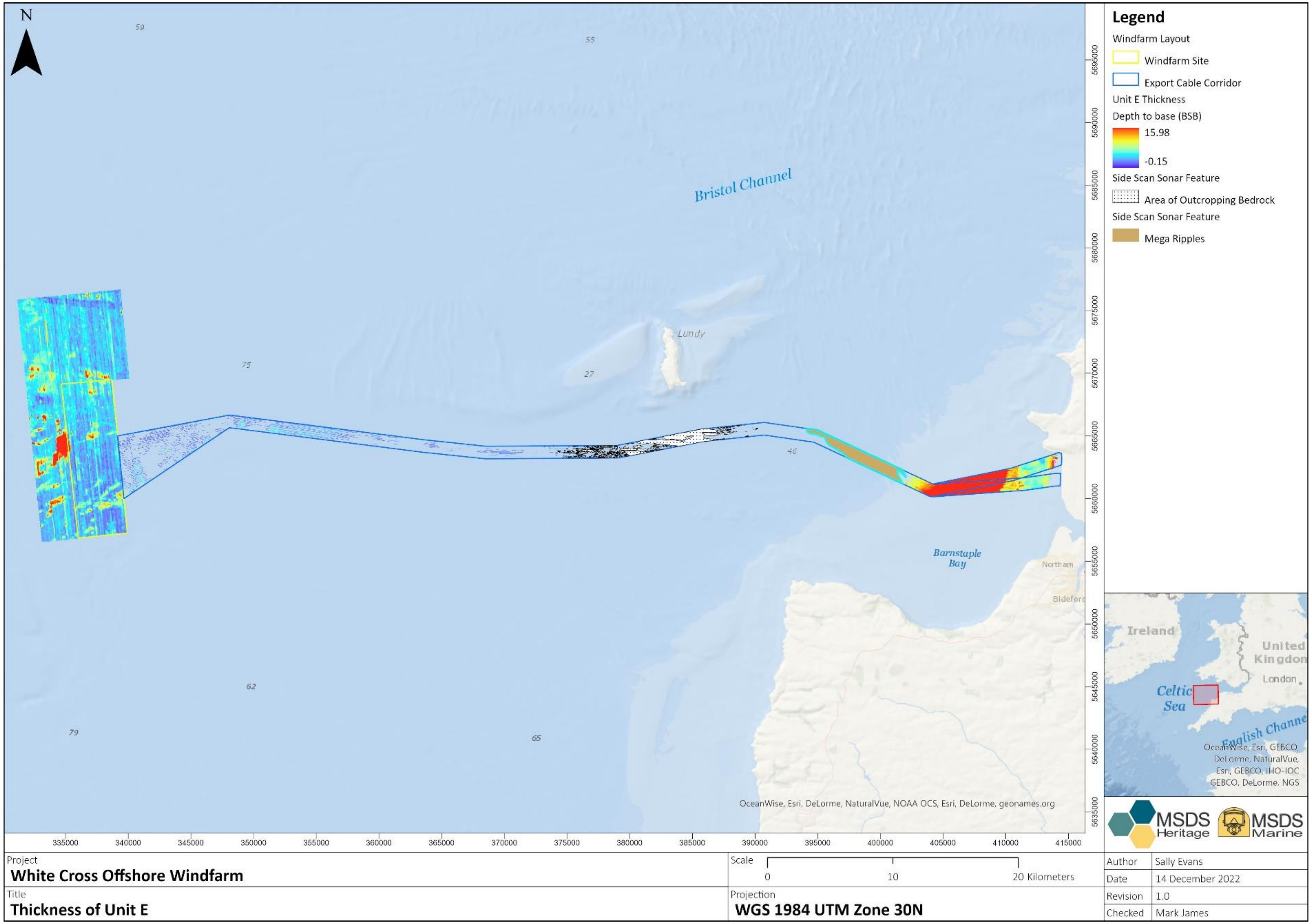


Figure 29: Thickness of Unit E

Quaternary Sequence

10.3.3 Unit E represents the Quaternary deposits mapped within the Offshore Development Area. The unit has not been subdivided within the current interpretation[36] though sub-division of this unit is likely to be possible. Rapid review of select SCS and SBP lines[37] indicates that the majority of Unit E represents a thin layer of seabed sediments, in line with the general description by N-SEA of Holocene sediments[36]. However, in areas where Unit E is thickest (see Figure 29) underlying sub-units may be present. Figure 30 shows an example of the SBP data from the fan (the western most section of the Offshore Export Cable Corridor, adjacent to the Windfarm Site), with continuous, parallel, layered reflectors evident at the top of the unit, and transparent acoustic signatures below in areas where the underlying bedrock exhibits potential erosional surfaces, demonstrating the potential for this unit to include different deposit types.

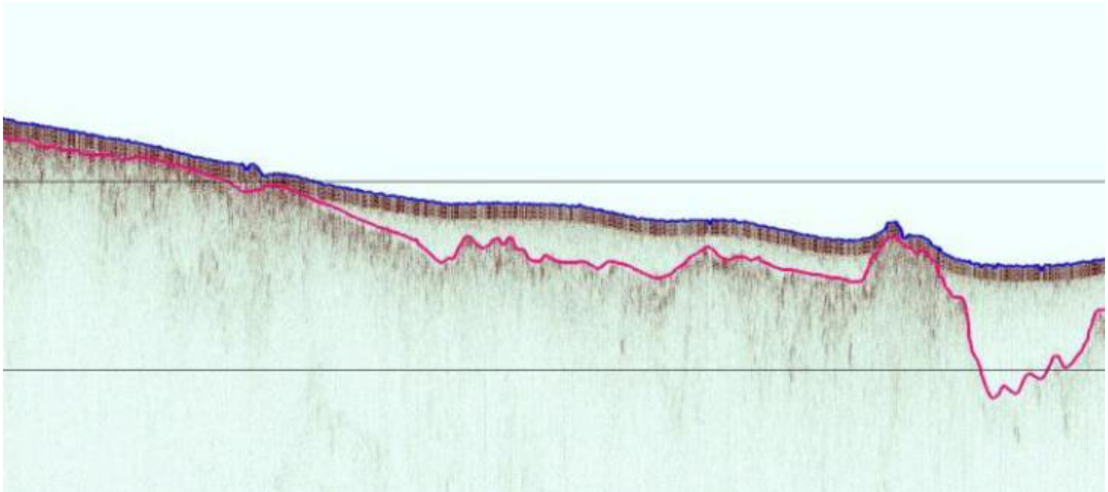


Figure 30: Example showing Unit E (base mapped as pink)

10.3.4 The following discussion therefore gives a brief summary of the key deposits mapped by other sources within the Offshore Development Area and wider region, to provide an indication of the potential range of sediments which may be incorporated within Unit E, and therefore its archaeological and palaeoenvironmental potential.

10.3.5 The Pleistocene deposits within the wider area are generally poorly dated, with uncertainties surrounding glacial extents in different periods, and chronologies for associated features and sediments. The following text is therefore structured by environment of deposition (e.g., glacial, marine etc), rather than chronologically, though separate consideration is given to Holocene sediments which are better dated owing to the existence of submerged forests, peats and other organic sediments along the adjacent coastlines which have seen extensive investigation[38].

10.3.6 There are also difficulties correlating offshore and onshore Quaternary units within the area as onshore and offshore deposits are rarely continuous[35] and both are referred to below. The

[36] NSea (2022) *Offshore and nearshore survey: White Cross wind farm: Geophysical survey results*. DOC NO: NSW-PJ00285-RR-DC-SUR-001

[37] Conducted by Professor Richard Bates.

[38] Grant, M., K. Westley, and F. Sturt, 2019. *Rapid Coastal Zone Assessment Survey for South-West England North Coast of Devon (excluding Exmoor) and North Coast of Cornwall*. University of Southampton, report for Historic England.

reference to onshore deposits is particularly relevant to the interpretation of deposits in the nearshore and intertidal area.

Quaternary Sequence: BGS Offshore Mapping

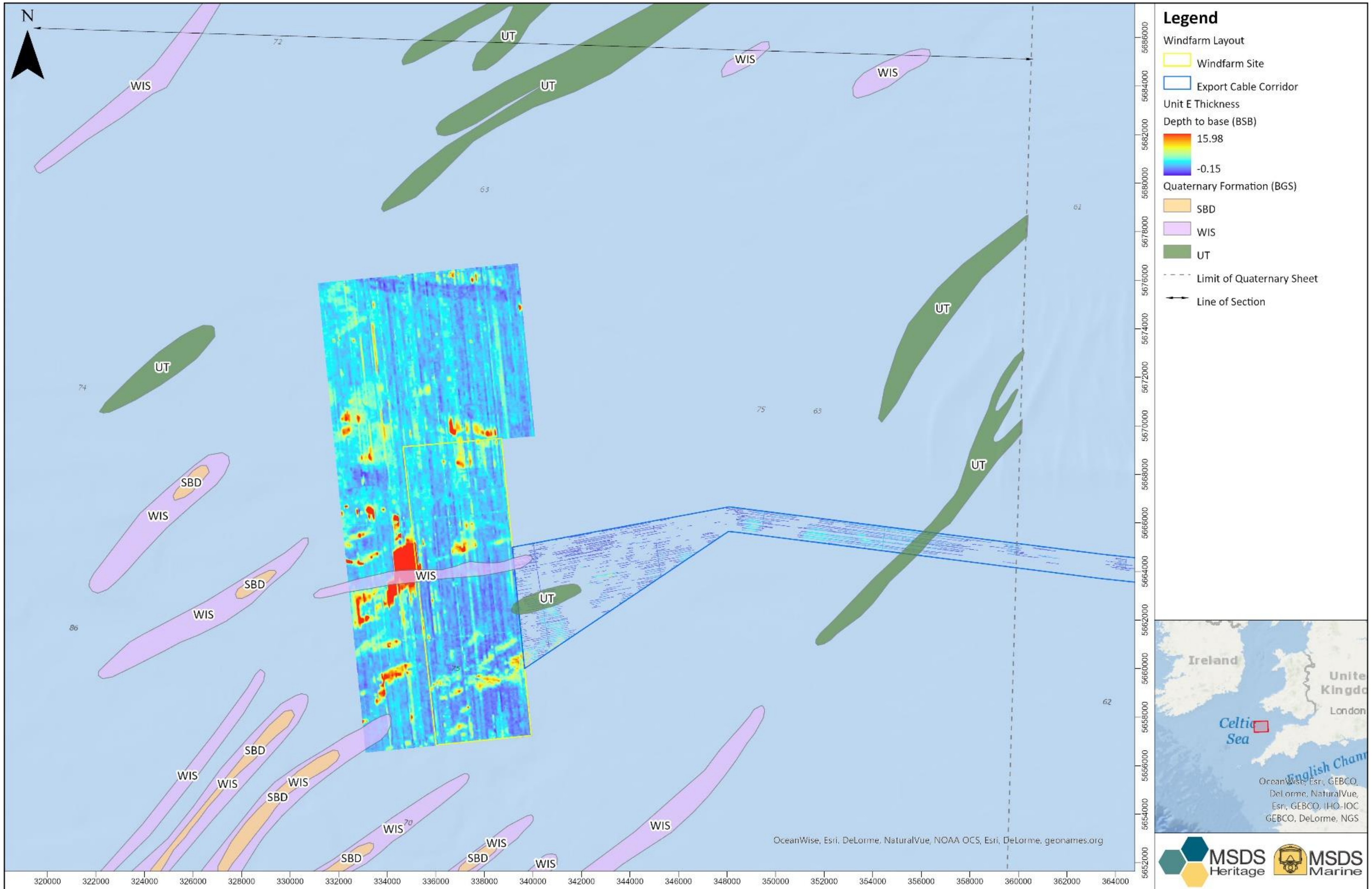
10.3.7 The BGS identify six Quaternary Formations within the offshore region from Cardigan Bay to the Bristol Channel, including the Bardsey Loom, Caernarfon Bay, St George's Channel, Cardigan Bay, Western Irish Sea, and Surface Sands Formations[35]. While these are present within the wider area, many in St George's channel, their distributions outside of the main troughs are more restricted, and only the following are mapped by the BGS within the Offshore Development Area (see Figure 31, and Table 24 for further details):

- Surface Sands Formation. It is not clear which members are present within the site. The Sea Bed Depression (SBD) member is present in depressions to the south-west of the Windfarm Site (see Figure 31), and sandy seabed sediments (Unit E) may represent Sedimentary Layer (SL) 2 or 1 and are thought to be present across the area.

- Western Irish Sea Formation (see Figure 31). Largely present as an infill deposit within incisions.

- Cardigan Bay Formation. Present in incisions. Members mapped include the Upper Till facies (UT) and Bedded and Infill facies (BAI), with the former overlaying the latter (See Figure 31 and Figure 32)[34]

- Undivided sediments. Undivided sediments are generally mapped across the whole area, with the exception of zones where Quaternary sediment is absent. They are mapped across the area shown on Figure 31 but have been excluded from this figure for clarity. They are shown on Figure 32 in olive green.



Project **White Cross Offshore Windfarm**	Scale 0 5 10 Kilometers	Author	Sally Evans
		Date	14 December 2022
Title **Quaternary features mapped by the BGS and Unit E thickness**	Projection **WGS 1984 UTM Zone 30N**	Revision	1.0
		Checked	Mark James

Figure 31: Quaternary features and deposits mapped by the BGS and Unit E thickness

Formation	Sub unit	Approximate age	Description and environment	Archaeological potential
Surface Sands Formation	SL1 SL2 SBD	Holocene	Base represents an unconformity (erosion surface). SL1 and 2 are mainly sandy in their upper parts representing modern marine processes. Lower parts may represent shallow water or sub aerial conditions (and SL2 member incorporates estuarine silts and peats in the Severn). SBD fills hollows in the WIS incisions. The hollows may be large kettle holes, partially infilled. Analysis indicates the deposit is a temperate marine one.	Lower parts may contain organic and other sediments laid down in sub aerial environments.
Western Irish Sea Formation (WIS)	Undivided	Devensian to Holocene	Five facies are recognised, representing glaciomarine, deltaic to marine environments. While undivided, cores in the Celtic Deep Trough and Bristol Channel indicate the presence of the chaotic facies (likely an ice-proximal, glaciomarine/lacustrine member) overlying older Quaternary sediments or bedrock. The prograding facies represents a prodeltaic to glaciomarine deposit, and the mud facies a glaciomarine deposit, thought to have been laid down by the retreating Devensian glacier.	Limited but potential cannot be ruled out
Cardigan Bay Formation	UT	Formation as a whole Wolstonian to Devensian. UT thought to be late Devensian. BAI may be Late Wolstonian to Devensian.	Tabular-unstratified, stiff to hard diamicton of clay with sand, gravel, shell, cobbles, and boulders. Interpreted as sub glacial till.	Limited due to adverse conditions
	BAI		Lenticular infill (lower part) overlain by a tabular stratified upper part. Where sampled this member consists of sands and muds (lower) and fine-grained silty sands and sandy clays (upper), both likely formed in arctic or boreal conditions	
Undivided sediments	-	Quaternary	Further west these include the Western Irish Sea Formation (undivided), the BAI of the Cardigan Bay Formation, Saint George's Channel Formation (STG) and the Incision Infill facies (FII) of the Caernarfon Bay Formation. The UT, and to a lesser extent BAI members of the Cardigan Bay Formation are widespread on the platforms.	Largely limited due to adverse conditions

Table 24: Offshore Quaternary deposits mapped by the BGS in the Offshore Development Area [39,35]

[39] BGS 1991, North Celtic Sea including parts of 1:250 000 series sheets Nymphe Bank 51 N - 08 W; Lundy 51 N - 06 W;Labadie Bank 50 N - 10 W; Haig Fras, 50 N - 08W; and Land's End 50 N - 06 W. Quaternary Geology.

10.3.8 Other sediments present within the wider region, such as the Bardsey Loom Formation, are mapped only within St George's Channel and thus are not anticipated to be present within the Offshore Development Area.

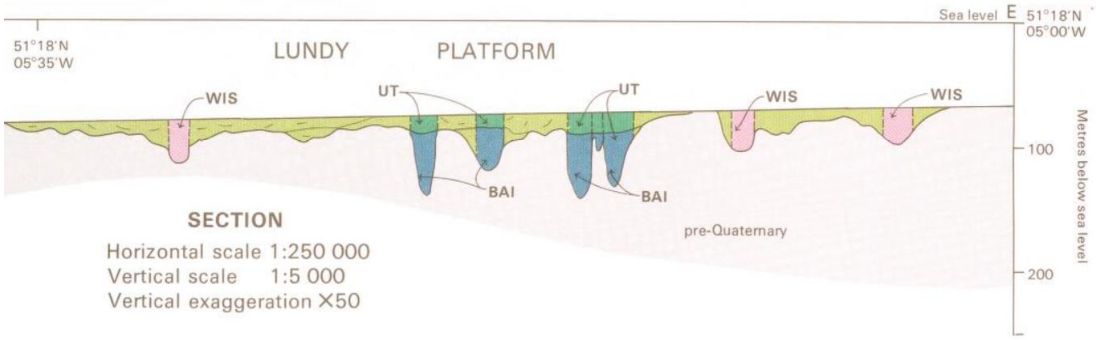


Figure 32: Section showing Quaternary Formations in the area (location of section on Figure 31)

10.3.9 Incisions are recorded within the Windfarm Site, and offshore parts of the Offshore Export Cable Corridor by the BGS[35] (Figure 31). These incisions, and others close to the Offshore Development Area, are recorded with basal fills of the Western Irish Sea Formation and Cardigan Bay Formation, and upper fills of the Surface Sands Formation (Seabed Depression Member)[35]. These deposits may be present within Unit E. Figure 31 shows the thickness of Unit E and compares this to the areas in which the BGS have mapped incisions and infills. While there is some overlap between the areas of deepened sediment within Unit E and the incisions, the correlation is not an exact one and features such as the deepened area of Unit E directly to the west of the Windfarm Site display a slightly different form than that mapped by the BGS. Nevertheless, other areas of deepened sediment within the Windfarm Site display an elongated form, similar to the incisions mapped by the BGS, and may therefore reflect a similar origin and infill. Given that Unit E is generally thin across the Offshore Development Area (see Figure 29), and in the offshore area thicker deposits appear to primarily be associated with depressions or incisions into the underlying bedrock, there is potential for infill deposits including the Western Irish Sea and Cardigan Bay Formations, overlain by the Surface Sands Formation (Seabed Depression Member) to be present within the Windfarm Site, offshore parts of the Offshore Export Cable Corridor. The majority of these deposits (in particular the former two) largely represent glacial periods, discussed further below.

10.3.10 Other areas in which Unit E is thickest lie with the Offshore Export Cable Corridor and close inshore. Their form differs from the elongated depressions seen in the Windfarm Site and their origin may therefore differ. Potential origins are considered further below.

Pleistocene glacial deposits

10.3.11 Evidence of Pleistocene glaciation within the area is complex[38]. The age of the glacial sediments both onshore and offshore is generally poorly defined, and the extents of different Pleistocene glaciations are not fully resolved[38]. Recent studies of offshore data indicate evidence of at least three phases of glaciation within the Bristol Channel (MIS 2, 4-3 and earlier)[32] (see Figure 33), though others indicate that the Devensian Irish Sea Ice Stream did not research this part of the coast[40].

10.3.12 While the extents of the different glacial phases are not certain, detailed work to the north-east of Lundy does indicate glacial coverage during multiple phases. In this area glacial till deposits interpreted as the Upper Till member of the Cardigan Bay Formation (as observed elsewhere offshore) have been identified below sand and gravel deposits interpreted as marine sediments[32,35]. This evidence has been used in reconstructions of previous glacial limits, which indicate coverage of the Offshore Development Area during multiple phases, including two Devensian stages and an earlier glaciation. These dates roughly correlate with those indicated by the BGS for the Western Irish Sea Formation and Cardigan Bay Formation (Devensian and Wolstonian), supporting the potential for multi-phased glacial deposits to be present within the Offshore Development Area. The Windfarm Site in particular lies in an area postulated to have seen at least three glacial phases (Figure 33), indicating greatest potential for multi-phased glacial deposits in this area.

10.3.13 In addition to the glacial deposits mapped offshore, glacial sediments and features are also present (though scattered) onshore[35], in the form of glaciogenic gravels, tills, erratics, and potential glaciolacustrine sediments. Periglacial deposits are more common onshore, including head deposits which form coastline terraces in some areas, infilling coastal valleys in others and overlying Pleistocene river terraces. Thus, there is potential for glacial and periglacial deposits across the whole of Unit E, from the Windfarm Site to landfall.

10.3.14 In addition to glacial sediments there is also potential for other glacially related features to be present within the Offshore Development Area. Glacial erratics are recorded at numerous locations onshore concentrated in Barnstaple Bay, at Baggy Point, Croyde, Saunton, and Brannam's Clay Pit near Fremington, likely representing ice-rafted features[38]. Large anomalies observed within the geophysical data to the south of Lundy may represent glacial erratics within the Offshore Development Area (e.g., Section 6.2). While dating of their time of deposition is uncertain in many cases, where onshore erratics have been investigated dates for associated deposits indicate origins in MIS 7 or 9[38], again indicating potential for evidence of different glaciations within the Offshore Development Area.

[40] Carr, S.J., Hiemstra, J.F. and Owen, G. 2017. *Landscape evolution of Lundy Island: challenging the proposed MIS 3 glaciation of SW Britain*. Proceedings of the Geologists' Association, DOI: 10.1016/j.pgeola.2017.06.005

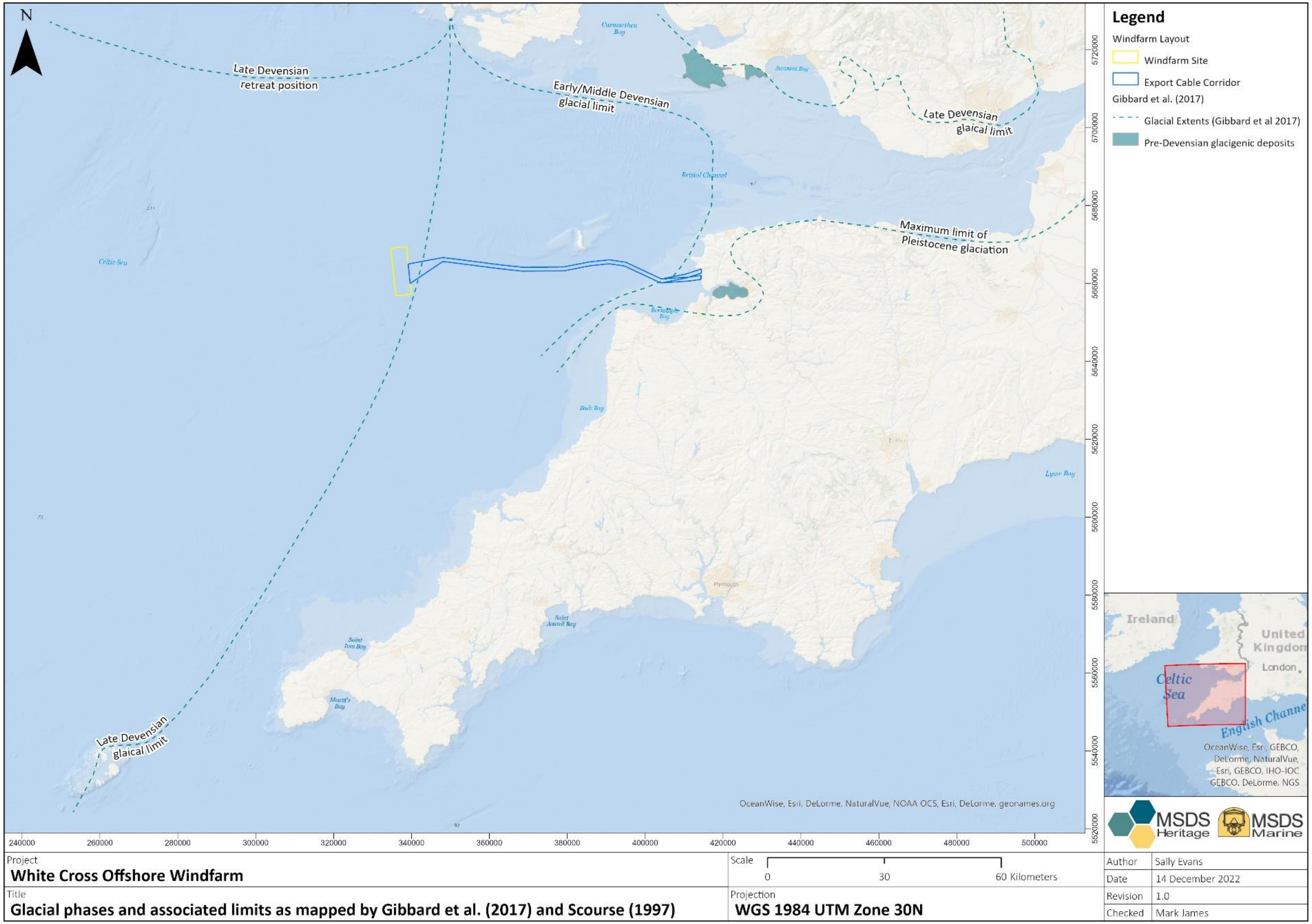


Figure 33: Glacial phases and associated limits as mapped by Gibbard et al. (2017) and Scourse (1997)

Pleistocene and Holocene fluvial networks

10.3.15 Pleistocene fluvial networks are also recorded within the wider Bristol Channel and North Devon area, and the Seabed Sediments Formation has been found to contain evidence of organic and estuarine sediments in its lower parts, laid down prior to marine transgression. There is potential for Unit E to contain evidence of these features and sediments.

10.3.16 Pleistocene fluvial features are recorded onshore within the vicinity of the Offshore Export Cable Corridor. These include the Taw-Torridge Estuary, which holds evidence of a series of Pleistocene gravel terraces. Three terraces are mapped, overlain by Holocene alluvium, with the lowest terrace OSL dated to 76-87 k BP with samples from Penhill Point (7.5km west of the landfall site, adjacent to the River Taw)[41]. An east-west palaeochannel network has been described to the south of Lundy by Grant et al[38] who indicate that the channels may form an offshore extension of the Taw-Torridge river system, potentially incised during cold low-stand periods. Whilst the channel network is described, it is not mapped. However, the description given indicates that the features lie to the south of Lundy, and therefore may intersect the Offshore Export Cable Corridor, indicating potential for associated fluvial and terrace deposits to be present within the site, though no river terrace sediments are currently recorded in this offshore area.

10.3.17 The West Coast Palaeolandscapes Study (WCPS) also investigated the wider area which included the nearshore part of the Offshore Export Cable Corridor (see Figure 34 for the extents of this study), interpreting legacy seismic and bathymetry data to map palaeolandscape features and create models of palaeolandscape reconstructions[42]. This project indicated the presence of a channel feature running to the south of Lundy connected with a glacial lake feature further to the north-east. The channel feature is crossed by the Offshore Export Cable Corridor in four locations, and a sediment-filled basin was also mapped in the area where the easternmost part of the channel is crossed by the Offshore Export Cable Corridor. However, the palaeochannel is indicated to be an interpolated feature and the study acknowledged that there was a lack of absolute data on which to base the reconstruction[42]. The authors indicated that later work may refine the understanding of the palaeolandscape, and this has been borne out by later projects which have indicated an apparently absence of the large glacial lake to the north of the Offshore Development Area, for example[38]. While some features within the WCPS may not be present within seabed sediments there remains potential for channels mapped within the Offshore Development Area to exist. Unit E may hold evidence of such features.

10.3.18 Comparison of the distribution of Unit E with features mapped by the WCPS indicates some potential correlations (See Figure 34). The interpolated fluvial feature in the nearshore area crosses a zone where Unit E is recorded at its maximum thickness. Deposits in this area may contain evidence of this fluvial feature. Likewise, further offshore Unit E is mapped in locations where fluvial features have been interpolated, again indicating potential. The floodplain area indicated between Lundy and Barnstaple Bay lies predominantly in the area where sand waves inhibited the penetration of the SBP, and the base of Unit E was not mapped (see Figure 29). This area may also hold potential for remains of the features mapped by the WCPS.

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[41] Rolfe, C.J. 2015. *Pleistocene sediments of the north Devon coast*. Unpublished PhD Thesis, University of Southampton.
[42] Fitch, S., and V. Gaffney, 2011. *West Coast Palaeolandscapes Survey*. University of Birmingham

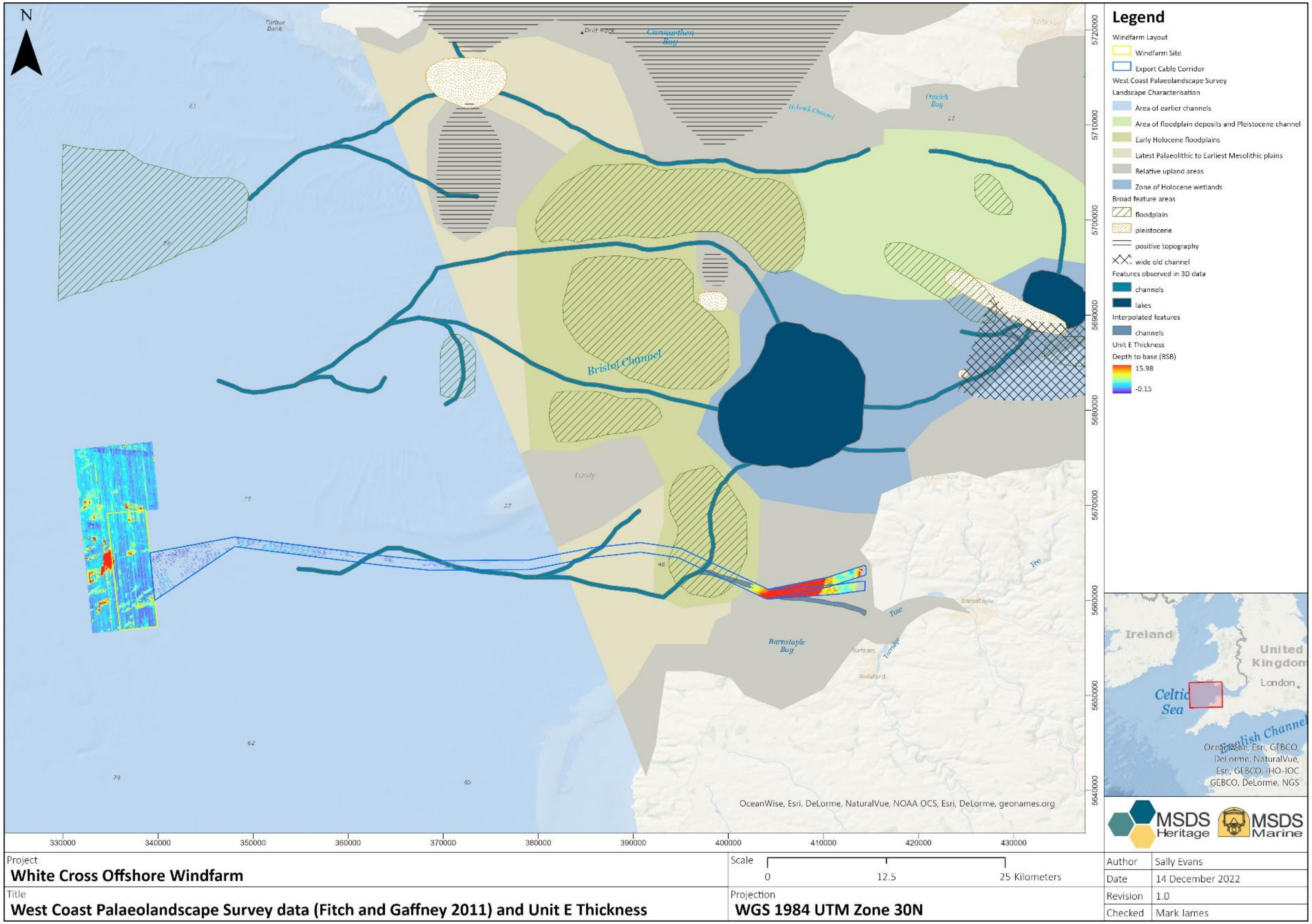

Figure 34: West Coast Palaeolandscape Survey data (Fitch and Gaffney 2011) and Unit E Thickness

Other late glacial and Holocene deposits and features

10.3.19 In addition to the potential for glacial and fluvial sediments and features, studies also indicate the potential for other late Devensian to Holocene deposits including prodeltaic sediments associated with the Western Irish Sea Formation (note, these are currently not mapped specifically within the area but could be contained within the undivided WIS sediments which are mapped, including within the Offshore Development Area), and Surface Sands Formation, which in places incorporates deposits laid in sub-aerial conditions, in its lowest parts, in places containing peats, muds, and gravels[43,35].

10.3.20 Holocene organic deposits are abundant along the coast, with submerged forests (e.g., at Westward Ho!), estuarine and organic sediments (e.g., associated with the Taw-Torridge estuary) recorded. The deposits include peat exposures, estuarine clays, and the remains of a submerged forest at Westward Ho!, associated with evidence of Mesolithic archaeological remains, while the Taw has produced evidence of palaeochannels and alluvial sequences[38].

10.3.21 A thick band of Unit E is present in the nearshore area, with another thickened band close to landfall on the northern Offshore Export Cable Corridor option. Further assessment of Unit E should be undertaken to investigate the potential for remains of these deposits within the Offshore Development Area.

Marine deposits and sea level change

10.3.22 Across much of the Offshore Development Area Unit E is interpreted as a marine deposit. This correlates with the distributions of the Surface Sands Formation SL1 or SL2 members, which (with the exception of the basal parts, discussed above) are primarily marine deposits and have been mapped in the area by the BGS[35]. The marine deposits of the Surface Sands Formation are generally thin, up to 2m in thickness, over much of the region, however, they are thicker in nearshore areas (up to 20 m)[35]. This may account for the thickening seen in Unit E close to the shore (though in these areas the lower parts of this formation may contain pre-inundation sediments, see above discussion).

10.3.23 The marine portions of the deposit have been laid down following the Holocene marine transgression. Sea level changes in the area have been summarised in a model for Barnstable Bay produced by Grant et al[38]. The model is based on removal of Holocene sediments to provide a picture of inundation with former coastlines reconstructed based on the resulting contours (with Holocene sediment removed). The model indicates that the bay was exposed as dry land during the late glacial and saw rapid inundation during the early Holocene. By c. 8k BP the coastline was similar to that of today, though the land was likely 2-3 km west of its current location in the area of the landfall sites. By 5 k BP the sea level was approximately the same as at present[38]. The sea level reconstruction provides an indication of the formation age for the marine sands and indicates when the area became uninhabitable.

Summary

10.3.24 In summary, Unit E may hold evidence of:

- Glacial sediments (in particular associated with the Western Irish Sea or Cardigan Bay Formations)

[43] BGS Lexicon. https://data.bgs.ac.uk/id/Lexicon/NamedRockUnit/SURF

- Pleistocene and Holocene fluvial and related features
- Holocene organic sediments laid down prior to marine inundation by c. 5 k BP
- Marine sediments post-dating the Holocene marine transgression

10.3.25 With the exception of the marine sediments, the potential for other deposits to occur is likely focused in areas where Unit E is at its thickest. The thin layer of Unit E which appears to be present across much of the Offshore Development Area is thought to represent marine deposits.

10.4 Palaeolandscape assessment and Prehistoric Archaeological Potential

10.4.1 This section gives a brief consideration of the potential for submerged prehistoric remains, including archaeological sites, palaeolandscape elements, and palaeoenvironmental evidence, to be present within the Offshore Development Area. At this stage, this assessment is preliminary and further work is needed on Unit E and potential sub-units within to clearly define potential.

10.4.2 The prehistoric archaeological record of the UK covers the period from the earliest hominin occupation, potentially as far back as 970,000 BP, to the end of the Iron Age and the Roman invasion of Britain by Claudius in AD 43. The coastline of the UK changed drastically during this period and large tracts of what is now the seabed were once subaerially exposed.

10.4.3 The UK has been affected by several glacial events over the last 1 million years; including the Anglian (480-430 ka BP), the Wolstonian (350-132 ka BP), and the Devensian (122-10 ka BP), and intervening marine transgressions all of which have influenced archaeological potential. Prehistoric archaeological potential is gauged with reference to evidence for human activity in the UK during each period, and the contemporary environment within the Offshore Development Area. Depositional environment and post-depositional factors are also key to understanding potential, and as such geological deposits present within the Offshore Development Area form an important consideration in understanding archaeological, palaeoenvironmental and palaeolandscape potential. Deposits with potential for prehistoric archaeological remains, or palaeoenvironmental information are generally those laid during periods of aerial exposure or by fluvial process, rather than sub-glacial or marine deposits (though these may include remains capable of providing dates for different environmental conditions, and constraining time periods of potential suitability for habitation). However, there is also potential for archaeological material to be redeposited or reworked within secondary contexts as a result of fluvial erosion or glacial processes[44].

10.4.4 While dating is uncertain, the BGS indicate that the offshore deposits currently mapped may span the Wolstonian to Holocene (MIS 6 – 1). Thus, the following brief discussion will only relate to the archaeological and palaeoenvironmental potential of deposits laid during the late Wolstonian onwards. This discussion will be updated following the detailed archaeological assessment of SBP and SCS data.

10.4.5 The key deposits mapped within the wider area, and the majority mapped within the Offshore

[44] Hosfield R and Chambers J (2004) *The Archaeological Potential of Secondary Contexts*. ALSF Project 3361

Development Area, are largely glacial in nature. The Bedded and Infill Facies of the Cardigan Bay Formation are thought to have been formed in arctic, or boreal, conditions from the Wolstonian to the Devensian[35], and the upper till facies represent a glacial till deposit formed during the late Devensian[35]. These deposits all have low archaeological potential owing to inhospitable conditions. While this formation is primarily glacial, it also spans the Ipswichian interglacial (MIS 5e) though sediments of this date are either absent or not well defined[35]. Additionally, although during the Ispwichian climatic amelioration may have allowed the development of environments which were more conducive to human activity than the preceding glacial phase, no such activity has been identified within the UK dating to this period and sea levels were generally higher further limiting potential within the Offshore Development Area[45].

10.4.6 The Devensian (122-10,000 BP, MIS 5d-1) glaciation which directly followed the Ipswichian interglacial was the last glaciation to affect the UK. The maximum extents of the glaciation are uncertain (see above discussion) but may have covered the Windfarm Site and majority of the Export Cable Corridor during different phases (see Figure 33).

10.4.7 Within the wider Celtic Sea area, deposits described by the BGS indicate predominantly glacial conditions during the Devensian, as can be expected. The Upper Till Member of the Cardigan Bay Formation, is thought to derive from this period, and the overlying Western Irish Sea Formation is also thought to be a Devensian deposit. The latter is undivided within the Offshore Development Area, but its members represent a range of environments from glaciomarine to prodeltaic. Most represent inhospitable environments, limiting archaeological potential, though palaeoenvironmental remains may survive (depending on the nature of the deposits; prodeltaic deposits for example, if present, could hold palaeoenvironmental potential).

10.4.8 The Surface Sands Formation is largely characterised by modern marine sands which post-date the Holocene marine transgression (complete by c. 5k BP), however, lower parts of the formation may have been deposited in sub aerial conditions and the formation incorporates estuarine and organic sediments in the Severn Estuary. These sediments were laid down following the retreat of the Devensian glaciation prior to marine inundation and have potential to hold archaeological remains. Holocene sediments including organic, estuarine and peat deposits, and submerged forests are noted around the coastline of North Devon, some of which are associated with Mesolithic archaeological remains. Mesolithic sites have been recorded in association with coastal peats at Westward Ho!, forming part of a wider area of Mesolithic activity stretching to Abbotsham, demonstrating the archaeological potential of these deposits and the general coastline of the area[38]. Mesolithic remains have also been identified at Lundy, Croyde, and around Northam, further demonstrating the potential in this area.

10.4.9 In addition to the deposits mapped by the BGS, other studies have indicated the potential for fluvial features to be present within the Offshore Development Area. Although channels are reported by the WCPS to the south of Lundy their existence within the Offshore Development

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[45] Marshall P, Bayliss A, Grant M, Bridgland DR, Duller G, Housley R, Matthews I, Outram Z, Penkman KEH, Pike A, Schreve D and Xuan C (2020) 6390 *Scientific dating of Pleistocene sites: guidelines for best practice. Consultation Draft*. Swindon, UK. Historic England https://eprints.soton.ac.uk/440891/1/ScientificDatingofPleistoceneSites_GuidelinesforBestPractice_consultationdraft.pdf. Accessed 08.07.2022

Area is currently unproven, though evidence of such features may be contained within Unit E. If present, such features often represented foci for past activity and thus may hold archaeological and paleoenvironmental potential.

10.4.10 Areas of unknown potential include parts of the Offshore Export Cable Corridor where sand waves masked underlying deposits (shown on Figure 29). In these areas the extent of Unit E is unknown.

10.4.11 In summary, Unit E may contain a range of deposits, of which the majority are likely to be glacial or marine. However, potential for fluvial deposits or sediments laid down under sub-aerial conditions in association with the Surface Sands Formation and other coastal formations indicates some archaeological and palaeoenvironmental potential may be associated with Unit E. This Unit should therefore be investigated further, focused on the areas where it is thickest (shown on Figure 29) as intervening areas are interpreted as modern marine sediments.

11.0 Mitigation

11.0.1 This section provides recommendations for the robust, but proportional, mitigation of impacts to the historic environment for low, medium, and high potential anomalies, and magnetic anomalies, identified within the geophysical dataset. As outlined in Section 5.8 recommended mitigation for these anomalies will be through the implementation of AEZs, TAEZs and AAPs. Mitigation relevant to the palaeolandscape is discussed separately (Section 11.7).

11.0.2 The mitigation strategies recommended within this report are based on the available data, which includes full coverage MBES and full coverage high frequency SSS. Magnetometer data was collected at the same line spacing as the SSS and MBES which means there is potential for smaller items of buried material of archaeological interest to be present within the assessment area that is not visible within the current dataset, or for magnetic anomalies to not be represented in their true position.

11.0.3 However, the data serve to characterise the potential of the area with respect to the requirement for exclusion zones. Mitigation will be developed through each phase of survey works as detailed within Section 12.0.

11.0.4 The data extents do not fully cover the 0.5 km buffer used when assessing the UKHO, NRHE, and the HER records, they do however cover the entirety of the Offshore Development Area. Whilst UKHO, NRHE, and HER records have been identified outside of the Offshore Development Area, only those records falling within, or close to, the boundary have been assessed for mitigation as no development, and thus impact, is planned outside this area.

11.1 Low Potential Anomalies

11.1.1 Low potential anomalies, and small magnetic anomalies, have been identified as potentially anthropogenic in origin but unlikely to be of archaeological significance and no exclusion zones are recommended for these anomalies. Should material of potential archaeological significance be identified during the course of pre-construction and construction works they should be reported under an appropriate protocol for archaeological discoveries such as the *Crown Estates Protocol for Archaeological Discoveries: Offshore Renewables Projects*[46] or a project specific protocol that considers the individual requirements of The Project.

11.2 Archaeological Exclusion Zones (AEZ)

11.2.1 Two high potential surface anomalies, and three medium potential anomalies, have been identified within the Offshore Development Area dataset. The anomalies have been identified as likely to be of anthropogenic origin and potentially of archaeological significance. The anomalies have been recommended AEZs based on the size of the anomaly, the extents of any debris, the potential significance of the anomaly, the potential impact of the development and the seabed dynamics within the area.

11.2.2 Dependant on the form of anomalies, AEZs will either be recommended as a radius from the centre point of the anomaly or as a distance from the extents. Particularly in the case of

[46] The Crown Estate, 2014. *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.

shipwrecks, which tend to be longer in length than width, the use of a circle provides unequal protection around the extents. This not only impacts the protection afforded but does not represent proportional mitigation.

11.2.3 In total five AEZs relating to high and medium potential anomalies have been recommended within the Offshore Development Area, all of which are within the Offshore Export Cable Corridor. Anomalies and their recommended exclusion zones are detailed in Table 25 and the distribution presented in Figure 35. Note, where discrepancies exist between the position within different datasets, the position deemed to be most accurate has been used, typically that derived from the MBES data.

Anomaly ID	Description	Potential	WGS84 Z30N		AEZ (m)
			X	Y	
WC22_0043	Potential wreck	High	397965.1	5663488.3	50 radius
WC22_0063	Wreck	High	389369.4	5665020.2	50 extents
WC22_0041	Potential debris	Medium	365016.8	5663704.8	35 radius
WC22_0045	Potential wreck	Medium	398452.7	5663633.1	50 radius
WC22_0046	Likely geological	Medium	398731.6	5663638.9	25 radius

Table 25: Archaeological Exclusion Zones within the Offshore Development Area

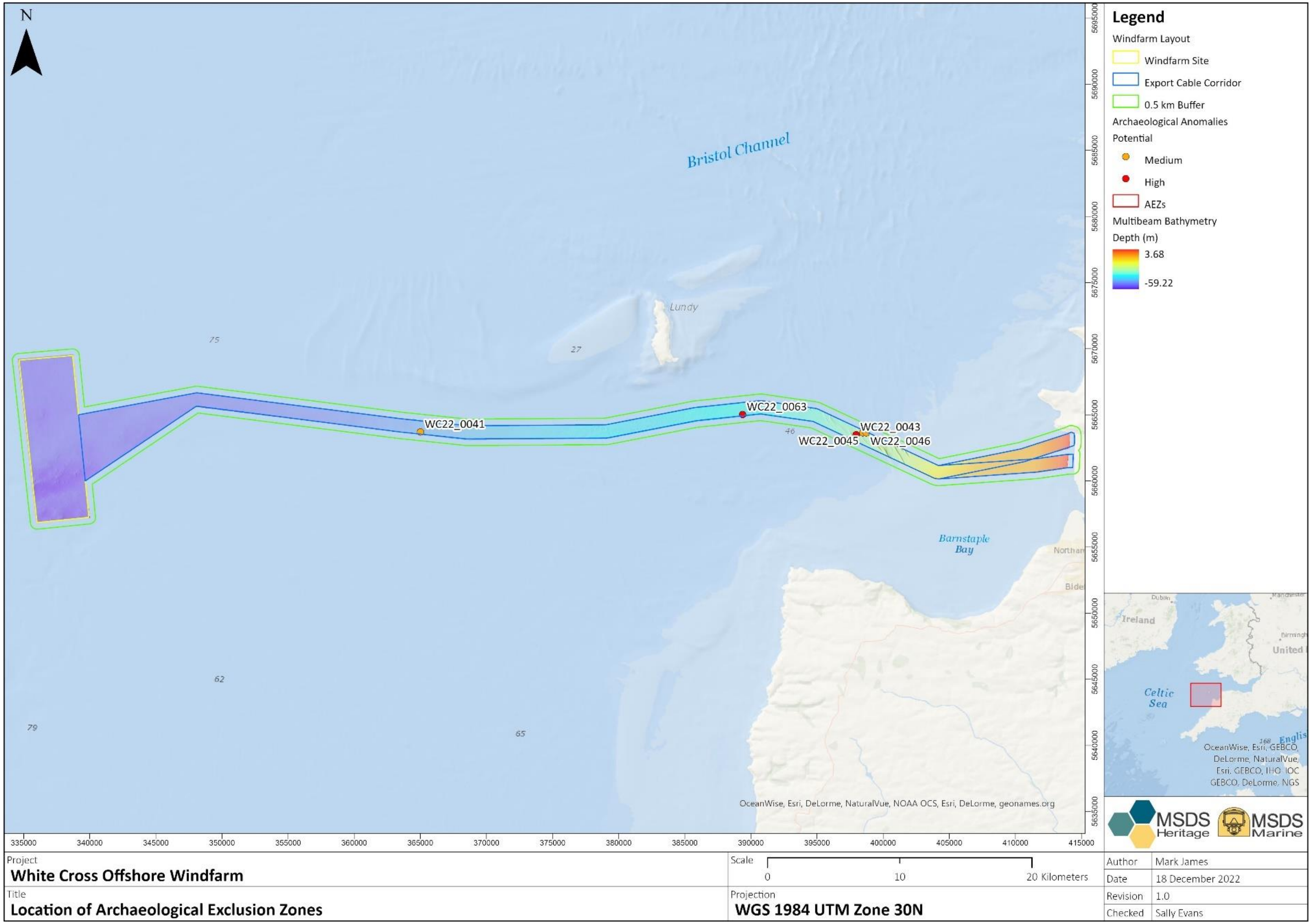


Figure 35: Location of Archaeological Exclusion Zones

11.3 Temporary Archaeological Exclusion Zones (TAEZ)

11.3.1 38 TAEZs have been recommended within the Offshore Development Area, all within the Offshore Export Cable Corridor. TAEZs are recommended where an anomaly is not visible in the dataset but is known to exist, where the position cannot be determined with enough accuracy for refined exclusion zones, or where the extents are not fully known. They are often larger than AEZs but are identified as temporary as they are highly likely to be altered following higher resolution or full coverage data assessment, however, they will remain in place until alterations have been formally agreed.

11.3.2 The size of the TAEZs takes into consideration the TVG line spacing, the potential to represent material of archaeological significance, and other anomalies that may be present within the surrounding area. Anomalies and their recommended exclusion zones are detailed in Table 26 and the distribution presented in Figure 36.

Anomaly ID	Description	Amplitude (nT)	WGS84 Z30N		TAEZ (m)
			X	Y	
WC22M_0202	Magnetic	139.9	390080.3	5665418.2	50
WC22M_0228	Magnetic	160.5	401149.5	5661683.6	50
WC22M_0271	Magnetic	168.5	377748.5	5663792.0	50
WC22M_0273	Magnetic	201.9	378372.7	5663798.4	50
WC22M_0302	Magnetic	138.9	376083.2	5663486.6	50
WC22M_0326	Magnetic	165.6	376611.7	5663790.0	50
WC22M_0421	Magnetic	156.8	385818.3	5664964.6	50
WC22M_0554	Magnetic	170.3	388929.1	5665594.9	50
WC22M_0569	Magnetic	108.1	394375.0	5665187.7	50
WC22M_0616	Magnetic	133.6	393786.4	5665204.5	50
WC22M_0617	Magnetic	116.4	393997.6	5665201.8	50
WC22M_0618	Magnetic	137.6	393763.2	5664673.9	50
WC22M_0628	Magnetic	238.0	392862.1	5665251.7	50
WC22M_0633	Magnetic	256.7	392010.7	5665381.5	50
WC22M_0653	Magnetic	129.8	391326.9	5665928.1	50
WC22M_0735	Magnetic	104.0	388016.0	5664970.2	50

Anomaly ID	Description	Amplitude (nT)	WGS84 Z30N		TAEZ (m)
			X	Y	
WC22M_0739	Magnetic	109.0	387418.8	5664981.7	50
WC22M_1197	Magnetic	182.8	411296.6	5661277.9	50
WC22M_1212	Magnetic	114.2	411592.6	5661175.2	50
WC22M_0651	Magnetic	184.1	391620.2	5665734.9	100
WC22M_0652	Magnetic	239.7	391622.1	5665814.4	100
WC22M_0696	Magnetic	268.4	389586.1	5665891.4	100
WC22M_0697	Magnetic	373.3	389591.5	5665830.9	100
WC22M_0698	Magnetic	260.3	389552.7	5665817.0	100
WC22M_1061	Magnetic	17749.0	413869.3	5662765.2	100
WC22M_1067	Magnetic	377.4	413800.1	5662659.4	100
WC22M_1070	Magnetic	1167.5	413869.5	5662620.5	100
WC22M_1073	Magnetic	10417.1	413861.7	5662615.4	100
WC22M_1084	Magnetic	2435.0	413494.2	5662514.6	100
WC22M_1085	Magnetic	643.6	413947.1	5662514.5	100
WC22M_1088	Magnetic	194.2	413624.6	5662493.0	100
WC22M_1145	Magnetic	1267.1	413771.4	5661799.8	100
WC22M_1154	Magnetic	212.7	413965.5	5661701.9	100
WC22M_1166	Magnetic	1018.5	413896.0	5661514.2	100
WC22M_1184	Magnetic	126.2	413893.7	5661390.1	100
WC22M_1185	Magnetic	512.3	413849.7	5661387.4	100
WC22M_1219	Magnetic	1338.1	413781.2	5661102.8	100
WC22M_1220	Magnetic	309.5	413884.2	5661085.6	100

Table 26: Temporary Archaeological Exclusion Zones within the Offshore Development Area

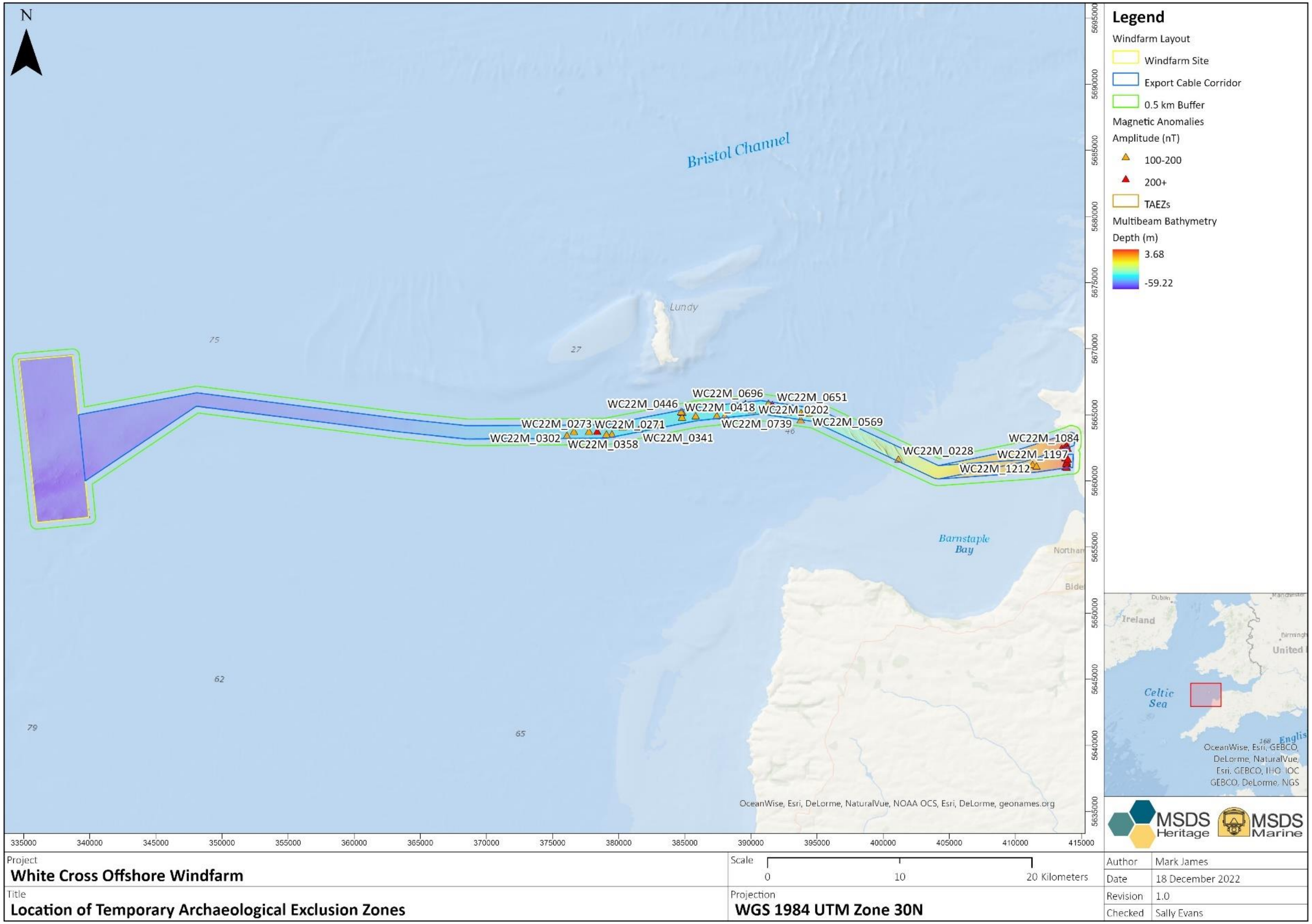


Figure 36: Location of Temporary Archaeological Exclusion Zones

11.4 Areas of Archaeological Potential (AAP)

11.4.1 One Area of Archaeological Potential (AAP) has been identified within the Offshore Development Area, extending from the eastern most extents of the Offshore Export Cable Corridor to between 1.0 km and 1.2 km seaward (Figure 37). The area has been highlighted as of heightened potential due to the large number of magnetic anomalies, particularly concentrated along the Mean Low Water Springs line, and the potential for these anomalies to represent material relating to World War II, and the preparations for D-Day.

11.4.2 Whilst no formal mitigation in the form of an AEZ, or TAEZ, is recommended within this area, the potential significance of any material that may be present should be established, and appropriate mitigation implemented. This could include further assessment of geophysical data collected during potential Unexploded Ordnance (pUXO) survey works, intrusive investigation, or a watching brief should open cut trenching be undertaken during cable installation.

11.5 Notes on Exclusion Zones

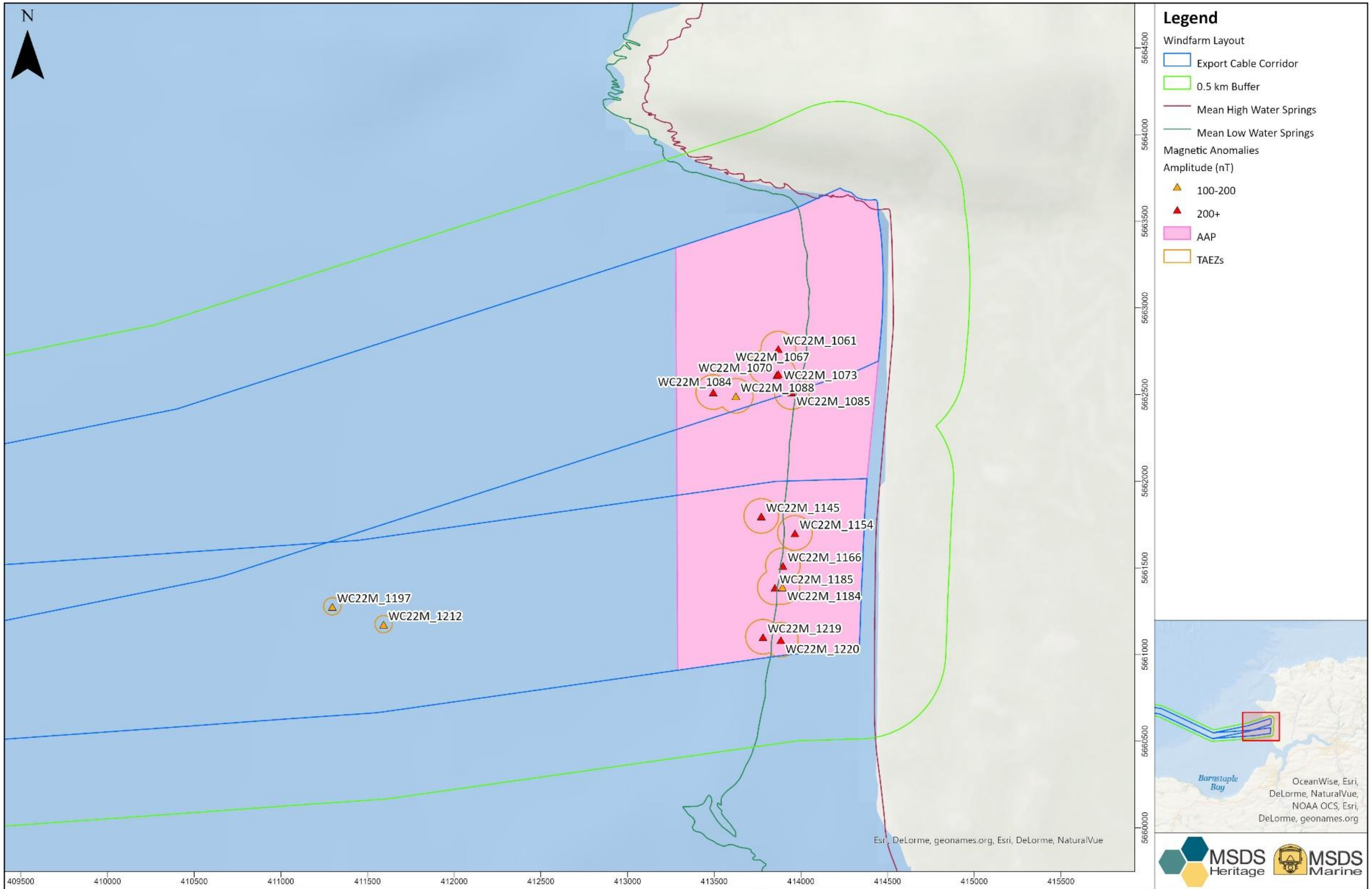
11.5.1 Exclusion zones have been recommended based on the available evidence as interpreted by an experienced and qualified maritime archaeologist, they are to be agreed between The Project, the archaeological curator, and the regulator. Exclusion zones are implemented to protect, in-situ, potentially archaeologically significant material.

11.5.2 Where an exclusion zone has been implemented, no development work impacting the seabed is to take place within the prescribed area. Should an exclusion zone impact the development program it is recommended that a program of ground truthing be undertaken to establish the identity of an anomaly in order that the potential archaeological significance can be assessed by a qualified and experienced archaeologist. Following identification and assessment, the exclusion zone can be re-assessed to ensure mitigation is appropriate to the archaeological significance of the anomaly.

11.6 Protocol for Archaeological Discoveries

11.6.1 An appropriate protocol for archaeological discoveries such as the *Crown Estates Protocol for Archaeological Discoveries: Offshore Renewables Projects*[47] should also be applied across the scheme. Such protocols provide a means of identifying previously unidentified archaeological remains and are an important part of the mitigation process.

[47] The Crown Estate, 2014. *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.



Project	Scale	Author	Mark James
White Cross Offshore Windfarm	0 — 0.8 — 1.5 Kilometers	Date	18 December 2022
Title	Projection	Revision	1.0
Nearshore Temporary Archaeological Exclusion Zones (TAEZs)	**WGS 1984 UTM Zone 30N**	Checked	Sally Evans

Figure 37: Location of Area of Archaeological Potential (AAP)

11.7 Prehistoric Archaeology and Palaeoenvironmental Remains

11.7.1 This report has outlined areas of prehistoric archaeological and palaeoenvironmental potential in particular associated with Unit E. More detailed investigation of Unit E including sub-division of this unit is recommended. This Unit is likely to contain all evidence of Quaternary environments within the Offshore Development Area. The resulting report should make recommendations for further investigation of key areas of potential, if identified. Recommendations may include geoarchaeological assessment.

11.7.2 Additionally, this report has also noted that sand waves and sediments may mask and protect underlying Quaternary deposits. Geoarchaeological assessment of cores should be undertaken in areas where SBP penetration did not extend below the base of the sand waves and marine sediments within the Export Cable Corridor, and where impacts would exceed beyond these limits, in order to determine whether any earlier sediments of archaeological and/or palaeoenvironmental interest survive and would be impacted.

11.7.3 The geoarchaeological assessment should follow a staged approach and can be aligned with the engineering requirement to undertake geotechnical works. Typically, this process involves close collaboration with the Site Investigation team. Archaeological input into geotechnical core locations can allow for the greatest insights into the palaeolandscape, such as through the sampling of stratified channel deposits, deposits likely to contain organic remains or un-eroded surfaces. Round-table discussions and the review of seismic profiles (where available) tends to be a conducive method of allowing engineering and archaeological requirements to be taken into consideration when micro-siting geotechnical cores.

11.7.4 Following the collection of geotechnical cores, it is recommended that they undergo a staged program of geoarchaeological assessment and analysis as the primary means of ground-truthing the potential identified in this report, and of mitigating impacts to remains. In brief the process is as follows;

- Stage 1: Geoarchaeological review of core logs;
- Stage 2: Geoarchaeological recording;
- Stage 3: Geoarchaeological assessment;
- Stage 4: Geoarchaeological analysis, and;
- Stage 5: final reporting

11.7.5 This work should be undertaken by a trained geoarchaeologist. Each stage should inform the scope of the next, and work may cease at any point where no recommendations for further work are made. This would be the case if, for example, cores were determined to hold no geoarchaeological potential at the end of Stage 2.

11.7.6 This geoarchaeological assessment and analysis should aim to deliver conclusions on the prehistoric archaeological and palaeoenvironmental remains within the area. Further mitigation may be required based on the results of this assessment.

12.0 Recommendations for Future Work

12.1 Archaeological Assessment of Geophysical Data

12.1.1 The archaeological interpretation of the geophysical data collected at the pre-application stage, to which this assessment pertains, fits within a wider framework of planned geophysical survey for White Cross Offshore Windfarm. The survey specification was designed for the purposes of consenting and Front End Engineering Design (FEED) to determine the most appropriate area for development. Future surveys will likely combine an increase in resolution, and the addition of magnetometer data with tighter line spacing (as determined by the pUXO risk), within the Offshore Development Area. With the data resolution and coverage set to increase, the confidence in interpretation and appropriateness of mitigation strategies will also increase.

12.1.2 All geophysical data collected as part of The Project will be assessed for archaeological potential by a qualified and experienced maritime archaeologist where relevant to the development. It is recommended that the archaeologist have a demonstrable background in both the collection and processing of geophysical data as well as the archaeological review of data.

12.1.3 The archaeological review of data at these stages is considered necessary, not only for the robust assessment of the historic environment and archaeological potential but also for development planning. As the planned surveys increase in coverage and resolution but decrease in area, it is beneficial to be aware of any potential archaeological mitigation that may be required to ensure minimal re-planning.

12.1.4 Prior to any impact on the seabed pUXO specification data will be made available to, and reviewed by, the archaeologist. This includes, but is not limited to, cable laying operations, WTG installations, jack up barge positioning, anchor positions, UXO and boulder clearance and geotechnical works.

12.1.5 The methodology for the archaeological interpretation of data will follow that on which this review is based but will be subject to the preparation and agreement of a separate method statement. Whilst it is anticipated that methodologies will not vary a great deal between phases of work it is important to draw upon previous results to ensure the method proposed is both robust but practical.

Survey Specification

12.1.6 Survey specifications will vary dependent on a number of factors including, water depth, vessel, and equipment, however, certain recommendations can be made such as coverage, size of anomaly to be ensonified, and positional accuracy.

12.1.7 Of particular relevance is the specification for pUXO surveys which are undertaken to a specification suitable to reduce the UXO risk to As Low As Reasonably Practical (ALARP). In almost all instances' data collected for UXO assessment is highly suitable for archaeological assessment. General specifications are detailed below;

- Sidescan Sonar: data should be high frequency (at least 400-600 kHz), collected with a minimum of 200% coverage and the fish should be flown at an optimal altitude (typically c.10% of range). The fish should be positioned with a correctly calibrated USBL system and layback recorded as a backup. The data should be of a quality and resolution to identify seabed anomalies >0.3 m.

- Sub-bottom Profiler: data should be collected at a frequency and power appropriate to the seabed type and the required penetration, vertical resolution should be <0.3 m where possible and the data should be heave corrected. Sub-bottom data are only collected below the sensor; therefore, data should be collected on all magnetometer lines as these are generally the tightest spacing.

- Multibeam Echo Sounder: for archaeological interpretation multibeam data are used for general seabed characterisation and quality control for the positioning of anomalies identified in the sidescan data. Data should be high resolution (typically 300-450 kHz) and acquired within IHO Special Order specifications, this includes full coverage data and a requirement to detect features >1.0 m on the seabed.
- Magnetometer: the method for magnetometer surveys will vary between multiple close survey lines or multiple magnetometers in an array and wider survey lines. Magnetometer surveys for UXO identification should aim for full coverage with a blanking distance of 2.5 m, a target positioning accuracy of +/-2.5 m and an absolute accuracy of <2 nT. The fish should be flown between 2.0 m and 4.0 m above seabed and positioned with a correctly calibrated USBL system and layback recorded as a backup.

12.2 Palaeolandscape

12.2.1 This report has outlined gaps in knowledge, and areas of prehistoric archaeological and palaeoenvironmental potential. Recommendations are as follows:

- More detailed investigation of Unit E including sub-division of this unit. This Unit is likely to contain all evidence of Quaternary environments within the Offshore Development Area. The resulting report should make recommendations for further investigation of key areas of potential, if identified. Recommendations may include geoarchaeological assessment.

- Sand waves and sediments may mask and protect underlying Quaternary deposits. Assessment of cores (following the process set out in Section 11.7) should be undertaken in areas where SBP penetration did not extend below the base of the sand waves and marine sediments within the Export Cable Corridor, and where impacts would exceed beyond these limits, in order to determine whether any earlier sediments of archaeological and/or palaeoenvironmental interest survive and would be impacted.

12.3 Protocol for Archaeological Discoveries (PAD)

12.3.1 A suitable protocol for archaeological discoveries is a key element of the mitigation procedures, particularly for anomalies identified as low archaeological potential, including small magnetic anomalies. A suitable protocol should also be implemented during any works that may visually inspect the seabed or recover material to deck.

12.3.2 The protocol will take the form of the Crown Estates *Protocol for Archaeological Discoveries: Offshore Renewables Projects*[48] or a project specific protocol that considers the individual requirements of The Project. The protocol will be agreed with the curator and the regulator prior to any impact on the seabed.

[48] The Crown Estate, 2014. *Protocol for Archaeological Discoveries: Offshore Renewables Projects*. Wessex Archaeology on behalf of the Crown Estate.

12.4 Ground Truthing

12.4.1 Should archaeological exclusion zones impact on the proposed development works it is recommended that a program of ground truthing is undertaken to establish the identity of the anomalies so that further archaeological assessment can be undertaken, and interpretations revised as appropriate.

13.0 Annex A – Anomalies of Archaeological Potential

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
WC22_0002	Low	Likely geological	0.0	2.4	0.8	0.5			337481.5	5667035.7
WC22_0003	Low	Potential debris	0.0	1.5	1.5	0.2			336832.1	5663952.5
WC22_0004	Low	Potential debris	0.0	2.2	0.3	0.4			337096.4	5661046.6
WC22_0005	Low	Likely geological	0.0	1.3	2.1	1.0			335628.5	5665470.3
WC22_0008	Low	Potential debris	0.0	3.1	0.7	0.6			336448.2	5662973.7
WC22_0009	Low	Likely geological	0.0	1.8	0.7	0.1			336459.8	5662271.1
WC22_0010	Low	Potential debris	0.0	19.6	4.0	0.4			336253.9	5662849.9
WC22_0011	Low	Linear feature	0.0	3.9	0.3	0.3			335763.0	5667871.2
WC22_0012	Low	Potential debris	0.0	2.6	0.6	0.8			336636.8	5663467.0
WC22_0013	Low	Potential debris	0.0	2.9	0.4	1.1			336635.4	5657031.6
WC22_0014	Low	Potential debris	0.0	4.5	4.8	0.0			335593.6	5666670.9
WC22_0015	Low	Likely geological	0.0	2.8	0.6	0.3			336119.2	5656859.2
WC22_0016	Low	Likely geological	0.0	2.6	0.3	0.4			338572.7	5657335.9
WC22_0019	Low	Likely geological	0.0	4.6	1.6	0.4			338501.2	5657114.1
WC22_0020	Low	Likely geological	0.0	29.7	13.3	0.3			337290.6	5664486.3
WC22_0021	Low	Potential debris	0.0	4.0	1.3	0.5			338127.9	5665464.2

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
WC22_0022	Low	Likely geological	0.0	2.6	0.5	0.5			338143.6	5658527.4
WC22_0023	Low	Likely geological	0.0	2.0	0.6	0.4			338882.9	5659422.1
WC22_0025	Low	Seabed disturbance	0.0	16.1	8.6	0.0			335403.0	5666573.7
WC22_0026	Low	Potential debris	0.0	17.2	6.3	0.6			338672.4	5667128.9
WC22_0027	Low	Potential debris	0.0	1.1	0.3	0.2			338916.4	5667799.9
WC22_0028	Low	Potential debris	0.0	1.5	0.3	0.2			336868.2	5658820.9
WC22_0029	Low	Likely geological	0.0	4.8	1.2	2.3			336450.1	5665513.0
WC22_0031	Low	Likely geological	0.0	2.2	0.6	0.3			346256.7	5665736.7
WC22_0032	Low	Potential debris	0.0	1.9	0.5	0.1			367632.3	5663812.5
WC22_0033	Low	Potential debris	0.0	2.3	0.3	0.3			365505.6	5664021.1
WC22_0034	Low	Likely geological	0.0	4.6	0.7	0.2			364951.0	5664092.0
WC22_0035	Low	Linear feature	0.0	8.3	0.2	0.1			369892.3	5663621.9
WC22_0036	Low	Potential debris	0.0	1.0	0.4	0.0			401635.0	5661823.1
WC22_0038	Low	Potential debris	0.0	2.7	0.5	1.4			391451.9	5665456.4
WC22_0039	Low	Potential debris	0.0	1.2	0.2	0.5			390891.8	5665741.6
WC22_0040	Low	Fishing gear	0.0	31.8	0.4	0.2			342393.6	5665283.6
WC22_0041	Medium	Potential debris	0.0	11.8	6.4	0.7	35	Radius	365016.8	5663704.8
WC22_0042	Low	Likely geological	0.0	13.6	7.6	2.9			386331.4	5664928.0

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
WC22_0043	High	Potential wreck	25.3	19.8	8.3	1.7	50	Radius	397965.1	5663488.3
WC22_0044	Low	Potential debris	0.0	61.2	13.2	0.1			373592.3	5663236.0
WC22_0045	Medium	Potential wreck	117.1	15.0	4.7	2.8	50	Radius	398452.7	5663633.1
WC22_0046	Medium	Likely geological	48.5	5.5	5.2	1.2	25	Radius	398731.6	5663638.9
WC22_0047	Low	Linear feature	0.0	4.1	0.2	0.2			373090.1	5664120.8
WC22_0048	Low	Fishing gear	0.0	66.9	0.2	0.3			366074.3	5663726.9
WC22_0049	Low	Potential debris	0.0	5.8	1.8	0.4			373474.3	5663516.8
WC22_0051	Low	Likely geological	0.0	4.0	2.4	0.8			346766.5	5666328.5
WC22_0052	Low	Potential debris	0.0	23.6	12.4	0.2			339372.5	5664007.6
WC22_0054	Low	Potential debris	0.0	1.6	1.0	0.3			342169.1	5663817.8
WC22_0055	Low	Potential debris	0.0	1.8	1.1	0.3			341383.6	5664713.9
WC22_0056	Low	Potential debris	0.0	2.3	0.4	0.3			348548.2	5666019.5
WC22_0058	Low	Linear feature	0.0	7.9	0.2	0.0			342044.6	5664413.2
WC22_0059	Low	Potential debris	0.0	3.0	1.5	0.1			346980.5	5666131.4
WC22_0060	Low	Potential debris	0.0	1.9	0.9	0.2			343343.7	5663332.8
WC22_0061	Low	Potential debris	0.0	1.3	1.3	1.7			343929.4	5663071.4
WC22_0062	Low	Potential debris	0.0	2.3	0.6	0.2			401902.9	5662186.8
WC22_0063	High	Wreck	1,011.6	52.6	14.0	2.3	50	Extents	389369.4	5665020.2

Name	Potential	Description	Mag (nT)	Length (m)	Width (m)	Height (m)	AEZ (m)	AEZ Type	X	Y
WC22_0064	Low	Likely geological	0.0	2.3	0.3	0.8			396204.5	5663889.2
WC22_0065	Low	Chain, cable, or rope	0.0	23.0	0.1	0.1			392012.6	5665795.6
WC22_0066	Low	Potential debris	8.5	22.9	5.6	0.1			410492.4	5660958.7
WC22_0067	Low	Potential debris	0.0	1.5	1.0	0.5			358020.6	5665009.8
WC22_0068	Low	Likely geological	0.0	1.8	0.6	0.0			411414.7	5661897.5
WC22_0069	Low	Chain, cable, or rope	0.0	9.5	0.1	0.0			412798.6	5662597.6
WC22_0070	Low	Potential debris	0.0	11.2	7.2	0.0			413303.9	5661320.8
WC22_0071	Low	Linear feature	0.0	3.9	0.1	0.0			413238.3	5661081.7
WC22_0072	Low	Potential debris	423.7	0.8	0.5	0.0			412299.4	5662456.1
WC22_0073	Low	Likely geological	0.0	2.0	0.9	0.0			372409.2	5664188.5
WC22_0074	Low	Potential debris	171.7	2.0	0.9	0.0			412610.9	5662327.0

WHITE CROSS

White Cross Offshore Windfarm Environmental Statement

Appendix 16.B: Offshore Archaeological WSI

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Glossary of Acronyms

Acronym	Definition
AC	Alternating Current
ADS	Archaeology Data Service
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
ALARP	As Low as Reasonably Possible
BABAO	British Association of Biological Anthropology and Osteoarchaeology
BC	Before Christ
BCE	Before the Common (or current) Era
Cal	Calibrated
CIfA	Chartered Institute for Archaeologists
DBA	Desked-Based Assessment
DCC	Devon County Council
DCC HET	Devon County Council Historic Environment Team
DC	Direct Current
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
FEED	Front End Engineering and Design
GI	Ground Investigations
GIS	Geographic Information System
HDD	Horizontal Directional Drilling
HER	Historic Environment Record
HRA	Habitats Regulations Appraisal
km	Kilometre
LGP	Last Glacial Period
LSE	Likely Significant Effect
MAG	Magnetometer
MBES	Multibeam Bathymetry
MHWS	Mean High Water Springs
MIS	Marine Isotope Stage
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MW	Megawatts
NMHR	National Marine Heritage Record
NPPF	National Planning Policy Framework
nT	nanoTesla
OASIS	Online Access to the Index of Archaeological Investigations

Acronym	Definition
OMS	Operation and Maintenance Service
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
OS	Ordnance Survey
OSP	Offshore Substation Platform
OWL	Offshore Wind Limited
OWF	Offshore Wind Farm
PAD	Protocol for Archaeological Discoveries
PPG	Planning Practice Guidance
ROV	Remote Operated Vehicle
SBP	Sub-bottom Profiler
SSS	Sidescan Sonar
TVG	Transverse Gradiometer
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation
WWI	World War I
WWII	World War II

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	Offshore Wind Limited
Aviation archaeology	The remains of crashed aircraft and archaeological material associated with historic aviation activities.
Devensian	Devensian The Last Glacial Period (LGP), also known colloquially as the last ice age or simply ice age, occurred from the end of the Eemian to the end of the Younger Dryas, encompassing the period c. 115,000 –c. 11,700 years ago. British geologists refer to the LGP as the Devensian.
Cumulative effects	The effect of the Offshore Project taken together with similar effects from a number of different projects, on the same single receptor/resource. Cumulative impacts are those that result from changes caused by other past, present or reasonably foreseeable actions together with the Offshore Project.
Department for Business, Energy and Industrial Strategy	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.
Dynamic cables	The floating substructures will require cables to run through the water column from their platform base at the water surface to the touchdown point on the seabed.
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 Offshore Project on the physical, biological and human environment during construction, operation and decommissioning.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Expert Topic Group	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Export Cable Corridor	The area in which the export cables will be laid, either from the Offshore Substation or the point at which the inter-array cable junction box s converge (if no offshore substation), to the Onshore Substation comprising both the Offshore Export Cable Corridor and Onshore Export Cable Corridor..
Floating substructure	The floating substructure acts as a stable and buoyant foundation for the WTG. The WTG is connected to the substructure via the transition piece and the substructure is kept in position by the mooring system.

Defined Term	Description
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.
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record. Includes the study of soils and sediments and of natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes and the effects on buried sites and artefacts.
Glacial/interglacial	A glacial period is a period within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last 1 million years, the Anglian, the Wolstonian and the Devensian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.
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.
Generation Assets	The infrastructure of the Offshore 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 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.
Historic seascape character	The attributes that contribute to the formation of the historic character of the seascape
Holocene	The Holocene is the current geological epoch. It began approximately 11,650 cal years before present (c. 9700 BCE), after the Last Glacial Period, which concluded with the Holocene glacial retreat.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable route which would house HDD entry or exit points.
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.
Inter-array cables	Cables which link the wind turbines to each other and the Offshore Substation Platform, or at the inter-array cables junction box (if no offshore substation). Array cables will connect the wind turbines to one and other and to the Offshore Substation (if utilised). The initial section for the inter-array cables will be freely suspended in the water column below the substructure (dynamic sections) while the on seabed sections of the cables will be buried where possible.
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

Defined Term	Description
Landfall to MHWS	Where the offshore export cables come ashore
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links
Marine isotope stage	Marine isotope stages are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.
Maritime archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
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.
Mesolithic	10000 to 4000 BC The Middle Stone Age, falling between the Palaeolithic and Neolithic and marking the beginning of a move from a hunter gatherer society towards a food producing society.
Mooring system	The equipment (mooring lines and seabed anchors) that keeps the floating substructure in position during operation through a fixed connection to the seabed.
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.

Defined Term	Description
Neolithic	4000BC to 2000 BC often referred to as the New Stone Age, this period marks the transition from a hunter gatherer society to that of a farming society.
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
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 components 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 Offshore 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 Wind Limited	Offshore Wind Ltd (OWL) is a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy Ltd
Palaeoenvironmental analysis	The study of sediments and the organic remains of plants and animals to reconstruct the environment of a past geological age.
Palaeogeographic features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing prehistoric physical landscape features such as former river channels (palaeochannels).

Defined Term	Description
Palaeolithic	500000 to 10000 BC The Old Stone Age defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into Lower, Middle and Upper Palaeolithic.
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 components that make up the Offshore 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
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water
Seabed features	Features seen on the seafloor in the sidescan sonar or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Seabed prehistory	Archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower.
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.
Study area	This is an area which is defined for each EIA topic which includes the windfarm site as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each EIA topic is intended to cover the area within which an effect can be reasonably expected.
Technical stakeholders	Technical consultees are considered to be organisations with detailed knowledge or experience of the area within which the Offshore Project is located and/or receptors which are considered in the EIA and HRA. Examples of technical stakeholders include Marine Management Organisation, local authorities, Natural England and Royal Society for the Protection of Birds.
Transition joint bay	Underground structures at the Landfall to MHWS that house the joints between the offshore export cables and the onshore export cables
White Cross Offshore Windfarm	100MW capacity offshore windfarm including associated onshore and offshore infrastructure

Defined Term	Description
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.
Wind Turbine Generators (WTG)	The wind turbine generators convert wind energy into electrical power. Key components include the rotor blades, nacelle (housing for electrical generator and other electrical and control equipment) and tower. The final selection of project wind turbine model will be made post-consent application

1. Appendix 16.B: Offshore Outline Written Scheme of Investigation

1.1 Introduction

1.1.1 Project Overview

1. White Cross Offshore Windfarm (hereafter referred to as 'the Project') is a proposed floating offshore windfarm located in the Celtic Sea) with a capacity of up to 100MW.

2. The Offshore Project for the offshore Section 36 and Marine Licence application includes all elements seaward of Mean High-Water Springs (MHWS) (hereafter referred to as 'the Offshore Project'). 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).

3. The Project is being developed by Offshore Wind Ltd (OWL) a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy Ltd.

4. The Project will help achieve the UK Government's commitment to net zero by 2050 and tackle the climate emergency by producing electricity from renewable energy. The Project was selected in 2021 as part of The Crown Estate's Test and Demonstration leasing opportunity.

5. The Windfarm Site is located over 52km off the North Cornwall and North Devon coast (west-north-west of Hartland Point). The Offshore Export Cable will connect the Offshore Substation Platform (OSP) to shore. Onshore, the WPD grid connection is confirmed as East Yelland (**Figure 1.2** of **Chapter 1: Introduction** of the **ES**). The Offshore Export Cable will come ashore at a Landfall at Saunton Sands on the North Devon Coast, and then be routed underground to the East Yelland Onshore Substation where it connects into the Western Power Distribution Network. A full project description of the Offshore Project is given in **Chapter 5: Project Description**.

6. The set of consents/permission required in order for the Project to proceed are outlined below:

   - Consent under the Section 36 of the Electricity Act 1989 (S.36) and a marine licence under the Marine and Coastal Access Act 2009 (MCAA 2009) are required for the following generation assets (within the Windfarm Site):
     - Wind Turbine Generators
     - Semi-submersible floating platforms

- Subsea catenary mooring lines
- Anchoring solutions (drag embedment anchors, suction anchor, or pin piles)
- Inter-array cables and associated protection
- Other associated offshore infrastructure, such as navigational markers.

- A second Marline Licence is required to enable the option for an Offshore Transmission Owner (OFTO) to be appointed under The Electricity (Competitive Tenders for Offshore Transmission Licences) Regulations 2015 for the following transmission assets (to Mean High Water Springs):

    - Offshore Substation Platform
    - Offshore export cable
    - Other associated offshore infrastructure, such as navigational markers.

- Planning permission under the Town and Country Planning Act 1990 (TCPA 1990) is required for the following onshore infrastructure assets Onshore Project

7. This document comprises the Outline Written Scheme of Investigation (WSI) (Offshore) including a Protocol for Archaeological Discoveries (PAD).

1.2 Project Background

1.2.1 Purpose and Structure of the Outline Onshore WSI

8. This Outline WSI (Offshore) has been produced to set out the proposed approach to the archaeological mitigation measures and investigations to be undertaken post-consent associated with White Cross Offshore Wind Farm.

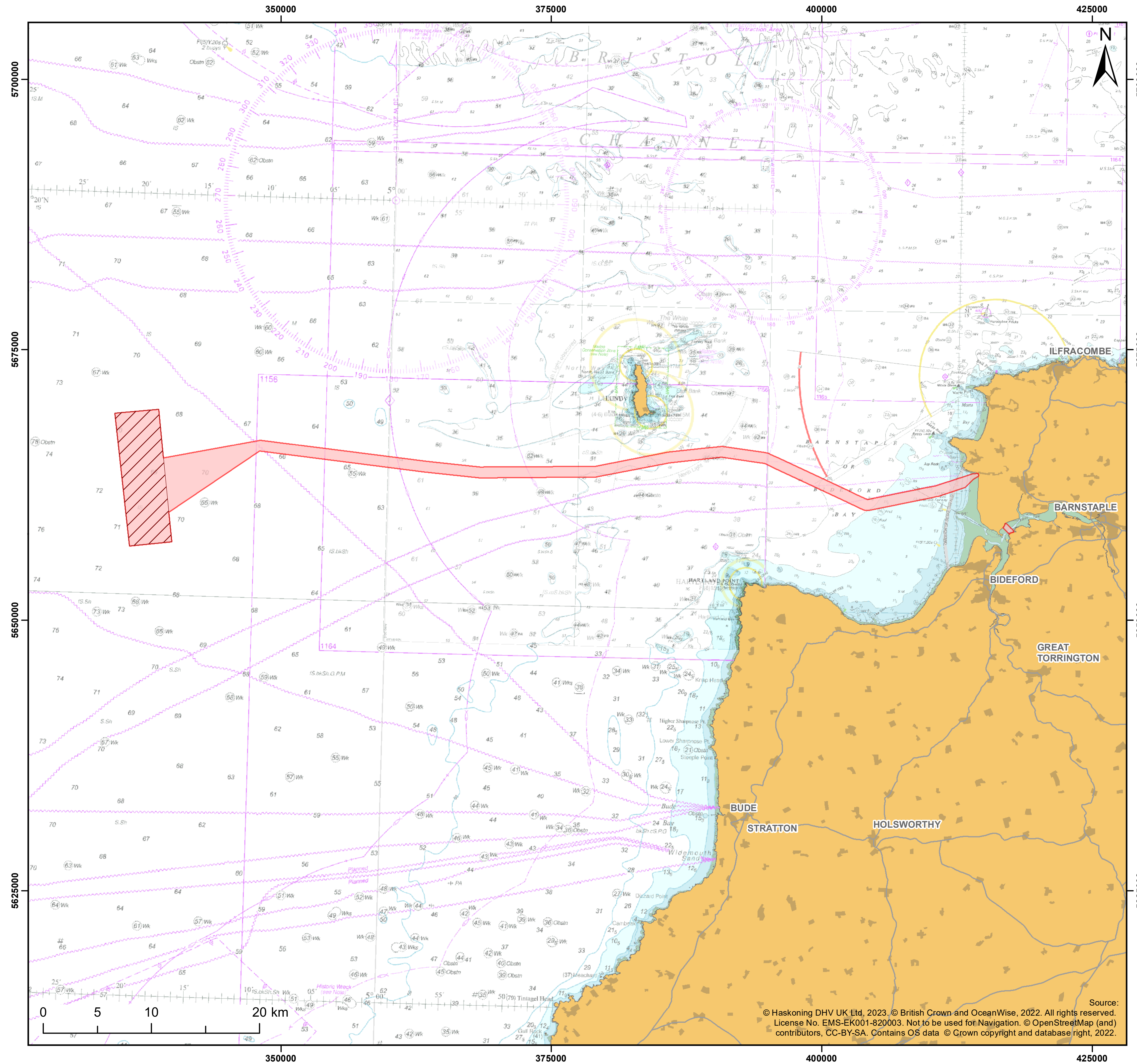
9. It is currently anticipated that, within the intertidal zone, either Horizontal Directional Drilling (HDD) or open cut trenching will be used for the nearshore cable installation. With the use of HDD entry on the landward side of the beach and exit below Mean Low Water Springs (MLWS) in the marine zone, will mean that impacts to potential intertidal archaeological material can be avoided.

10. An updated, final Offshore WSI will be developed post-consent in consultation with Historic England and the Devon County Council Historic Environment Team (DCC HET).

1.2.2 Project Study Area

11. The Offshore Development Area includes the Windfarm Site and the Offshore Export Cable Corridors (see **Figure 1**)The array site covers an area of 50km^2.

12. The study area has therefore been defined as the Offshore Development Area including the intertidal zone up to Mean High Water Springs (MHWS).



Legend:

- Windfarm Site
- Offshore Development Area

Client:	Project:
Offshore Wind Ltd.	White Cross Offshore Windfarm

Title:

Project Study Area

Figure: 1 | Drawing No: PC2978-RHD-ZZ-XX-DR-Z-0478

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	03/03/2023	AB	GSP	A3	1:350,000
P01	19/12/2022	AB	GSP	A3	1:350,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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1.2.3 Approach

13. This WSI (Offshore) has been prepared in accordance with 'Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects' (The Crown Estate, 2021). A WSI:

- Sets out the roles and respective responsibilities of the project team, contractors, retained archaeologist and archaeological contractor(s) and formal lines of communication between the parties and with archaeological curator(s) (**Section 1.5**)
- Outlines the known and potential archaeological receptors that could be impacted by the scheme (**Section 1.2** and **Section 1.3**)
- Outlines the agreed mitigation and archaeological actions that are to take place in various circumstances (**Section 1.4.2**)
- Sets out the importance of research frameworks in setting objectives that are delivered through realisation of the work (see below)
- Provides summarised details on methodologies for these archaeological actions, which will be clarified in more detail in subsequent activity-specific method statements (**Section 1.6** and **Section 1.6.3**).

14. As an 'Outline' WSI, this document has been developed as part of the EIA process to set out the framework for the assumed mitigation that will be submitted alongside the application. Prior to further surveys taking place for White Cross, a pre-commencement survey Draft WSI (in accordance with this Outline WSI) will be developed if required. This will be done in consultation with the archaeological curators (see **Section 1.5**) and agreed with the Regulator to ensure archaeological objectives are considered.

15. A final, agreed WSI (in accordance with the pre-commencement survey Draft WSI) will set out the overarching approach to survey and archaeological investigations. This would be agreed with the archaeological curators and the Regulator prior to pre-construction works commencing.

16. The Crown Estate document sets out high level guidance on a range of archaeological methodologies that may be required in the production of WSIs. For each individual work package set out in **Section 1.6** and **Section 1.6.3**, account has been taken of these standard, high level methodologies. Each section sets out how they are relevant to the delivery of White Cross and explains any necessary adaptations and amendments for agreement with Historic England.

17. Specific archaeological objectives will be established for all surveys and work packages on a case-by-case basis. This will be achieved with reference to all relevant project datasets (and associated archaeological and geoarchaeological interpretations) and to

other relevant research and investigations with specific reference to established research agendas. These include (but not limited to):

- Identifying and Protecting Palaeolithic Remains (English Heritage, 1998)
- People and the Sea: A Maritime Research Agenda for England (Ransley et al, 2013)
- South West Archaeological Research Framework (Somerset County Council, 2012).

18. In demonstrating adherence to industry good practice, this Outline WSI (Offshore) also draws upon available archaeological guidance for offshore development including:

- Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate 2014)
- Chartered Institute for Archaeologists (CIfA) Code of Practice and Standards and Guidance (CIfA 2014a, 2014b, 2014c, 2014d)
- Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Plets R., Dix J. and Bates R. 2013)
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather 2011)
- Historic Environment Guidance for the Offshore Renewable Energy Sector Guidance (Wessex Archaeology 2007)
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC) 2006).

1.3 Baseline Summary of Offshore Archaeology and Cultural Heritage

1.3.1 Summary of Assessment to Date

19. The baseline environment assessment is presented in **Section 16.4** of **Chapter 16: Marine Archaeology and Cultural Heritage** of the White Cross Environmental Statement (ES). This was informed by the archaeological assessment of site-specific survey data acquired for the project.

20. In order to provide site specific and up to date information on which to base the impact assessment, a geophysical site characterisation survey was conducted across the Offshore Development Area. This was conducted by N-Sea and Ultrabeam Hydrographic (Ultrabeam) between May and August 2022, and consisted of Sidescan Sonar (SSS), Multibeam Bathymetry (MBES), Magnetometer, and Sub-bottom Profiler (SBP) (**Appendix 8.A: Geophysical Results Report** of **Chapter 8** of the **ES**).

21. The survey achieved 100% SSS and MBES coverage of the Offshore Development Area, with TVG and SBP collected along each of the survey lines, the TVG separation was 1.5m, and the maximum altitude was 8m.

- The data were collected to a specification appropriate to achieve the following interpretation requirements:
- Sidescan Sonar: ensonification of anomalies > 0.5m
- Multibeam Bathymetry: ensonification of anomalies > 1.0m offshore and 0.2m nearshore
- Magnetometer (Transverse Gradiometer (TVG)): 5nT threshold for anomaly picking
- Sub-bottom Profiler (SBP): penetration of up to 16m was achieved
- Single Channel Sparker (SCS): penetration of up to 60m was achieved.

22. Further details of the collection of geophysical data is provided in **Section 16.3.8** of **Chapter 16: Marine Archaeology and Cultural Heritage** of the White Cross ES.

23. MSDS Marine were appointed to undertake the archaeological assessment of the acquired geophysical survey data. MSDS Marine are a specialist marine and coastal contractor and are a CIfA registered organisation. MSDS Marine undertook a detailed assessment of the SSS, MBES and Mag data.

24. The assessment of SBP data has been undertaken in two phases as follow:

- Phase 1 comprises review of the SBP geophysical interpretative report prepared by N-Sea to inform the engineering design of the project. The report was reviewed by MSDS Marine to understand the wider geology and stratigraphy and to identify units of potential archaeological interest. A sub-set of SBP profiles were reviewed to corroborate the findings in the N-Sea geophysical interpretative report. Horizon maps created by N-Sea were plotted in relation to wider palaeolandscape features to understand the context of the units of archaeological interest.

- Phase 2 comprises further bespoke SBP interpretation of units of archaeological interest to resolve localised variations and identify deposits of potential archaeological interest that may be targeted in future geotechnical surveys. This information is ongoing and will be presented in a separate report to Appendix 16.A which will be available post-submission and will inform archaeological input into future geotechnical investigations.

25. In addition, a desk-based assessment was undertaken for the ES which was informed by the sources listed in **Table 1.1** and incorporated the results of the archaeological assessment of the site-specific survey data.

Table 1.1 Other Available Data and Information Sources.

Data set	Spatial coverage	Notes
The United Kingdom Hydrographic Office (UKHO) data for charted wrecks and obstructions	UK	Data for all known charted wrecks and obstructions
The National Heritage List for England (NHLE) maintained by Historic England	England	Official, up to date, register of all nationally protected historic buildings and sites in England - listed buildings, scheduled monuments, protected wrecks, registered parks and gardens, and battlefields (including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973)
Records held by Historic England, formally part of the National Record of the Historic Environment (NRHE) dataset	England (to 12nm limit)	Records of heritage assets and documented losses of wrecks and aircraft.
Devon Historic Environment Record (DHER)	Devon County	Historic Environment Records (HERs) are information services that provide access to comprehensive and dynamic resources relating to the archaeology and historic built environment of a defined geographic area. HERs contain details on local archaeological sites and finds, historic buildings and historic landscapes and are regularly updated.
The Coastal and Intertidal Zone Archaeology Network (CITiZAN)	UK	CITiZAN, the Coastal and Intertidal Zone Archaeological Network, highlights the threat of coastal erosion to a wealth of foreshore and intertidal sites. These archaeological features encompass a huge time span, many are of considerable local or national significance

Data set	Spatial coverage	Notes
Relevant mapping including Admiralty Charts, historic maps and Ordnance Survey	UK	Information relation to previously charted wrecks, seabed topography and topography
Existing archaeological studies and published sources	Irish Sea/Celtic Sea	Background information on the archaeology of the Celtic Sea, including the results of nearby offshore windfarm projects including the Atlantic Array offshore wind farm.
West Coast Palaeolandscapes Survey	West Coast of England	Study mapping submerged landscapes contained within an area of the Irish Sea and Bristol Channel using wide variety of seismic data sources. of the Irish Sea using wide variety of seismic data sources.

26. A site walkover survey was also undertaken in August 2022 to determine whether any heritage assets survive above ground within the intertidal zone (**Section 1.3.4**).

1.3.2 Seabed Prehistory

27. There are no known seabed prehistory sites within the study area.

28. The Offshore Development Area is located within an area of high prehistoric archaeological potential, within which, archaeological and palaeoenvironmental evidence related to human occupation of the UK may be preserved. The Offshore Area of Search has been shaped by three major glaciations over the past 970,000 years, leading to lower sea levels and, consequently, there have been long periods when these areas, and the wider Bristol Channel region, were exposed as land suitable for hominin occupation (Wenban-Smith, 2002).

29. The West Coast Palaeolandscapes Survey has mapped parts of the Celtic Sea and all of the Bristol Channel revealing a series of lakes, floodplains, river channels and seabed features (Fitch and Gaffney, 2011). Sometime after 16,000. BC Britain was cut off from Ireland with some of the study area, largely the cable route, remaining dry land until c.7000 BC.

30. By the Mesolithic period the Bristol Channel changed drastically, with sea level rise causing the coastline to retreat further inland (Fitch and Gaffney, 2011). Lundy remained connected to the mainland at this time by a small promontory and was likely a centre for Mesolithic activity (Schofield, 1994). The scheduled monument Prehistoric

settlement at North End, Lundy (List entry: 1016029) supports this with occupation evidence dating to 8000 BC.

31. The Devon HER records extensive evidence of Mesolithic occupation within the coastal regions of the study area namely the intertidal zone at Westward Ho!, around Croyde and around Northam. The records largely comprise large amounts of Mesolithic flints with Mesolithic finds at Westward Ho! including peat deposits, middens, flints, a whale bone harpoon, and a submerged forest.

32. By the Neolithic period, the coastline around the UK was largely as it is today. As such, evidence from the Neolithic onwards is likely to be of an increasingly maritime nature.

33. An archaeological review of the geophysical survey assessments and ground model covering the Offshore Development Area was conducted by MSDS Marine. This was done to inform the undertaking of the palaeolandscape assessment and potential for previously undiscovered submerged prehistoric sites to be present. The full assessment is presented as **Appendix 16.A** of the **ES** with a summary also provided in **Section 16.4.1** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES**.

34. In short, there is limited archaeological potential from the Quaternary Unit E. Unit E has the potential to hold evidence of glacial sediments (associated with the Western Irish Sea or Cardigan Bay Formations), Pleistocene and Holocene fluvial and related features, Holocene organic sediments laid down prior to marine inundation by c.5k BP (Before Present) and Marine sediments post-dating the Holocene marine transgression. Unit E is presented on **Figure 31** of **Appendix 16.A** of **Chapter 16 Marine Archaeology and Cultural Heritage of the ES**.

35. With the exception of the marine sediments, the potential for other deposits to occur is likely focused in areas where Unit E is at its thickest. The thin layer of Unit E which appears to be present across much of the Offshore Development Area is thought to represent marine deposits. The potential for fluvial deposits or sediments laid down under sub-aerial conditions in association with the Surface Sands Formation and other coastal formations indicates some archaeological and palaeoenvironmental potential may be associated with Unit E. This Unit should therefore be investigated further, focused on the areas where it is thickest as intervening areas are interpreted as modern marine sediments.

1.3.3 Maritime and Aviation Archaeology

36. There are no known sites within the study area that are subject to statutory protection from the Protection of Wrecks Act 1973, the Protection of Military Remains Act 1986 or the Ancient Monuments and Archaeological Areas Act 1979.

1.3.3.1 Seabed Features

37. SSS, MBES, and magnetometer data interpreted by MSDS Marine has demonstrated the presence of several seabed features which have been identified at varying levels of archaeological potential. Seabed features are discriminated by MSDS Marine in accordance with the definitions set out in **Table 1.2.**

Table 1.2 MSDS Marine Criteria for discriminating the relevance of identified seabed features with the study area

Potential	Criteria
High	An anomaly almost certainly of anthropogenic origin and with a high potential of being of archaeological significance. High potential anomalies tend to be the remains of wrecks, the suspected remains of wrecks, or known structures of archaeological significance.
Medium	An anomaly believed to be of anthropogenic origin but that would require further investigation to establish its archaeological significance. Examples may include larger unidentifiable debris or clusters of debris, unidentifiable structures, or significant magnetic anomalies.
Low	An anomaly potentially of anthropogenic origin but that is unlikely to be of archaeological significance. Examples may include discarded modern debris such as rope, cable, chain, or fishing gear; small, isolated anomalies with no wider context; or small boulder-like features with associated magnetometer readings.

38. All full assessment of seabed features is presented in **Appendix 16.A** of the **ES** with a detailed summary provided in **Section 16.4.2** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES**. The distribution of these features is presented on **Figures 16.2, 16.3, 16.4** and **16.5** of the same chapter.

39. In short, A total of 58 seabed features were identified within the Offshore Development Area as being of archaeological potential. 21 of these were located in the Windfarm Site, while the remainder are located within the Offshore Export Cable Corridor. The distribution of these anomalies is presented on **Figure 16.2** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the Environmental Statement and in **Table 1.3**.

Table 1.3 Distribution of seabed features of archaeological potential

Potential	Windfarm Site	Offshore Export Cable Corridor	Total
High	0	2	2
Medium	0	3	3
Low	21	32	55
Total	21	37	58

40. Of the 58 anomalies two have been interpreted as being of high archaeological potential, while three have been interpreted as medium archaeological potential.

41. The two high potential anomalies have been identified as a wreck (WC22_0063) associated with UKHO record 72153 potential wreck and a potential wreck (WC22_0043) with no associated UKHO or Historic Environment records. The medium anomalies have been interpreted as a potential wreck (WS22_0045), potential debris (WC22_0046) and a potential geological feature (WC22_0041).

1.3.3.2 Magnetic Anomalies

42. Within the Offshore Development Area there are 481 magnetic anomalies ranging between ranging between 5 nT and 373 nT. Of these six relate to archaeological anomalies discussed above, while 36 relate to know infrastructure. The distribution of these magnetic anomalies is presented **Figure 16.6** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES** and in **Table 1.4**.

Table 1.4 Distribution of magnetic anomalies

Intensity (nT)	Windfarm Site	Offshore Cable Corridor	Total
5 to 50	52	324	376
50 to 100	0	33	33
100 to 200	0	22	22
200 +	0	8	8
Total	52	387	439

43. All full assessment of seabed features is presented in **Appendix 16.A** of the **ES** with a detailed summary provided in **Section 16.4.3** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES**. The two concentrations of magnetic anomalies are noted within the nearshore area of the Offshore Export Cable Corridor and from c.35km from the Windfarms Site to c.20km from shore. The magnetic anomalies within the Offshore Cable Corridor are located in an area of rocky outcropping, so are likely to be a result of snagging.

44. The nearshore magnetic anomalies are likely to be associated with the US Assault Training Centre (MDV57283). This is the only Historic Environment record within the intertidal zone. Should any of these be associated with loss of life, they could fall under

the Protection of Military Remains Act 1986, however, no loss of life is known to have occurred at Saunton Sands. Loss of life is associated with the American Army's Assault Training Centre as 98 US military personnel were killed during training exercises; however, this occurred a Woolacombe

1.3.3.3 UKHO Records, HER and Maritime Records Maintained by Historic England

45. Within the Offshore Development Area there are five UKHO records (see **Figure 16.7** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES**), two within the Windfarm Site, two within the Offshore Cable Corridor and one in the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge). Three of the records are recorded as foul ground, while 72153 is wreck WC22_0063. The one located in Taw Estuary Crossing (12201) is recorded as 'dead' meaning it has not been recorded by repeated surveys so is not considered to be located at its recorded position.

46. Similarly, there are 42 maritime records maintained by Historic England within the Offshore Export Cable Corridor (see **Table 1.5** and **Figure 16.8** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES**). These are all reported losses at named locations. Named locations are arbitrary positions, the point of which is deemed to be closest to the position of a wrecking event. The positions may have originated from several sources, including documentary records, and accounts of sinking (either from the crew or third parties). It is usual for several records to be assigned to same location.

Table 1.5 Historic England Reported Losses

ID	Name	Description	Record Type
1342752	Whitley Mk V Bd359	British Bomber, 1943	Reported Loss
878070	Woolton	British Craft, 1785	Reported Loss
1366146	Le Busse	1724 wreck of Dutch or German craft which stranded near Bideford while bound from Bordeaux for the Netherlands and/or Lubeck. Constructed of wood, she was a sailing vessel.	Reported Loss
1383047	Jesus	1541 wreck of English cargo vessel which was lost in Barnstaple Bay en route from Andalucía to Bristol with sack wine (sherry); a wooden sailing vessel.	Reported Loss
877412	Martha	British Craft, 1744	Reported Loss
1062484	Seaflower	British Cargo Vessel, 1768	Reported Loss
878069	Sandwich	British Craft, 1785	Reported Loss
1069911	Kate	English Cutter, 1895	Reported Loss

ID	Name	Description	Record Type
1317671	N/A	1751 wreck of part of craft which stranded in Barnstaple Bay; a wooden sailing vessel.	Reported Loss
878111	N/A	Craft, 1823	Reported Loss
877424	Charles	British Cargo Vessel, 1757	Reported Loss
1069881	Aura	Welsh Cutter, 1890	Reported Loss
878199	Henry Patterson	Irish Brigantine, 1854	Reported Loss
880740	Model	English Ketch, 1911	Reported Loss
1062495	Kitty	1822 wreck of an English cargo vessel which foundered in Barnstaple Bay, while en route from Neath to Bideford with a cargo of culm. Built of wood, she was a sail-driven vessel.	Reported Loss
1069932	Veronica	Welsh Cargo Vessel, 1900	Reported Loss
1069871	Hero	Welsh Schooner, 1889	Reported Loss
1518118	N/A	1977 wreck of British sand barge which foundered opposite the beacon at the entrance to the River Taw. The possible remains of this vessel are recorded as 1518119.	Reported Loss
880373	Pride of The West	English Schooner, 1869	Reported Loss
1346031	Amphitrite	1819 wreck of English smack which was wrecked in Barnstaple Bay en route from San Miguel to Bristol and/or Newcastle-upon-Tyne. Laden with oranges, she was a wooden sailing vessel.	Reported Loss
1318218	Molly	Craft, 1752	Reported Loss
877419	Dieppe Packet	English Packet, 1751	Reported Loss
1069931	Linda	English Ketch, 1900	Reported Loss
1340453	Hero	1807 wreck of a vessel, lost in Barnstaple Bay while en route from Bridgewater to Plymouth.	Reported Loss
878108	Bee	1821 wreck of an English craft which foundered in Barnstaple Bay. Built of wood, she was a sail-driven vessel. The crew were drowned, but the sails and rigging were salvaged from the wreck.	Reported Loss
1069897	Emperor	English Ketch, 1893	Reported Loss
1069916	Active	English Sloop, 1896	Reported Loss
1338259	N/A	Sloop, 1799	Reported Loss
1395529	Ceres	1936 wreck of an English ketch which foundered in Barnstaple Bay after she leaked. This sailing vessel was built in 1811 and carried a cargo of slag.	Reported Loss

ID	Name	Description	Record Type
1230791	Mary And Anne	Cargo Vessel, 1750	Reported Loss
1359864	John And Mary	1825 wreck of a brig, stranded in Barnstaple Bay during a gale. Built of wood, she was a sail-driven vessel.	Reported Loss
1047842	N/A	1767 wreck of Dutch cargo vessel which was lost in Barnstaple Bay en route from Surinam for Amsterdam. The trajectory of her voyage, which had originated in Angola, suggests that this particular ship was involved in the slave trade.	Reported Loss
1062494	N/A	1822 wreck of brig which foundered in Bideford Bay; a wooden sailing vessel.	Reported Loss
880727	Thistlemor	English Cargo Vessel, 1909	Reported Loss
880803	Chrysolite	English Schooner, 1918	Reported Loss
1062482	Union	1753 wreck of English craft which stranded near Barnstaple en route from Cork for Bristol. Constructed of wood, she was a sailing vessel.	Reported Loss
1364459	Vestal	British Craft, 1838	Reported Loss
878115	Hawke	1829 wreck of an English craft, lost on the north tail of Appledore Bar. Built of wood, she was a sailing-vessel. The crew were drowned.	Reported Loss
1069930	Joseph And Thomas	English Ketch, 1899	Reported Loss
880717	Mary	English Smack, 1908	Reported Loss
1518044	Monte Gurugu	Spanish steam cargo vessel which sank in 1949 after it began to leak due to severe weather, exploded and split into before sinking c.12m NNW of Hartland Point and 8.5m SE of Rat Island	Reported Loss
1094903	City Of Exeter	1887 wreck of English cargo vessel which foundered 4 miles SW of Lundy while en route from Cardiff to St-Nazaire with coal. Built in 1870, she was an iron screw steamer.	Reported Loss

47. Whilst the positions, and extents of the polygons, are reviewed within the geophysical datasets typically no remains are expected at the given locations. The presentation of named locations serves to characterise the potential within the area for remains of wrecks, and/or, aircraft to be present on the seabed.

48. Additionally, within the Offshore Export Cable Corridor, there is one HER record while. This is presented on **Figure 16.9** of **Chapter 16 Marine Archaeology and Cultural**

Heritage of the **ES** and comprises MDV57283 Braunton Areas A, B, C and D of US Assault Training Centre (MDV73990).

49. The Assault Training Centre covered eleven separate areas. The brief of the Assault Training Centre was to train combat units under realistic battle conditions in preparation for D-Day. This included overcoming on and offshore obstacles, reduction of fortifications, repulsing of counter attacks and establishing of the beach head.

50. Facilities included a full-scale German-type 'Hedgehog' and full-scale obstacles and individual fortifications of various types sited along the sheltered beaches (including Croyde and Woolacombe). Also, mock-ups of various types of landing craft, obstacle courses, combat ranges and observation towers. Accommodation was in tent cities at Braunton and Croyde and at the hutted Braunton Camp.

51. Area A covered the southern part of Braunton Burrows with constructions including mock-up areas, an assembly area and five Estuary Beaches. Area B covered the southwestern part of Braunton Burrows with constructions including engineer obstacle courses, pillboxes, demolition range and two Estuary Beaches (Bass, 2005).

52. Area C spanned the central part of Braunton Burrows with the training ranges concentrated in the coastal strip with pillbox-sized concrete structures running parallel to the shore. Constructions included engineer and infantry demolition ranges, rocket range and Saunton Blue and Yellow Beaches as well as part of Estuary Red Beach.

53. Area D at the northern end of Braunton Burrows contained the greatest concentration and diversity of assault ranges and training constructions. The majority were built on Saunton Golf Course and were subsequently demolished or buried. Constructions included a flamethrower range, tank trap, target pits, radio towers, 'Hedgehog', pillboxes and Saunton Green, Yellow and Red Beaches (Bass, 2005).

1.3.4 Aviation remains

54. There are no known wrecks or aviation crash sites protected under the Protection of Military Remains Act 1986.

55. A single Historic England record for an aircraft is located within the Offshore Cable Corridor. This is the reported loss at a named location for an Armstrong Whitworth Whitley Mk. V night bomber (1342752) which was ditched off Barnstaple in 1943 due to bad weather. A named location does not signify wrecked remains but is an approximate location of where the crash was thought to have happened.

56. No anomalies characteristic of aviation remains were identified by MSDS Marine within the geophysical data, however, should aviation remains be located within the windfarm these would likely be associated with WWI and WWII and would be afforded protection under the Protection of Military Remains Act 1986.

1.3.5 Intertidal Archaeology

57. Within the intertidal zone there are no designated heritage assets and 14 non-designated assets. One falls within the Offshore Development Area, while the remainder are located within the Taw Estuary Crossing (between MHWS on the northern edge to MHWS on the southern edge). The distribution of these is presented in **Figure 16.9** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES** and presented in **Table 1.6**.

Table 1.6 Summary of HER Records in the Intertidal Zone

MonUID	Name	Summary
MDV102605	Possible intertidal structures north of West Yelland Marsh	Three linear features are visible in the intertidal zone on aerial photographs taken in 2010. They may be structural, as their alignment differs to the outcrops of rock in this location but could be a result of vegetation growth relating to modern activity. They are not visible on any earlier available aerial photographs and caution must be exercised in interpretation, but it is possible that they are intertidal structures that have eroded out of the shoreline.
MDV102705	Military training area between Broadsands and Crow Point, Braunton Burrows.	The area between Broadsands and Crow Neck was used for military training in the Second Word War; the 'embarkation beaches' were a core part of the US training area for Operation Overlord. Numerous structures, pits and tracks are visible on aerial photograph taken in the 1950s, and very few manifest in a recognisable form above the ground surface in 2010. They are described in greater detail in individual records. The site continued in military use and later structures are visible on aerial photographs into the 1950s.
MDV102712	Craters on the foreshore at Broadsands	Several craters are visible as earthworks on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord. The earthworks are visible in 1946 but have probably been levelled by water action since.
MDV102712	Craters on the foreshore at Broadsands	Several craters are visible as earthworks on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.

MonUID	Name	Summary
MDV102714	Two possible minefields on the foreshore at Broadsands	Two groups of craters in a rough grid pattern are visible as circular earthwork pits on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV102714	Two possible minefields on the foreshore at Broadsands	Two groups of craters in a rough grid pattern are visible as circular earthwork pits on aerial photographs taken in 1945. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV102727	Possible anti-tank obstacles at Broadsands	Probable concrete anti-tank obstacles are visible as structures on aerial photographs in the 1940s, and form part of the Second World War U.S. military training site. Examination of aerial photographs from 2010 suggests that there is a row of features here.
MDV102728	Anti-tank obstacles at Broadsands	Probable concrete anti-tank obstacles are visible as a row of structures on aerial photographs in the 1940s, and form part of the Second World War U.S. military training site. They are not visible on later available aerial photographs and are likely to have been removed or covered by sand.
MDV102729	Two scaffold structures on Broadsands	Two scaffold structures are visible on aerial photographs in the 1940s. They are sited next to a channel and likely to have been used during military training, perhaps for U.S. troops to practice descent into landing craft during the latter part of Second World War.
MDV102940	Earthworks from mines or military training on the foreshore at Broadsands	An extensive area of linear earthworks is visible on aerial photographs taken between 1945 and 1946. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV102940	Earthworks from mines or military training on the foreshore at Broadsands	An extensive area of linear earthworks is visible on aerial photographs taken between 1945 and 1946. They are part of the Second World War U.S. Army military training area, associated with exercises undertaken on the foreshore to prepare for Operation Overlord.
MDV57283	Braunton Areas A, B, C and D of US Assault Training Centre	Braunton Areas A, B, C and D of US World War II Assault Training Centre in North Devon.
MDV102619	Anti-glider poles across	A large number of pale upright poles across Braunton Marshes are visible on oblique aerial photographs between

MonUID	Name	Summary
	Horsey Island and Braunton Marshes	1944 and 1945. They are interpreted as early Second World War anti-glider defences. Some infield poles may have been removed by 1944, and the remainder removed by 1946.
MDV102619	Anti-glider poles across Horsey Island and Braunton Marshes	A large number of pale upright poles across Braunton Marshes are visible on oblique aerial photographs between 1944 and 1945. They are interpreted as early Second World War anti-glider defences. Some infield poles may have been removed by 1944, and the remainder removed by 1946.

58. The records presented within **Table 1.6** are all related to MDV57283 Braunton Areas A, B, C and D of US Assault Training Centre which is summarised in **Section 1.3.3.3**. after the war the military infrastructure was demolished and bulldozed into the sea. As such, any remains will likely be fragmentary in nature.

59. Of the 439 magnetic anomalies discussed above in **Section 1.3.3.2**, one of these is located within the intertidal zone. This is summarised in **Table 1.7** below. An additional, ten are located outside the Offshore Export Cable Corridor. These and WC22M_1029 are likely to be associated with the US Assault Training Centre (MDV57283). Should any of these be associated with loss of life, they could fall under the Protection of Military Remains Act 1986, however, no loss of life is known to have occurred at Saunton Sands.

Table 1.7 Magnetic anomalies within the intertidal zone

ID	Amplitude	POINT_X	POINT_Y
WC22M_1029	16	414032.8	5663298.9

60. Additionally, as discussed above in **Section 1.3.2**, the Devon HER records extensive evidence of Mesolithic occupation within the wider coastal regions of the Offshore Development Area namely the intertidal zone at Westward Ho!. around Croyde and

around Northam. Neolithic and Bronze Age finds, largely comprising flint scatters, have also been found at the locations above. As such, there is potential for prehistoric remains to be present within the intertidal zone. However, if present, these are likely to be isolated finds as the construction and subsequent the demolition of the US Assault Training Centre will have had a negative impact on any archaeological sites, possibly resulting in their removal.

1.4 Impact Assessment

1.4.1 Potential Impacts

61. The ES for White Cross identifies the potential for direct and indirect impacts upon offshore and intertidal archaeology and cultural heritage. These include both direct and indirect physical changes and non-physical changes to the setting of heritage assets or historic seascape character.

62. Direct impacts to heritage assets below MHWS, either proud of the seabed or buried within it, or within intertidal deposits, may result in damage to, or destruction of, archaeological material.

63. Impacts may also damage the relationship between the material and the wider environment. Direct impacts may occur where heritage assets are located within the footprint of the Project where construction activities will take place. These include:

- Seabed preparation (including Unexploded Ordnance (UXO) and boulder clearance, where required)
- Installation of wind turbine moorings and foundations for OSP
- Installation of offshore cabling (inter array and platform link)
- Installation of the offshore cabling at landfall
- Installation of cabling crossing the River Taw
- Seabed contact by legs of jack-up vessels

64. Indirect impacts may occur where the Project:

- Causes changes to the hydrodynamic and sedimentary process regimes
- Affect heritage assets by altering erosion and accretion patterns
- Altering tidal currents which in turn may affect the stability of nearby morphological and archaeological features.

65. Such impacts may occur if buried heritage assets become exposed to marine processes, due to increased wave or tidal action, for example. This will result in a faster rate of deterioration than heritage assets afforded protection by sediment cover.

Conversely, increased sedimentation could result in an exposed site becoming buried thus affording it protection and may be considered a beneficial impact.

66. The setting of a heritage asset is described as the surroundings in which a heritage asset is experienced (Historic England 2017). Elements of setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral. Historic England's guidance on setting notes how the setting of buried heritage assets may not be readily appreciated by a casual observer but retain a presence in the landscape.

67. For offshore assets, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer' and their 'setting' does not form a key part of their significance. However, offshore heritage assets may still be located physically within a 'setting' of relevance to their historical and archaeological interest. This may be of relevance to the historic seascape character of a study area. It is, therefore, essential that this character is considered in terms of ability to accommodate change and how perception of character might be changes by a proposed project.

1.4.2 Summary Mitigation

68. This section outlines the embedded mitigation relevant to the Marine Archaeology and Cultural Heritage assessment, which has been incorporated into the design of the projects. A summary of embedded mitigation is presented in **Table 1.8**.

Table 1.8 Summary of Embedded Mitigation

Parameter	Mitigation measure	Description
Known heritage assets	Archaeological Exclusion Zones (AEZs) (**Section 1.7.1**)	For archaeologically significant anomalies that are clearly identifiable in the survey data and where the extents are largely known, AEZs will be employed. AEZs will remain for the life of the project or until ground truthing or higher resolution data determines a reduction in potential, significance, or extents.
	Temporary Archaeological Exclusion Zones (TAEZs) (see **Section 1.7.1**)	Where an anomaly is not visible in the survey data but likely to exist on the seabed at a known position or where the extents of an anomaly are not fully identifiable, TAEZs will be employed. TAEZs have been identified as highly likely to be altered following higher resolution or

Parameter	Mitigation measure	Description
		full coverage data assessment, however, they will remain in place until alterations have been formally agreed.
Potential heritage assets (maritime or aviation)	Avoidance by micro-siting of design following the acquisition of high-resolution geophysical data, to be acquired post-consent.	Avoidance where possible of identified anomalies.
		Avoidance by micro-siting where possible of previously recorded sites that have not been seen in the geophysical data and at which the presence of surviving material is considered unlikely
		Further investigation of any identified anomalies and previously recorded sites that cannot be avoided by micro-siting of design and the application of either embedded mitigation (avoidance) or additional mitigation (**Section 1.4.2.1**).
	Implementation of a protocol for archaeological discoveries to address unexpected discoveries which might be encountered during planned activities	In order to account for unexpected discoveries of archaeological material during construction, operation and decommissioning, a formal protocol will be required. It is recommended that if any objects of possible archaeological interest are encountered, that they should be reported using a protocol (**Section 1.10**).

69. Additional mitigation measures which will be included in the WSI are as follows:

- Watching briefs where seabed material is brought to the surface, or in the intertidal zone if open and cut trenching is used for cable installation
- Archaeological assessment of further geophysical data to be acquired post-consent (**Section 1.6.1**)
- Geoarchaeological assessment of geotechnical data acquired for the project (**Section 1.6.2**).

1.4.3 Impact Assessment Summary

70. With due consideration of the mitigation and investigation outlined above, potential impacts to archaeology and cultural heritage below MHWS have been assessed as part

of the EIA for White Cross. A summary of the impacts and suggested mitigation is provided in **Table 1.9** below.

Table 1.9 Summary of potential impacts on archaeology and cultural heritage

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Potential mitigation measure	Residual impact	Cumulative residual effect
Construction							
Impact 1: Direct impact to known heritage assets	Wrecks and anomalies of archaeological interest (seabed features identified as high and medium archaeological potential	High	No change due to application of AEZs			No change	No change
	Historic wrecks for which remains have yet been to be identified	High	No change due to application of AEZs				
	Additional anomalies of possible archaeological interest	High	High	Major adverse	Avoid location		
					Additional mitigation to reduce or offset impacts (see **Section 1.4.2**).	Minor adverse	
Impact 2: Direct impact to potential	*In situ* prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment and investigation	No Change	Potential beneficial effect (described but currently not quantifiable, to be

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Potential mitigation measure	Residual impact	Cumulative residual effect
heritage assets					and additional mitigation to avoid, reduce or offset impacts (see **Section 1.4.2**).		realised through regional mapping of accessible data and provision of publicly accessible data post-consent).
	Isolated finds	Medium	Low	Minor adverse	PAD supported by an archaeological watching brief or archaeological monitoring if open and cut trenching is used for the nearshore cable installation.	Minor adverse	Potential beneficial effect (currently not quantifiable, to be realised through the archaeological recording and publication of previously unknown archaeological remains).
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	Low	No Change	N/A	No Change	No Change
Impact 4: Impacts to the setting	Known and potential	Medium to High	Low	No Change	N/A	No Change	No Change

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Potential mitigation measure	Residual impact	Cumulative residual effect
of heritage assets	heritage assets						
Operation and Maintenance							
Impact 1: Direct impact to known heritage assets	Known heritage assets	Medium to High	No Change due to application of AEZs			No Change	No Change
Impact 2: Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment of geophysical and geotechnical data (see **Section 1.4.2**).	Minor adverse	Potential beneficial effect (described but currently not quantifiable, to be realised through regional mapping of accessible data and provision of publicly accessible data post-consent)
	Isolated finds	Medium	Low	Minor adverse	PAD		
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No Change. **Chapter 8: Marine Geology, Oceanography and Physical Processes** concludes there would be no significant effect resulting from the project.			No Change	No Change
Impact 4: Impacts to the setting	Known and potential heritage assets	Medium to High	Negligible	Minor adverse	N/A	Minor adverse	Minor adverse

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Potential mitigation measure	Residual impact	Cumulative residual effect
of heritage assets							
Decommissioning							
Impact 1: Direct impact to known heritage assets	Known heritage assets	Medium to High	No Change due to application of AEZs			No Change	No Change
Impact 2: Direct impact to potential heritage assets	*In situ* prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment of geophysical and geotechnical data (see **Section 1.4.2**).	Minor adverse	Potential beneficial effect (described but currently not quantifiable, to be realised through regional mapping of accessible data and provision of publicly accessible data post-consent)
	Isolated finds	Medium	Low	Minor adverse	PAD		
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No Change. Effects comparable to those assessed for Construction Impact 1.			No Change	No Change
Impact 4: Impacts to the setting	Known and potential heritage assets	Medium to High	No Change	No Change	N/A		

Potential impact	Receptor	Cultural Heritage Importance	Magnitude of impact	Significance of effect	Potential mitigation measure	Residual impact	Cumulative residual effect
of heritage assets							

1.5 Roles, Responsibilities and Communications

71. The overall responsibility for the implementation of the final Offshore WSI will be with the project team (or subsequent project owner). The project team will ensure that its agents and contractors are contractually bound to adhere to the terms of the final Offshore WSI, including the implementation of the Protocol for Archaeological Discoveries (**Section 1.10**).

72. For each phase of archaeological works the project team or their agents will obtain the services of specialised archaeological contractors with the required expertise and experience to undertake the necessary archaeological works as and when required.

73. The project team will also retain the services of a suitably qualified and experienced archaeological contractor as the 'retained archaeologist'. The retained archaeologist will oversee and ensure the successful implementation of the final Offshore WSI and contractual commitments relating to archaeology.

74. The responsibilities of the retained archaeologist are as follows:

- Producing, reviewing, and updating this WSI after consultation with the project team, regulators Marine Management Organisation (MMO) and the curators (Historic England) to produce and agree a final Offshore WSI
- Advising the project team of their responsibilities in the implementation of the final Offshore WSI and the PAD
- Compiling, agreeing, and issuing method statements to archaeological contractors to adhere to, after consultation with the project team, regulators and curators
- Advising the project team on necessary interactions with the regulators, curators and other third parties
- Procuring and liaising with specialist archaeological contractors and monitoring the works undertaken by them
- Monitoring the preparation and submission of archaeological reports as required and making them available to the regulators and curators for review and approval
- Advising the project team on any final requirements and arrangements for further analysis, archive deposition, publication, and popular dissemination.

75. All agents and contractors engaged by the project team will:

- Familiarise themselves with the requirements of the final Offshore WSI and make it available to their staff
- Explaining the requirements of the final Offshore WSI and the need for strict adherence to it

- Familiarise themselves with the protocol for archaeological discoveries (**Section 1.10**) and ensure its implementation
- Ensure adherence to the protocol by staff, ensuring staff awareness protocol and making staff available for training through toolbox talks, as necessary
- Assist and afford access to archaeological contractors as advised by the project team and the retained archaeologist
- Inform the retained archaeologist and the archaeological contractors of any environmental or health and safety constraints which they may be aware that relate to the archaeologist's activities on site.

76. The specific responsibilities of the specialist archaeological contractors during subsequent phases of work will be set out in separate specific method statements relevant to each package of works.

77. The regulatory body responsible for enforcing conditions is the MMO. The regulatory body responsible for enforcing the implementation of requirements is the relevant Planning Authority in which the works are situated. In this instance Devon County Council (DCC).

78. The archaeological curator for heritage matters offshore (below MHWS) is Historic England. The archaeological curator responsible for heritage matters onshore (above MLWS and including the intertidal zone) is Devon County Council Historic Environment Team (DCC HET) (Development Control and Planning).

79. Prior to and during any geoarchaeological recording, assessment and analysis, consultation with the Historic England Regional Science Advisor for the Southwest of England is also recommended to agree on the suitability of the approach.

1.6 Methodology for Further Site Investigation

1.6.1 Marine Geophysical Investigations

80. The geophysical data assessed by MSDS Marine to inform the ES chapter has been summarised in **Section 1.3.1**. The geophysical data assessment carried out in support of the ES is considered to provide an accurate characterisation of the archaeological potential of the offshore project areas, appropriate to the purposes of EIA.

81. Prior to the acquisition of pre-construction geophysical data, it is recommended that a review of previous assessments is undertaken by a suitably qualified and experienced archaeological contractor. This will clarify the suitability of existing data and will include the identification of any data gaps. This will help to inform the acquisition of pre-construction geophysical data.

82. At the time of writing MSDS Marine are currently undertaking a detailed assessment of SBP data, as discussed is **Section 1.3.1**, which will inform archaeological input into future geotechnical investigations. This will be available post ES submission.

83. As part of the review, the archaeological contractor should identify specific objectives to inform the scope of further survey work. The acquisition and assessment of geophysical data will be carried out in accordance with good practice as set out in The Crown Estate (2021) guidance and with consideration of industry guidelines including:

- Plets R., Dix J., and Bates R. (2013) Marine Geophysical Data Acquisition, Processing, and Interpretation – guidance notes (guidance prepared for Historic England, currently under review).

84. As stated in The Crown Estate (2021) guidance, archaeological input will take the form of advice on the following points:

- Available details of sites, features and/or anomalies identified in previous studies
- Archaeological potential of areas where no existing sites, features and/or anomalies are yet known
- Geophysical survey specification including design, geophysical sources, and acquisition methodology
- Requirements for processing and interpreting of resulting data.

85. The specification of any proposed marine geophysical surveys whose primary aim is non-archaeological will be subject to advice from the retained archaeologist. This will ensure that archaeological input is provided at the planning stage and will enable archaeological considerations to be accounted for without compromising the primary objective of the survey. This is likely to include the acquisition of SSS, magnetometer, MBES and SBP data. The data will also be sufficiently robust to enable professional archaeological interpretation and analysis.

86. A series of archaeological objectives will be established by the retained archaeologist for the acquisition of pre-construction data. The overarching objectives of the assessment of marine geophysical survey data are to:

- Identify known heritage assets and provide additional detail on the nature and extent of those assets
- Identify previously unidentified seabed features
- Identify buried palaeolandscape features that help to clarify the nature of the submerged prehistoric landscape
- Monitor construction and post-construction effects.

87. Before any geophysical survey takes place, Historic England will be consulted to ensure the suitability of any data to meet the archaeological objectives discussed above and to answer any question which may have arisen through consultation. This will usually be in the form of a method statement (or alternative format for pre-consent surveys undertaken before the creation of the WSI) and will reference existing guidance (i.e.: Plets *et al*. 2013), where appropriate. The method statement will be issued by the project team in advance of any further geophysical survey campaigns that incorporate archaeological objectives. The project team will be responsible for ensuring that all surveys proceed in line with any planned method statement as agreed with Historic England.

88. It should be noted that not all archaeological remains can be identified through geophysical survey, particularly non-ferrous buried remains such as wooden vessels. Specific consideration will, therefore, need to be given to the scope of geophysical surveys which incorporate archaeological objectives. The limitations of geophysical equipment to penetrate deep into mobile sediment where archaeological material, particularly non-ferrous material, could be buried must also be considered.

89. On completion of the geophysical surveys the data will be processed, assessed, and interpreted by an experienced and qualified archaeological contractor. Geophysical survey data, supplied to an agreed technical standard and specification, at the same level of fidelity as recorded, will be interpreted by an archaeological geophysicist with an appropriate level of expertise.

90. Survey data, together with operational reports and trackplots, should be made available in digital formats to the archaeological geophysicist. Where possible full-fidelity data unreduced in range, frequency, sampling, and dimensionality from that recorded must be used as the input for archaeological interpretation. Full detail on the provision of data for assessment is provided in The Crown Estate guidance (The Crown Estate, 2021: 20).

91. The results of further geophysical interpretation will be compiled as an archaeological technical report consistent with the methodologies for reporting set out in The Crown Estate (2021) guidance and will form part of the project archive as set out in **Section 1.9**. The resulting spatial interpretation data, such as the locations and extents of identified features and/or deposits of archaeological potential, will be provided alongside the compiled report in a suitable digital format. These may include Geographic Information System (GIS) shapefiles or CAD (Computer Aided Design) drawing files as agreed with the project team and, where appropriate, the archaeological curator(s).

92. All reports and digital deliverables relating to the assessment should be available for subsequent data interpretations within the life cycle of the project.

1.6.2 Marine Geoarchaeological Investigations

93. No geotechnical data has been acquired for the project to date. As such, the geoarchaeological assessment of all further geotechnical data acquired for the project forms part of the commitment by the project team to additional mitigation and investigations.

94. Detail on the key tasks and associated aims associated with marine geoarchaeological investigation and assessment is set out in The Crown Estate guidance (2021: 24, Table 4). In summary, these tasks include:

- Geoarchaeological input into geotechnical survey planning (to ensure archaeological objectives are considered in the planning stage of the geotechnical survey)
- Review of geotechnical logs (to establish the likely presence and depth of deposits of archaeological interest and provide a broad characterisation of the site)
- Recording of geotechnical cores (to preserve by record individual core or borehole samples of potential archaeological interest)
- Archaeological sampling (to retain adequate samples (quantity and quality) for palaeoenvironmental assessment and analysis and dating)
- Assessment and analysis (to provide a chronostratigraphic and palaeoenvironmental understanding of the area, to inform interpretation of geophysical datasets and ground model).

95. Where geotechnical surveys are undertaken for primarily non-archaeological purposes, advice will be obtained from the retained archaeologist, to ensure that archaeological considerations are accounted for. These surveys, and subsequent geoarchaeological assessment, will be undertaken in accordance with The Crown Estate (2021) guidance and with industry best practice as set out in but not limited to:

- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011)
- Environmental Archaeology: A Guide to the theory and practice of methods, from sampling and recovery to post-excavation (Historic England, 2011)
- Geoarchaeology: using earth sciences to understand the archaeological record (Historic England, 2007).

96. The geotechnical specification will also be informed by any previous stages of work, for example archaeological interpretation of geophysical data. This will allow for previous and additional objectives to be achieved.

97. Borehole/vibrocore locations will be micro-sited to avoid AEZs embedded into the Project design and anomalies of possible archaeological interest, as set out in **Section 1.7.1**. Comparison of the proposed locations will also be made to the positions of previously identified paleogeographic features and deposits of archaeological interest. This will allow for samples to be obtained to inform archaeological interpretation. Provisions will be made for archaeology specific boreholes to be acquired where deposits of archaeological or palaeoenvironmental potential have been identified.

98. During all geotechnical surveys, all operatives will observe the protocol for archaeological discoveries, as set out in **Section 1.10**. Archaeological briefings for survey staff will be carried out prior to the commencement of surveys and the project team will be responsible for ensuring that surveys proceed in accordance with any planned method statement agreed with Historic England.

99. The project team will procure the services of a specialist geoarchaeological contractor to undertake assessment, and, if required, palaeoenvironmental analysis and dating. The primary aim of any geoarchaeological investigations will be the development of a Quaternary (sedimentary) deposit model for the study area.

100. Geotechnical cores, or a representative sample of cores agreed with the archaeological contractor, will be retained undisturbed until a selection of cores for archaeological recording has been made. If the cores cannot be retained then further steps should be taken, such as having an archaeologist present during sampling operations.

101. Georchaeological assessment will be carried out in accordance with existing interpretations of SBP data assessed for White Cross. As set out above in **Section 1.6.1**, any further SBP data acquired for the project will be assessed by a suitably qualified and experienced archaeological contractor. This will allow for the results of the geotechnical surveys to be incorporated with subsequent geoarchaeological assessment.

102. Prior to the commencement of any site investigation campaign a method statement will be prepared by the retained archaeologist and issued by the project team setting out the specific details of the campaign to inform consultation with Historic England regarding the scope and proposed locations of geotechnical work. Historic England will also be consulted on subsequent geoarchaeological assessments commissioned by the project team.

103. As stated in The Crown Estate (2021) guidance, it is also recommended that the method statement includes a timetable and policy for the storage, retention and disposal of offshore samples including access to the geotechnical material, agreed at the outset of the geotechnical investigation, between the project team, Historic England, and any receiving institutions (e.g., the geotechnical testing laboratory).

104. The results of further marine geoarchaeological assessment will be compiled as an archaeological technical report consistent with the methodologies for reporting set out in The Crown Estate (2021) guidance and will form part of the project archive as set out in **Section 1.9**. The final report will integrate the results of review, recording, assessment, analysis, and dating.

105. The report will address the palaeoenvironment, prehistory and any other historical periods as relevant (for example, remains of Roman or medieval settlements now on the seabed) of the area affected by the development, including relevant data generated by desk-based assessment and other field investigations, including geophysical surveys. Where necessary, the geophysical data interpretation may need to be re-assessed depending on the findings of the geotechnical assessment. If warranted, publication of the findings will need to be considered depending on the results of the assessment.

1.6.3 Archaeological Investigation using Divers and / or Remotely Operated Vehicles (ROVs)

106. During detailed post-consent design of White Cross and following the acquisition and assessment of pre-construction geophysical data, it may be possible to micro-site components of the development to avoid AEZs and any other geophysical anomalies of archaeological potential.

107. As stated in The Crown Estate (2021) guidance, this would apply to:

- The moorings of the floating turbine foundations
- The foundations of associated infrastructure (such as the offshore substation platform)
- Cables
- Legs of jack-up crane vessels and/or anchors of other vessels.

108. These footprints will likely correspond to areas which will require As Low as Reasonably Possible (ALARP) certification for risks associated with UXO.

109. However, if it is not possible to avoid geophysical anomalies of archaeological potential, further assessment will need to be undertaken to confirm their character. To

this end, diver and / or ROV investigation will be implemented to further establish the archaeological interest of any seabed features seen in the geophysical data which haven't been previously identified. Ground-truthing may also be required to clarify the extent of a site to alter (enlarge, reduce, move, or remove) AEZs as set out in **Section 1.7.1.**

110. All ground-truthing that may be required to inform the construction of White Cross will be carried out in accordance with good practice as set out in The Crown Estate (2021) guidance.

111. Diver or ROV-based investigations will take place as required. Where the primary objectives are archaeological, operations will be led by archaeologists. However, it may also be possible to combine such surveys with non-archaeological objectives, such as for the identification of UXO.

112. For any diver and/or ROV survey a method statement will be produced by the retained archaeologist (or the archaeological contractor, if appointed). This would be prepared in consultation with the project team and Historic England.

113. To maximise the potential benefits of any proposed diver or ROV surveys, the project team will seek archaeological input at the planning stage of any such works. Any such survey specification will be informed by previous stages of the project, so that archaeological considerations can be considered.

114. The selection of geophysical anomalies requiring ground-truthing/assessment will require consideration of a multitude of factors. There may be a limited number of geophysical anomalies to assess which can easily be incorporated into the scope of planned ROV surveys for UXO. Several geophysical anomalies identified as being of possible archaeological interest may also correspond to anomalies interpreted as potential UXO.

115. There is also potential for a large number of anomalies to be present within the footprint of potential impact, necessitating additional consideration to select an appropriate proportion of anomalies. These may be based on the size of the features or on their location within an area of archaeological potential.

116. The specific approach to the selection of anomalies for ground-truthing will be discussed as part of planning for diver and/or ROV surveys by the project team and retained archaeologist in consultation with Historic England. This will then be captured in the associated method statement.

117. Where the primary objectives of ROV or diver survey are non-archaeological, but may also contribute to archaeological objectives, consideration will be given to having

the retained archaeologist (or the archaeological contractor, if appointed), present during the surveys. For example, when surveying sites of archaeological interest or in areas of high archaeological potential, the presence of an archaeological specialist will help to optimise archaeological results and thereby reduce the need for repeat survey. However, their inclusion would only occur when their input has been considered appropriate and proportionate. This would be agreed through consultation with Historic England.

118. For surveys without an archaeologist on-board, training will be provided (i.e., through a briefing note supported by attendance at planned kick off meetings) to ensure that all operatives are fully informed of the archaeological objectives and requirements for acquiring and delivering data as necessary to understand the archaeological interest of investigated features.

119. All data, including the list of targets, target investigation reports and video footage, will be made available for review by the retained archaeologist (or an archaeological contractor with appropriate expertise). It is recommended that the daily reports and target investigation reports are also provided regularly during survey operations, to ensure timely archaeological advice.

120. If remains of archaeological interest are identified during diver / ROV surveys, where possible, they will be avoided through the implementation of AEZs (see **Section 1.7.1**). Where archaeological remains can't be avoided, if remains are small enough (e.g., anchors and other isolated finds) it may be possible to move these outside the area of impact. However, if large remains such as a wreck are identified, the scheme design may need to be altered.

121. If this is not possible, consultation with Historic England will be undertaken to determine whether an archaeological diver/ROV-based assessment or further mitigation is required. Any further work will require detailed methodologies to be set out in a method statement. This would be agreed with Historic England. Discussions may also need to include the Receiver of Wreck and if aircraft, the Ministry of Defence.

122. The results of diver / ROV assessment will be compiled as an archaeological technical report consistent with the methodologies for reporting set out in The Crown Estate (2021) guidance and will form part of the project archive as set out in **Section 1.9**. The report will identify those sites and/or geophysical anomalies that are potentially of archaeological interest and significance which may warrant further investigation. It will also identify and characterise those sites that are no longer of archaeological interest. These may be removed from the list of AEZs or geophysical anomalies of possible archaeological interest, following consultation with Historic

England. The applicable digital data, including gazetteers and GIS shapefiles, will be updated by the retained archaeologist, and reissued to the project team and relevant contractors.

1.7 Delivery of Mitigation

1.7.1 Archaeological Exclusion Zones (AEZs) and Temporary Archaeological Exclusion Zones

123. AEZs agreed between the project team and Historic England will be the primary means employed to preserve features or remains of archaeological interest or potential archaeological interest in-situ.

124. The principal objective of an AEZ is to prevent damage to or disturbance of a wreck, aircraft or features of potential archaeological interest on the seafloor during activities that may cause damage or disturbance. A requirement for provisions to be made, where feasible, for the in-situ conservation of heritage assets is established through the European Convention on the Protection of the Archaeological Heritage (revised) (Valletta 1992) (Article 4).

125. The implementation, monitoring, and modification of AEZs will take place in accordance with the measures specified in The Crown Estate (2021) guidance.

126. AEZs comprise a boundary placed around a heritage asset or potential assets where no development activities can be undertaken. The AEZ will extend form the boundary of the assets and will include a buffer to ensure that all material associated with that asset is encapsulated inside the boundary and will reduce the risk of unintentional impacts.

127. The position, extent, and design of any AEZs will consider all available information including geology, hydrology, and sediment transport. As most AEZs will not be a standard shape (i.e., they comprise a buffer around the known extents of the site rather than a circle consisting of a centre-point with a radius distance), the AEZs agreed during the EIA process must be supplied as a GIS shapefile.

128. The list of AEZs is 'live' and will be held in the project GIS maintained by the retained archaeologist. At all stages of the project development, the project team should supply the retained archaeologist (if different from the previous process) and all contractors with the agreed AEZs as shapefile data. In addition, all documentation required for project delivery provided to contractors will include the lists and illustrated locations of AEZs.

129. TAEZs by their nature are more likely to be subject to change. TAEZs may be removed following further investigation and in consultation with Historic England if the feature proves to be non-archaeological. However, it may also be formalised as an AEZ if further investigation identifies an important heritage asset.

130. Subject to approval by Historic England, AEZs will be implemented around all high and medium seabed features, while TAEZs will be implemented around a selection of high amplitude magnetic anomalies. These are presented on **Figures 16.13** and **16.14** of **Chapter 16 Marine Archaeology and Cultural Heritage** of the **ES** and in **Table 1.10** and **Table 1.11** below.

Table 1.10 Archaeological Exclusion Zones within the Offshore Development Area

Anomaly ID	Description	Potential	WGS84 Z30N		AEZ (m)
			X	Y	
WC22_0043	Potential wreck	High	397965.1	5663488.3	50 radius
WC22_0063	Wreck	High	389369.4	5665020.2	50 extents
WC22_0041	Potential debris	Medium	365016.8	5663704.8	35 radius
WC22_0045	Potential wreck	Medium	398452.7	5663633.1	50 radius
WC22_0046	Likely geological	Medium	398731.6	5663638.9	25 radius

Table 1.11 Temporary Archaeological Exclusion Zones within the Offshore Development Area

Anomaly ID	Description	Amplitude	WGS84 Z30N		AEZ (m)
			X	Y	
WC22M_0202	Magnetic	139.9	390080.3	5665418.2	50 radius
WC22M_0228	Magnetic	160.5	401149.5	5661683.6	50 radius
WC22M_0271	Magnetic	168.5	377748.5	5663792.0	50 radius
WC22M_0273	Magnetic	201.9	378372.7	5663798.4	50 radius
WC22M_0302	Magnetic	138.9	376083.2	5663486.6	50 radius
WC22M_0326	Magnetic	165.6	376611.7	5663790.0	50 radius
WC22M_0421	Magnetic	156.8	385818.3	5664964.6	50 radius
WC22M_0554	Magnetic	170.3	388929.1	5665594.9	50 radius
WC22M_0569	Magnetic	108.1	394375.0	5665187.7	50 radius
WC22M_0616	Magnetic	133.6	393786.4	5665204.5	50 radius
WC22M_0617	Magnetic	116.4	393997.6	5665201.8	50 radius
WC22M_0618	Magnetic	137.6	393763.2	5664673.9	50 radius
WC22M_0628	Magnetic	238.0	392862.1	5665251.7	50 radius
WC22M_0633	Magnetic	256.7	392010.7	5665381.5	50 radius
WC22M_0653	Magnetic	129.8	391326.9	5665928.1	50 radius
WC22M_0735	Magnetic	104.0	388016.0	5664970.2	50 radius
WC22M_0739	Magnetic	109.0	387418.8	5664981.7	50 radius
WC22M_0651	Magnetic	184.1	391620.2	5665734.9	100 radius

Anomaly ID	Description	Amplitude	WGS84 Z30N X	Y	AEZ (m)
WC22M_0652	Magnetic	239.7	391622.1	5665814.4	100 radius
WC22M_0696	Magnetic	268.4	389586.1	5665891.4	100 radius
WC22M_0697	Magnetic	373.3	389591.5	5665830.9	100 radius
WC22M_0698	Magnetic	260.3	389552.7	5665817.0	100 radius
WC22M_1084	Magnetic	2435.0	413494.2	5662514.6	100
WC22M_1088	Magnetic	194.2	413624.6	5662493.0	100 radius

131. As set out in The Crown Estate (2021) guidance, AEZs may be altered (enlarged, reduced, moved, or removed) due to further data assessment or archaeological field evaluation covering those areas that are subject to AEZs. If new finds of potential archaeological significance come to light during pre-construction surveys, during construction, or during operation or decommissioning phases as reported through the Protocol for Archaeological Discoveries (**Section 1.10**), they may be subject to the implementation of a Temporary Exclusion Zone (TAEZ). A TAEZ will prevent impact to the seabed within their extents but allow activities in other areas to continue.

132. The need for, the design (position, extent) and implementation of any new exclusion zones (TAEZs, which may be formalised and converted to AEZs), or any alterations to existing AEZs, will be subject to discussions between the retained archaeologist and the project team, and in consultation with Historic England. This will be confirmed with a formal response. Following alteration, a new plan giving details of the AEZs will be drawn up and issued to each relevant party.

1.7.2 Archaeological Watching Briefs

133. As defined in The Crown Estate (2021) guidance, a watching brief is:

"*a formal programme of archaeological monitoring that involves attendance by a suitably qualified and experienced archaeologist during groundworks or other site activities/interventions associated with the scheme in the terrestrial or inter-tidal zone, and/ or marine activities such as during offshore obstruction clearance (where considered appropriate)*".

134. It is currently anticipated that, within the intertidal zone, the use of either HDD or open cut trenching will be used for the nearshore cable installation., With the use of HHD, with entry on the landward side of the beach, and exit below MLWS in the marine zone, impacts to potential intertidal archaeological material can be avoided. However,

open and cut trenching could cause a direct impact to any potential heritage assets should these be present.

135. As such, an archaeological watching brief would be required. This would involve the inspection of excavated surfaces, up-cast material and recovered object by a suitably qualified archaeologist. Any finds would need to be collected, their position recorded, and a record number assigned. A metal detector may also be used to enhance artefact recovery.

136. Archaeological features or structures should be examined and/or excavated with a sufficient sample of each layer/feature type investigated to clarify the date, character, relationships, and function of the feature/structure. Any standing section of trench edge should be inspected by the archaeologist on site, where safe to do so.

137. Development activities will include provision for sampling of features and deposits in order to recover artefacts, ecofacts and dating evidence, and to determine stratigraphic relationships, if appropriate. Sieving of bulk environmental samples should be undertaken to enhance levels of artefact recovery where appropriate. Bulk sediment samples may be taken specifically for artefact recovery.

138. Offshore, should activities be undertaken which could lead to disturbance to archaeological remains or remains being brought to the surface (e.g., clearance operations and pre-lay grapnel runs), an archaeological watching brief may be required. This would comprise on board supervision by a suitably qualified and experienced archaeologist. If areas subject to clearance are considered to be of medium or high archaeological potential, on board monitoring may be required to ensure consideration is given to any archaeological material brought to the surface. In areas of low archaeological potential any material brought to the surface will be dealt with through the Protocol for Archaeological Discoveries (PAD) set out in **Section 1.10**.

139. It is anticipated that the archaeological assessment of high-resolution pre-construction geophysical data (**Section 1.6.1**) will allow for the spatial identification of locations where the risk of encountering unexpected archaeological material is higher. Areas where large sand wave features are present for example, have greater potential for concealing archaeological remains. The same applies where areas of greater concentrations of geophysical anomalies of archaeological potential have been recorded. Watching briefs may also be required if micro-siting to avoid seabed and sub-seabed features of potential archaeological interest is not possible.

140. Should an on-board watching brief be required, the approach will be in accordance with The Crown Estate (2021) guidance. This will be set out in a method statement

prepared by the retained archaeologist in consultation with Historic England. If significant archaeological material or palaeoenvironmental deposits are encountered then the project team, in consultation with Historic England, will make provision for the retained archaeologist (or the archaeological contractor, if appointed), to undertake a programme of investigation commensurate with the evidence discovered.

141. Recording and reporting for any watching briefs, should these be required, will be undertaken in line with the approaches set out in The Crown Estate (2021) guidance.

1.7.3 Archaeological Recording, Samples and Artefacts

142. As required by The Crown Estate (2021) guidance, archaeological recording and assessment of samples and artefacts should be undertaken with the goal of addressing objectives set out in published local and regional research frameworks (such as those listed in **Section 1.2.3**).

143. The Crown Estate (2021) guidance sets out high-level methodologies for:

- Indexing and recording systems
- Position-fixing and levelling
- Environmental sampling strategies
- Environmental samples: handling, labelling, packaging, and storage
- Artefacts: handling, labelling, packaging, and storage
- Ordnance
- Human remains
- Aircraft
- Wreck
- Materials conservation and storage.

144. Any archaeological remains or environmental samples that are found during activities associated with White Cross will be treated in accordance with this guidance and best practice as set out in:

- Standards and guidance for the collection, documentation, conservation, and research of archaeological materials (CIfA, 2014c)
- First Aid for Underwater Finds (Robinson, 1998).

145. Isolated discoveries of artefacts that may come to light during the development will be dealt with through the Protocol for Archaeological Discoveries as set out in **Section 1.10**.

146. For activities where archaeological materials might be encountered each method statement will set out the approach to recording and dealing with samples and

artefacts where relevant. These will be based on all relevant and specific guidance and best practice. A general summary of key requirements is included below.

147. Any finds recovered or exposed during archaeological works will, at the point of discovery, be held by the archaeological contractor in appropriate conditions pending further recording, investigation, study, or conservation. All finds will be recorded and labelled appropriately. Where it is impracticable to recover finds these will need recorded.

148. Contingency will be made for specialist conservation advice from an appropriately qualified and experienced Archaeological Conservator should unexpected, unusual, or extremely fragile and delicate objects be recovered. All retained finds will be processed in accordance with the CIfA's Standard and guidance for the collection, documentation, conservation and research of archaeological material (CIfA, 2014c).

149. Recovered objects will be selected, retained, or disposed of in accordance with the policy agreed with the institution receiving the archive, and in consultation with the archaeological contractors.

150. Should ordnance be discovered, it should be treated with extreme care as it may still be active. Guidelines on addressing UXO discoveries provided to contractors by the project team must be followed prior to any recording of items for archaeological purposes.

151. If human remains are identified, they should be treated with due care and respect. For each situation, the following actions are to be undertaken and the retained archaeologist will inform the project team and the archaeological curators.

152. For human remains on land and in intertidal areas, application should be made to the Ministry of Justice for an exhumation licence under the Burial Act 1857.

153. For human remains within territorial waters where the remains have been intentionally buried, applications should be made to the Ministry of Justice for an exhumation licence. In all other cases, the retained archaeologist will immediately inform the Coroner and the Police.

154. Where practical, the human remains will be left *in-situ*, covered, and protected. Where human remains have been found and development will unavoidably disturb them, the remains will be fully recorded, excavated, and removed from the site once the appropriate licence has been obtained.

155. An appropriate Human Skeletal Biologist will, if required, be available to advise on and assist with the recovery and storage of human remains. The excavation, recording,

analysis, and storage of any human remains will be undertaken in line with the Guidelines to the Standards for Recording Human Remains (Mitchell and Brickley, 2017 and follow best practice as appropriate (BABAO 2010; Mays 2004; Mays et al., 2013; McKinley and Roberts 1993).

156. Regarding the remains of crashed aircraft, most aircraft wrecks are military and so fall under the legal protection of the Protection of Military Remains Act 1986. These would have to be avoided without a licence. Any finds that are suspected of being military aircraft will be reported immediately to the retained archaeologist.

157. In the case of a military aircraft being investigated under licence, any human remains will be reported immediately. For isolated items of aircraft reported through the protocol for archaeological discoveries, with advice sought from Historic England as set out in **Section 1.10.**

158. All archaeological artefacts that have come from a ship are wreck for the purposes of the Merchant Shipping Act 1995. The project team, via their archaeological contractors, should ensure that the Receiver of Wreck is notified within 28 days of recovery, by the project team or their agents, for all items of wreck that have been recovered.

159. All recovered materials will be subject to a conservation assessment to determine whether special measures are required while the material is being held. This conservation assessment will be carried out by the retained archaeologist or an archaeological contractor with an appropriate level of expertise, with advice from appropriate specialists.

160. The retained archaeologist or an archaeological contractor with appropriate expertise will implement recommendations arising from the conservation assessment. Where no special measures are recommended, finds will be conserved, bagged, boxed, and stored in accordance with industry guidelines.

1.8 Requirements for Monitoring

161. Monitoring requirements are anticipated to comprise:

- Monitoring of the final Offshore WSI by the retained archaeologist to ensure that the scheme of investigation is appropriate to the scheme design
- Monitoring of archaeological works by the archaeological curators, including monitoring of the effectiveness of AEZs
- Monitoring during and post construction, including a conservation programme for finds as set out in **Section 1.7.3**.

162. The performance of this WSI will be monitored over the course of the project (White Cross). If changes are made either to the project or if archaeological issues come to the fore, revisions would be made to the WSI after agreement with the MMO in consultation with Historic England. Any changes would be made through method statements submitted for approval by the project team or their agents.

163. The reports prepared for each archaeological work package will be distributed to the MMO and Historic England by the project team or their agents. This will allow for results to be reviewed and any archaeological concerns to be addressed.

164. All survey reports undertaken for the purposes of archaeological evaluation will be submitted to the MMO and Historic England within a specified timescale of the survey being completed to be agreed with the regulator.

165. Prior to the start of any work timetables or work on site that may impact archaeology, Historic England and the MMO will be notified. They will be informed at this time of the name and contact details of the retained archaeologist.

166. During any site evaluation, investigations, or construction work with the potential to impact archaeology, the retained archaeologist, with notification to the project team, may liaise directly with Historic England about monitoring and reporting. The project team will be kept informed of all contact between the retained archaeologist and the archaeological curators.

167. As required by The Crown Estate (2021) guidance, provision for monitoring AEZs will be set out in a method statement agreed between the project team and the Regulator in reference to any relevant regulatory consent. Monitoring will take place relative to the baseline data used to establish the AEZ and continue for the duration agreed between the project team and Historic England, as set out in the WSI and subsequent method statements.

168. This may include, for example, periodic archaeological reports prepared by the retained archaeologist, to monitor the effectiveness of the AEZs. These reports will review whether any incursions have been made into any of the AEZs and whether there is still an archaeological need for maintaining them. The frequency of the reports would be agreed with the MMO through consultation with Historic England but would likely include reports at key phases of construction and a post-construction report. This would include an assessment of pre-construction geophysical data. If it becomes clear that activities have encroached upon an AEZ, the project team will seek advice from the retained archaeologist.

169. A post-construction monitoring report including the archaeological assessment of post-construction geophysical survey data relative to the baseline data will also assess the effects of any indirect impacts that may have occurred to heritage assets resulting from the construction of White Cross.

170. Based on the results of the initial post-construction review, any further requirements during the operation phase will be agreed in consultation with Historic England. Further monitoring may only be necessary if significant changes to coastal and / or offshore processes are identified or if new information relevant to the integrity of archaeologically important items comes to light.

1.9 Archaeological Recording, Reporting, Data Management and Archiving

1.9.1 Method Statements

171. As noted above, the WSI provides a framework for archaeological investigations. As such, detailed archaeological method statements will be produced prior to survey or construction work, to provide a detailed methodology for each package of development or survey works, as required.

172. Each method statement will be consistent with the WSI, applicable guidance and will reflect the recommended methodologies set out in The Crown Estate (2021) guidance. The objectives for each work package will be set out in the method statement and will take account of applicable objectives from the relevant research frameworks (such as those listed in **Section 1.2.3**) that will be addressed through the delivery of the work.

173. Each method statement will be prepared by the retained archaeologist in consultation with the project team and Historic England. If the retained archaeologist does not have a sufficient level of experience with regards to the archaeological work required for a specific package of project works, they will appoint a suitably qualified and experienced archaeological contractor to contribute to or prepare the document and undertake the work. Formal approval for each method statement will be required from Historic England prior to works commencing and in accordance with agreed timescales.

174. As set out in The Crown Estate (2021) guidance, method statements should cover the following key matters, as relevant to each work package:

- Specific objectives of archaeological works
- Extent of investigation

- Investigation methodology, to cover:
  - Intrusive methods
  - Non-intrusive methods
  - Recording system
  - Finds, including the policy for selection, retention and disposal and provision for immediate conservation and storage
- Environmental sampling strategy
- Form of commission and contractual relationship with the OWF Project Team
- Relation between licence condition(s), WSI and the method statement
- Context in terms of relevant construction works
- Summary results of previous archaeological investigations in the vicinity
- Archaeological potential
- Anticipated post-investigation actions, including processing, assessment, and analysis of finds and samples
- Reporting, including Intellectual Property Rights in the report and associated data, confidentiality, and timescale for deposition of the report in a publicly accessible archive
- Timetable, to include investigation and post-investigation actions
- Monitoring arrangements, including monitoring by archaeological curator(s)
- Health, safety, and welfare.

1.9.2 Data Management

175. All data management will take place in accordance with the approaches set out in The Crown Estate (2021) guidance.

176. The retained archaeologist has overall responsibility for all matters related to archaeological data management. Issues regarding data storage and management, such as how long and in what format data should be stored, will be confirmed through discussions between the retained archaeologist and the project team.

177. Should a different retained archaeologist be appointed for different stages of a project, the project team should ensure that all relevant data is provided to the new retained archaeologist (for example, shapefiles of AEZs, geophysical anomalies of archaeological potential, areas of high archaeological potential, etc.).

178. On completion of scheme construction, the retained archaeologist will produce an OASIS (Online Access to the Index of Archaeological Investigations) form for the whole scheme, and copies of all archaeological reports will be attached. When the OASIS form is submitted, it is automatically sent to the relevant HERs, and notification is also

sent to Historic England, so that they may advise the respective competent authority on compliance with relevant consent conditions.

1.9.3 Reports

179. Each package of work outlined in the WSI will give rise to one or more archaeological reports, as set out in the method statement relating to the work.

180. Each archaeological report will be consistent with the final Offshore WSI, and The Crown Estate (2021) guidance on reporting, and will demonstrate sufficient planning, recording and data management, with a commitment to archiving and the public dissemination of results. The report will satisfy the method statement for the investigation and will present the project information in sufficient detail to allow interpretation without recourse to the project archive.

181. Archaeological reports will be prepared in accordance with the guidance given in the relevant CIfA's Standards and Guidance documents. Reports will typically include:

- A non-technical summary
- The aims and methods of the work
- The results of the work including finds and environmental remains
- A statement of the potential of the results
- Proposals for further analysis and publication
- Illustrations and appendices to support the report

182. Each archaeological report will be submitted in draft to the retained archaeologist for submission to the project team. If the report is prepared by the retained archaeologist, it will be submitted directly to the project team. Arrangements and timescales for submitting draft Archaeological Reports by the project team to Historic England will be set out in the WSI or method statement relating to the work. The timescales will ensure that Historic England have sufficient time to comment on findings prior to the next stage of archaeological work commencing

183. On completion of archaeological works relating to construction of the scheme and to a timetable agreed with the project team and Historic England, an overarching report on the archaeology of the scheme will be prepared in draft and final copies in accordance with the methods set out above. The overarching report should serve as an index to, and summary of, the archaeological investigations.

1.9.4 Post-fieldwork Assessment

184. Where required, provisions will be made for post-fieldwork assessment. This will address where possible, the character, extent, date, integrity, state of preservation

and relative quality of any archaeological features or remains that are recorded. Costs will be provided for any further research, analysis, publication, and archiving.

185. Decisions regarding the scope of post-fieldwork assessment will be made by agreement between the project team and Historic England following submission of investigation reports, based on the possible importance of the results in terms of their contribution to archaeological knowledge, understanding or methodological development.

186. As a minimum, a single assessment may be carried out after the works associated with the scheme have been completed. Such an assessment may be carried out by expanding the overarching archaeological report to include proposals in respect of analysis, publication, and archiving.

187. As set out in The Crown Estate (2021) guidance, an assessment of the potential of the archive for further analysis may include (but is not limited to):

- The dating and dendrochronological assessment of timbers
- The conservation of appropriate materials, including the X-raying of metalwork
- The spot-dating of all pottery from any investigation. This will be corroborated by scanning of other categories of material
- The preparation of site matrices with supporting lists of contexts by type, by spot-dated phase and by structural grouping supported by appropriate scaled plans
- An assessment statement will be prepared for each category of material, including reference to quantity, provenance, range and variety, condition, and existence of other primary sources
- A statement of potential for each material category and for the data set will be prepared, including specific questions that can be answered and the potential value of the data to local, regional, and national investigation priorities.

1.9.5 Analysis and Publication

188. Based on recommendations made by the post-fieldwork assessment, and as agreed with the relevant archaeological curators, mitigation requirements will be satisfied by carrying out analysis and reporting of the post-fieldwork assessment. If appropriate, this may include publication of important results in a recognised peer-reviewed journal or as a monograph.

189. In terms of mitigation measures relating to the cumulative impacts from the Project with the projects listed in **Table 16.31** of **Chapter 16 Marine Archaeology and Cultural Heritage** these can be offset through a contribution to regional research initiatives and provide the foundation for the creation of 'joined-up' objectives

for post-consent investigation and mitigation. This would include links with academic and industry wide research initiatives such as the BRITICE-CHRONO project and the West Coast Palaeolandscape Survey (Fitch and Gaffney, 2011).

190. This approach would require discussion with relevant stakeholders, the archaeological consultant, OWL, and the developers of the projects listed in the ES. It is recommended that this be undertaken post-consent once further data has been obtained for the Project and those listed in **Table 16.31** of **Chapter 16 Marine Archaeology and Cultural Heritage**.

191. The retained archaeologist should confirm the timeframe for the distribution and/or publishing of reports, in consultation with the project team and Historic England. This should be included in the WSI or method statement, as appropriate.

1.9.6 Archive

192. It is accepted practice to keep project archives, including written, drawn, photographic and artefactual elements (together with a summary of the contents of the archive) together wherever possible and to deposit them in appropriate receiving institutions once their contents are in the public domain. Archives will be developed in line with guidance including:

- Standard and guidance for the creation, compilation, transfer, and deposition of archaeological archives (CIfA 2014b)
- Environmental Guidelines for the Permanent Storage of Excavated Material from Archaeological Sites (Institute of Conservation 1984)
- Guidelines for the preparation of excavation archives for long-term storage (Walker 1990).

193. The relevant archaeological curators and the archaeological contractor will agree with the receiving institution a policy for the selection, retention, and disposal of excavated material. They will confirm requirements in respect of the format, presentation and packaging of archive records and materials, and will notify the receiving institution in advance of any fieldwork.

194. The timetable for depositing archives with the receiving institution after completion of the post-fieldwork programme will be agreed based on a method statement prepared for the project team by the retained archaeologist following fieldwork. In England, the National Marine Heritage Record (NMHR) will be the repository for maritime fieldwork records.

1.10 Protocol for Archaeological Discoveries (PAD)

195. In order to account for unexpected discoveries of archaeological material during construction, operation and decommissioning, a formal protocol will be required. It is recommended that if any objects of possible archaeological interest are encountered, that they should be reported using a protocol based on the Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate 2014) (ORPAD). This will establish whether the objects are of archaeological interest and allow for appropriate mitigation measures to be recommended where necessary.

196. Activities during which previously unidentified sites or unexpected discoveries of material which may be encountered include:

- Pre-construction surveys, for example:
  - Obstructions on the seabed encountered during geotechnical surveys or grab sampling
  - Archaeological material within cores or grab samples
  - Seabed features identified during diver or ROV surveys
- Seabed clearance, pre-lay grapnel runs (e.g. finds brought to the surface)
- Vessel anchoring (e.g. anchor caught on obstruction)
- Installation of the export cables (e.g. obstruction interactions with plough)
- Installation of wind turbine moorings (e.g. obstruction interactions with jack-up legs).

197. This protocol will apply to pre-construction, construction and installation, operation, and maintenance activities in developing offshore renewable energy schemes where an archaeologist is not present on site.

198. The protocol will also apply to operation and maintenance activities. The protocol allows for the effective reporting of discoveries of archaeological material to ensure that advice, concerning measures to address discoveries, is received, and implemented, in a timely and efficient manner.

199. Under the PAD, each vessel or worksite team has a Site Champion, a single person who is responsible for reporting discoveries to a Nominated Contact within the Developer's core team. The Nominated Contact will report any new discoveries to the retained archaeologist, or an archaeological contractor engaged to implement the protocol.

200. Individual Site Champions for specific activities will be specified in work package method statements and the identity of the Site Champion will be clearly communicated to work teams, via pre-commencement briefings.

201. The project team will be responsible for ensuring that teams are provided with appropriate training in the application of the protocol and that all staff and contractors are aware of their responsibilities under the protocol. The protocol documentation, including a full description of the methodology and requirements for implementing the protocol will mirror that of the ORPAD which can be found via the following web link:

- https://www.wessexarch.co.uk/sites/default/files/field_file/2_Protocol%20For%20Archaeological%20Discoveries.pdf.

202. Training will be provided to construction staff, site crews and work teams about the practical application of the protocol in their day-to-day work through the Implementation Service or by an alternative sufficiently experienced and qualified archaeological contractor. Hard copies of the protocol document will be made available for use on board the construction vessels.

203. Provision will be made by the project team, in accordance with the protocol, for the prompt reporting / recording to Historic England of archaeological remains encountered or suspected during works.

204. If the find is a wreck within the meaning of the Merchant Shipping Act (1996) then a report will also be made to the Receiver of Wreck. If the find is treasure within the meaning of the Treasure Act (1996) then a report will also be made to the Coroner.

205. Following completion of the construction phase, a report will be prepared presenting the results of the protocol implementation during activities and submitted to the MMO in a timely manner. If no discoveries are made, a nil discoveries report should be compiled to demonstrate adherence to the scheme.

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