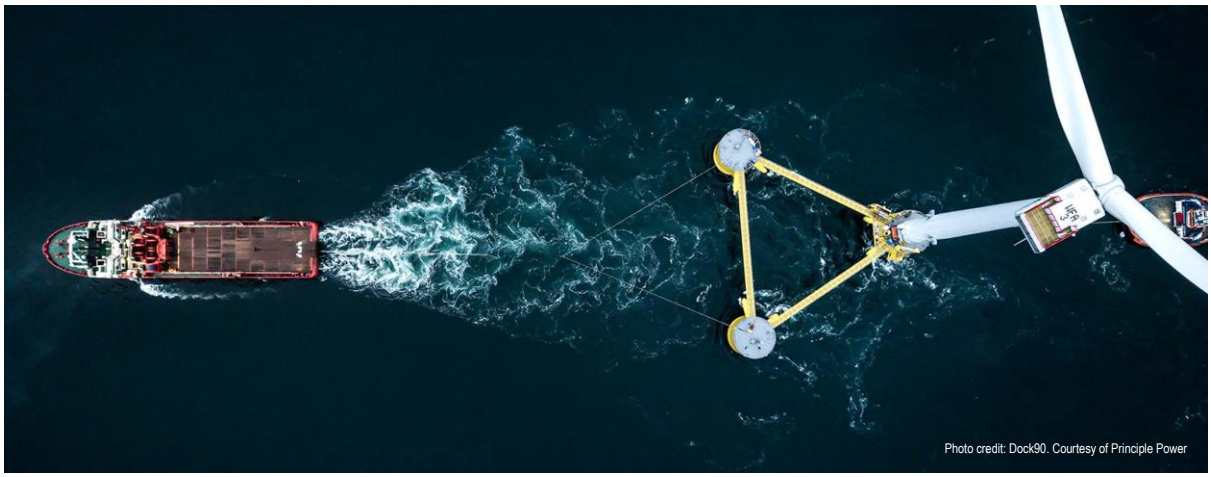

Project Erebus Environmental Statement
Chapter 14: Offshore Archaeology and Cultural Heritage

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Acronyms

Term	Definition
AAP	Area of Archaeological Potential
AEZ	Archaeological Exclusion Zone
AMAPs	Areas of Maritime Archaeological Potential
CEA	Cumulative Effects Assessment
CIfA	Chartered Institute for Archaeologists
COARS	Coastal and Offshore Archaeological Research Services
DAT	Dyfed Archaeological Trust
DE	Drag Embedment
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ES	Environmental Statement
HDD	Horizontal Directional Drilling
HER	Historic Environment Record
HLC	Historic Landscape Characterisation
MBES	Multibeam Bathymetry
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MFE	Mass Flow Excavator
MHPA	Milford Haven Port Authority
MHWS	Mean High Water Spring
MIS	Marine Isotope Stage
MLMO	High Level Marine Objectives
MPA	Marine Protected Area
MoD	Ministry of Defence
MPS	Marine Policy Statement
NFP	Nearshore Floatation Pits
NMRW	National Monuments Record of Wales

Term	Definition
NRW	Natural Resources Wales
OS	Ordnance Survey
PAD	Protocol for Archaeological Discoveries
PMRA 1986	Protection of Military Remains Act 1986
PPW	Planning Policy Wales
PWA 1973	Protection of Wrecks Act 1973
RAF	Royal Air Force
RCAHMW	Royal Commission on Ancient and Historic Monuments of Wales
RNAS	Royal Navy Air Service
ROV	Remotely Operated Vehicle
RoW	Receiver of Wreck
SBP	Sub-Bottom Profiler
SSS	Side Scan Sonar
TAEZ	Temporary Archaeological Exclusion Zone
TANs	Technical Advice Notes
TSHD	Trailing Suction Hopper Dredger
UKHO	United Kingdom Hydrographic Office

Chapter 14 Offshore Archaeology and Cultural Heritage

14.1 Introduction

14.1.1.1 The proposed Project Erebus (the Project) is a demonstration scale Floating Offshore Wind (FLOW) development in the Celtic Sea region. The Applicant, Blue Gem Wind, is a joint venture between Simply Blue Energy (SBE) and TotalEnergies, set up to create a new low carbon offshore energy sector in the region; that contributes to climate change targets, supply chain diversification and energy security.

14.1.1.2 This assessment has been undertaken by MSDS Marine. The Chapter has been authored by Sally Evans (BA, MA, ACIfA) and Mark James (BA, MCIfA) who each has over ten years' experience in the field of archaeology and marine archaeology. Phoebe Ronn (BA, PCIfA) who has two years' experience in marine archaeology has also contributed to the report.

14.1.1.3 The array area is located approximately 35 km southwest of the Pembrokeshire coastline, covering an area of 43.5 km^2 in water depths of between 65-85 m. The array area is located outside of the 12 nm limit, but all elements of the Project, array area, offshore export cable corridor and landfall, fall within Welsh territorial waters or the Welsh Zone.

14.1.1.4 The Project comprises six to ten Wind Turbine Generators (WTG) with a total generating capacity up to 100 MW. Each WTG is housed on a semi-submersible floating platform with a mooring system comprising a maximum of five catenary mooring lines, up to 870 m in length, and a range of foundation options including drag embedment anchors, driven piles, drilled piles and/or suction piles. Up to 10 dynamic array cables are proposed, with a lazy wave configuration from the semi-submersible floating platform to the seabed. The offshore export cable, up to 49 km in length, links the array area to landfall at West Angle Bay, Pembrokeshire.

14.1.1.5 This chapter provides an assessment of the known and potential archaeological remains and historic assets within the Proposed Development, and identifies the potential risks, impacts, and effects to these resources posed by the Proposed Development. Mitigation is recommended where significant effects would occur and recommendations are in line with the key legislation, policy, and guidance relevant to the assessment.

14.1.1.6 This chapter is supported by two Technical Appendices (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report; and 14.2: Marine Archaeology Draft Written Scheme of Investigation & Protocol), which set out detailed assessment of site-specific data including from geophysical survey, ground model results, drone survey and a walkover survey, in addition to assessment of existing data sources and previous works.

14.2 Legislation, Policy and Guidelines

14.2.1.1 Legislation, policy, and guidance relating to the marine historic environment within Welsh territorial waters has been collated and assessed. The most notable and relevant examples to the Project are summarised below. All work set out within this document follows the legislation, policy and guidance detailed within this section.

14.2.2 Legislation

14.2.2.1 Relevant legislation and guidance documents have been reviewed and taken into consideration as part of this assessment. Of particular relevance are:

- The World Heritage Convention (1972);
- United Nations Convention on the Law of the Sea (1982);
- International Council of Monuments and Sites Charter on the Protection and Management of Underwater Cultural Heritage (1996) (the Sofia Charter);
- UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001);
- European Convention on the Protection of Archaeological Heritage (Revised) 1992 (the Valletta Convention) – this was ratified by the UK Government in 2000 and came into force in 2001; and
- European Landscape Convention 2000 – adopted in the UK 1st March 2007.

14.2.3 In addition to this, there are a number of Acts that relate specifically to maritime cultural heritage within the UK and Wales. These are as follows:

- Protection of Wrecks Act (PWA) (1973):
  - Section One – this section of the PWA 1973 enables the Secretary of State to protect wreck sites from unauthorised interference if they are of archaeological or artistic importance. Under the Act it is an offence to carry out certain activities in a defined area surrounding the site, unless a licence for those activities has been obtained from the Government;
  - Section Two – this section of the PWA 1973 provides protection for wrecks that are designated as dangerous due to their contents and is administered by the Maritime and Coastguard Agency (MCA) through the Receiver of Wreck (RoW). While Section Two of the Act is not used to designate sites because of their archaeological interest, it is possible that a dangerous wreck designated under this section might also be of archaeological interest.
- Ancient Monuments and Archaeological Areas Act (1979):
  - This Act has previously been primarily employed to protect sites on land, but in recent years it has also been used in the designation of underwater sites. Scheduled Monuments, and Areas of Archaeological Importance, are afforded statutory protection by the Secretary of State, and consent is required for any intrusive works;
- Protection of Military Remains Act (PMRA) (1986):
  - Under the PMRA 1986, all aircraft that have crashed in military service are protected, and the Ministry of Defence (MoD) has powers to protect vessels that were in military service when they were lost. The MoD can designate named losses as Protected Places even if the position of the wreck is not known. In addition, the MoD can designate Controlled Sites around wrecks whose position is known. In the case of Protected Places, the vessel must have been lost after 4th August 1914, whereas in the case of a wreck protected as a Controlled Site, no more than 200 years must have elapsed since loss;
  - Diving is not prohibited at a Protected Place, but it is an offence to tamper with, damage, move or remove sensitive remains. However, diving, salvage and excavation are all prohibited on Controlled Sites, though licences for restricted activities can be sought from the MoD.

- Merchant Shipping Act (1995):
  - Within the context of the Merchant Shipping Act 1995, 'wreck' refers to flotsam, jetsam, derelict, and lagan found in or on the shores of the sea, or any tidal water. It includes a ship, aircraft or hovercraft, parts of these, their cargo or equipment. It may be of antique or archaeological value such as gold coins, or a yacht or dinghy abandoned at sea, or items such as drums of chemicals or crates of foodstuffs (Definition from the Maritime and Coastguard Agency web site);
  - The ownership of underwater finds recovered from the sea is decided in line with a set of procedures detailed in the Merchant Shipping Act 1995. If finds are brought ashore, the salvor is required to give notice to the Receiver of Wreck (RoW) that he/she is in possession of the material. This applies whether material has been recovered from within or outside UK Territorial Waters;
- Marine and Coastal Access Act (2009):
  - This Act introduced new planning and management systems for overseeing the marine environment. It introduced a requirement to obtain marine licences, administered in Wales by Natural Resources Wales (NRW) for works at sea (including the deposition or removal of any substance or object below Mean High Water). The Act also instated a marine planning system to promote the efficient, sustainable use and protection of the marine environment. This is guided by the Marine Policy Statement and local marine plans. The Act also amended certain provisions of the Planning Act 2008;
  - This Act also introduced the designation of Marine Conservation Zones (MCZs) which are a type of Marine Protected Area (MPA). This designation seeks to protect important marine wildlife, habitats, geology, and geomorphology;
- Historic Environment (Wales) Act (2016):
  - This forms part of a suite of legislation, policy, advice, and guidance that makes improvements to the existing systems for the protection and sustainable management of the Welsh historic environment. The Historic Environment (Wales) Act became law on 21 March 2016. In conjunction with this, Cadw has started to prepare several policy, advice and guidance documents relating to managing the historic environment, which will be subject to amendment as the provisions of the Act alter, and will be subject to full public consultation before adoption. This includes Technical Advice Note 24: Historic Environment which will provide guidance on local development plans, designated assets and archaeological remains;
- The Planning (Listed Buildings and Conservation Areas) (Wales) Regulations (2012):
  - This Act was passed in July 2015 and makes provision for the preparation and revision of a new National Development Framework for Wales and the production of Strategic Development Plans. Although planning law only applies within the territory of local authorities, which generally extends only to Mean Low Water (MLW), Cadw is fully aware of the significance of seabed prehistory and submerged landscapes, and the importance of a seamless approach to protection.

14.2.3.1 Other relevant legislation has also been considered during this assessment (see Chapter 5: Policy and Legislation).

14.2.4 National Policy Statements

14.2.4.1 Although this Project is seeking Section 36 consent under the Electricity Act 1989 and a Marine Licence under the Marine and Coastal Access Act (MCAA) 2009, as opposed to a Development Consent Order (DCO), its size (up to 100 MW) is similar to the minimum threshold (100 MW) for Nationally Significant Infrastructure Projects (NSIPs). As such, guidance relevant to NSIPs is considered relevant to use for this Project. National Policy Statements (NPSs) were developed to provide guidance in the determination of NSIPs. Those relevant for the assessment of impacts on offshore archaeology and cultural heritage include[1]:

- Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a); and
- NPS for Renewable Energy Infrastructure (EN-3), July 2011 (DECC, 2011b).

14.2.4.2 Even though the NPSs listed above specifically relate to Nationally Significant Infrastructure Projects (NSIP), and the Project is not classified as an NSIP, a review of EN-1 and EN-3 has still been undertaken.

14.2.4.3 Details of specific policies within EN-1 and EN-3 used to inform this assessment are provided in Table 14.1 below. The specific assessment requirements for marine archaeology are detailed, together with an indication of the paragraph numbers of the chapter where each is addressed.

Table 14.1 – NPS EN-1 and EN-3 Assessment Provisions Relevant to Offshore Archaeology and Cultural Heritage

NPS Requirement	NPS Reference	ES Reference
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.	EN-1, para 5.5.8	See Section 14.5
Where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation.	EN-1, para 5.8.9	See Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report
Avoidance of important heritage assets, including archaeological sites and historic wrecks, is the most effective form of protection and can be achieved through the implementation of AEZ around such heritage assets which preclude development activities within their boundaries.	EN-3, para 2.6.145	See Section 14.4.6

[1] A period of consultation on a set of revised energy NPS's, managed by the Department of Business, Energy and Industrial Strategy (BEIS), ended on 29th November 2021.

14.2.5 Marine Policy Statement

14.2.5.1 The UK Marine Policy Statement (MPS) (HM Government, 2011) and UK High Level Marine Objectives (HLMO) set out the importance of cultural heritage as a component of delivering sustainable development in the UK, through the use of a system of Marine Planning. Table 14.2 sets out National and Regional Policy Requirements from the MPS Relevant to Offshore Archaeology

Table 14.2 – National and Regional Policy Requirements from the MPS Relevant to Offshore Archaeology

Policy Description	Reference	ES Reference
The MPS recognises that heritage assets are a finite and irreplaceable resource, and should be 'conserved in a manner appropriate and proportionate to their significance' (para 2.6.6.3). It is recognized that while designated heritage assets have a demonstrable high level of significance, undesignated heritage assets may also hold high significance, and remains of designable quality should therefore be treated in the same manner as designated remains.	MPS, Section 2.6.6.3	This chapter identifies known and potential heritage assets and their significance and takes this into account in the employment of standard and additional mitigation.
The MPS further states that there should be a presumption in favour of preservation *in situ*, and 'The more significant the asset, the greater should be the presumption in favour of its conservation. Substantial loss or harm to designated assets should be exceptional'. (para 2.6.6.8). 'Where the loss of the whole or a material part of a heritage asset's significance is justified, the marine plan authority should identify and require suitable mitigating actions to record and advance understanding of the significance of the heritage asset before it is lost' (para 2.6.6.9)	MPS, Section 2.6.6.8-9	The mitigation strategies recommended within this chapter take account of the significance of heritage assets and favour *in situ* preservation. This is a key aspect of the standard mitigation employed by the project. Additional mitigation has also been recommended, where necessary, including options for preservation by record.
The documents clearly identify cultural heritage as an important component of decision making and state that non-designated heritage sites should be considered subject to the same policy principles as applied to designated heritage assets, According to the MPS, the interest and significance of all heritage assets that may be affected by a proposed development should be identified and properly assessed to minimise conflict.	MPS, Section 2.6.6.3	This chapter identifies non-designated heritage sites and their significance and takes this into account in the employment of standard and additional mitigation.

14.2.5.2 The following policies were reviewed and taken into account as part of this assessment.

14.2.6 Planning Policy Wales (2017)

14.2.6.1 Planning Policy Wales (PPW), edition 11, was published by the Welsh Government in February 2021. This document includes the principal national guidance on the importance, management and safeguarding of the historic environment within the planning process in Wales and provides advice on all aspects of planning policy in Wales. PPW is supplemented by a series of Technical Advice Notes (TANs) and Circulars issued by the Welsh Office and the National Assembly of Wales. PPW, the TANs, Circulars and policy clarification letters comprise national planning policy in Wales.

14.2.7 Welsh National Marine Plan (2019):

14.2.7.1 The Welsh Government published its first marine plan for Welsh inshore and offshore waters, the Welsh National Marine Plan (WNMP), in November 2019. The WNMP was developed in accordance with the MCAA 2009 and the UK MPS. The WNMP covers a 20-year period from its adoption in 2019. The publishing of the WNMP in November 2019 followed a period of consultation from 7 December 2017 to 29 March 2018. The WNMP is discussed further in Chapter 5: Policy and Legislation.

14.2.7.2 This policy covers cultural heritage, historic landscapes, and amenity issues. It also stresses the need for sustainable development and holistic management. The key objective from the WNMP relevant to marine archaeology is detailed below:

- Objective 7: Support enjoyment and stewardship of our coasts and seas and their resources by encouraging equitable and safe access to a resilient marine environment, whilst protecting and promoting valuable landscapes, seascapes, and historic assets." (supported by SOC_05, and in part by SOC_06 and SOC_07).

14.2.7.3 Table 14.3 sets out other national WNMP policies which are particularly relevant to offshore archaeology and cultural heritage.

Table 14.3 – Other National WNMP Policy Provisions Relevant to Offshore Archaeology and Cultural Heritage

WNMP Policy Descriptions	Reference	ES Reference
Identifies that proposals which may affect historic assets should demonstrate that they will, in order of preference: a) avoid, b) minimise, c) mitigate, d) if it is not possible to mitigate, to state the case, such as reasoning the greater public benefit, for proceeding, and that opportunities to enhance historic assets are encouraged.	SOC_05	See Sections 14.4.6 and 14.6
Identifies that proposals which may affect designated landscapes should demonstrate that they will, in order of preference: a) avoid, b) minimise, c) mitigate, d) if it is not possible to mitigate, to state the case, such as reasoning the greater public benefit, for proceeding, and that opportunities to enhance designated landscapes are encouraged.	SOC_06	See Sections 14.4.6 and 14.6
Identifies that proposals which may affect seascapes should demonstrate that they will, in order of preference: a) avoid, b) minimise, c) mitigate, d) if it is not possible to mitigate, to state the case, such as reasoning the greater public benefit, for proceeding, and that opportunities to enhance seascapes are encouraged.	SOC_07	See Sections 14.4.6 and 14.6

14.2.8 Guidance

14.2.8.1 Recognition has been taken of the following best practice guidelines/guidance:

- Welsh Government Technical Advice Note 24: The Historic Environment (Welsh Government, 2017a);
- Managing the Marine Historic Environment of Wales (Cadw, 2020);
- Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Cadw, 2011);
- Heritage Impact Assessment in Wales, Cadw, Welsh Assembly Government (Cadw, 2017);
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee, 2006);
- Military Aircraft Crash Sites (English Heritage, 2002);
- Aircraft Crash Sites at Sea (Wessex Archaeology, 2008);
- Identifying and Protecting Palaeolithic Remains (English Heritage, 1998);
- Marine Geophysics Data Acquisition, Processing and Interpretation, Guidance Notes, (English Heritage, 2013);
- Standard and guidance for historic environment desk-based assessment (CIfA, 2017);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (COWRIE, 2011);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (COWRIE, 2008);

- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007);
- Archaeological Written Schemes of Investigating: Offshore Renewables Projects (The Crown Estate 2021); and
- Protocol for Archaeological Discoveries (PAD), (The Crown Estate 2014).

14.3 Consultation and Scoping

14.3.1.1 Consultation with key stakeholders has taken place during the production of this Chapter and supporting Technical Appendices. This primarily took place within a joint onshore and offshore archaeology stakeholder meeting held on Microsoft Teams on 15 April 2021. Table 14.4 contains details of the consultation in this meeting, in relation to offshore archaeology this meeting was attended by Dyfed Archaeological Trust, Cadw, the Royal Commission on Ancient and Historic Monuments of Wales (RCAHMW), Pembrokeshire Coast National Park, MSDS Marine, MarineSpace and ITP Energised. In this meeting the approach to the current assessment was outlined (including Study Areas, datasets, site-specific survey work and assessment approach), and consultees were given the opportunity to comment on methods used and the approach to the assessment. Consultation was also undertaken during the scoping process.

Table 14.4 – Consultation for Offshore Archaeology

Consultee	Response	Applicant Action
NRW Scoping Opinion (January 2020)	'Cadw have reviewed the scoping area and noted that there are 66 scheduled monuments, 3 registered historic park and gardens, 2 registered historic landscapes and 188 listed buildings located inside the submitted scoping area for the Environmental Impact Assessment. However, only one scheduled monument (PE554 West Angle Bay Early Medieval Settlement) and two listed buildings (5954 Corse Bridge and attached Walled Channel and 16583 Seaweed on foreshore) are located inside 500 m of the proposed export cable corridor below the mean high-water spring tide line. These must be included within the assessment contained within the submitted ES. LiDAR data identified as a data source in Table 7-9 tends to be low resolution or absent in many parts of Wales. Collection of LiDAR data should be considered as part of the archaeological surveys to inform the EIA. When considering reasonable alternatives within the submitted ES, you should ensure that consideration is given to Archaeology and Cultural Heritage receptors, and whether impacts could be mitigated through alternative site or technology selection'	The scoping opinion response related primarily to heritage assets above MHWS and considered within Chapter 23: Onshore Archaeology and Cultural Heritage. The exceptions are the two listed buildings (5954 and 16583). However, while these were close to an earlier potential export cable corridor option, they now lie outside of the Study Area. The scoping opinion also contained comment on methodologies and datasets. The methodology, including all datasets, was discussed with all stakeholders on 15 April 2021 and their responses have been outlined above.

Consultee	Response	Applicant Action
Cadw (15/04/2021)	Cadw confirmed that it was happy with the approach to archaeology and cultural heritage for offshore, no issues were raised or highlighted.	No change required.
Dyfed Archaeological Trust (DAT) (15/04/2021)	DAT confirmed that it was happy with the approach to archaeology and cultural heritage for offshore, no issues were raised or highlighted.	No change required.
RCAHMW (15/04/2021)	Technical issues affected the RCAHMW during the meeting, however the minutes and presentation were circulated and no issues were raised. Additionally, MSDS Marine is in the process of arranging a meeting, following a new staff appointment at the RCAHMW, to consult further.	No change required.
Pembrokeshire Coast National Park (15/04/2021)	Pembrokeshire Coast National Park confirmed that it was happy with the approach to archaeology and cultural heritage for offshore, no issues were raised or highlighted.	No change required.
Cadw / RCAHMW (15/10/2021)	Meeting was held with Cadw and RCAHMW to present findings from ROV surveys and discuss approach to Temporary Archaeological Exclusion Zones for contacts in Row's Rock channel. Cadw and RCAHMW both commented it was excellent to see early investigation and happy with proposed approach. Advised that clear statements required in ES to propose next steps.	The Chapter provides further details in Section 14.4.4, 14.5 and 14.6.

14.4 Assessment Methodology and Significance Criteria

14.4.1.1 Detailed discussion on the EIA methodology can be found in Chapter 2: Overview of EIA Methodology. Impacts to offshore archaeology are based on the impacts identified within the EIA Scoping Report, and any additional potential impacts which have been identified via consultation with key stakeholders.

14.4.1.2 This assessment has been based on the existing baseline environment, as described in Section 14.5 (see also Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report) and the Project Design Envelope as detailed in Chapter 4: Proposed Development Description. Specific parameters that have been the basis of this assessment are provided in Table 14.14

14.4.1.3 Impacts have been assessed for the following three distinct phases of the proposed project:

- Construction;
- Operation (and maintenance); and
- Decommissioning.

14.4.2 Study Area

14.4.2.1 The Proposed Development consists of the array area and offshore export cable corridor (referred to as the ECC). The Proposed Development (Volume 2, Figure 4.1) covers the offshore component for installation, including where the ECC makes landfall, in West Angle Bay.

14.4.2.2 For this assessment, a Marine Archaeological Study Area (Study Area) has been defined (see Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report, Figure 1). The Study Area comprises a buffer zone of 2 km around the Proposed Development up to Mean High Water Spring (MHWS). Additionally, a buffer of 200 m has been applied at the offshore consent boundary above MHWS. These buffers are included within the Study Area. The buffer extends above MHWS, as there is potential for remains eroded from the surrounding area to be present within the intertidal zone and, thus, within the Proposed Development. The buffers were selected in order to better characterise the potential for archaeological remains.

14.4.3 Desk Study

14.4.3.1 In order to assess the known and potential archaeological resource, a wide variety of information sources and reference materials have been consulted to inform the assessment. Information has been collated from regional archaeological assessments and surveys, existing datasets and published sources. Evidence from these data sources has been reviewed to produce an understanding of known and potential heritage assets, with the overall aim of determining the nature, extent and significance of the historic environment within a specified area (i.e., within the Proposed Development and Study Area) (CIfA 2014: 4).

14.4.3.2 The following primary data sources have been reviewed during the production of this Chapter:

- List of designated heritage assets held by Cadw Including:
  - World Heritage Sites;
  - Protected Wrecks;
  - Scheduled Monuments;
  - Listed Buildings;
  - Registered Parks and Gardens;
  - Registered Landscapes;
- List of wrecks designated under the Protection of Military Remains Act, 1986;
- United Kingdom Hydrographic Office (UKHO) records of wrecks, obstructions, and fouls;
- National Monuments Record of Wales (NMRW) data from the RCAHMW;
- Historic Environment Record (HER) data from DAT;
- Records from the Receiver of Wrecks (RoW); and
- Secondary sources consulted include relevant literature from journals, publications, and unpublished archaeological reports.

14.4.3.3 Known heritage assets have been collated to create a gazetteer (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report, Annex 1: Gazetteer). Entries are provided with a number, with the prefix 'MSDS_Erebus'. These inform the assessment and, where relevant, are referred to within the text.

14.4.3.4 A series of other projects and desk-based sources has also contributed to the understanding of the relationship between seabed environments and the preservation of archaeological remains; and also feed into the assessment. These include:

- Enhancing our Understanding: Mapping Navigational Hazards as areas of Maritime Archaeological Potential (Merrit *et al.*, 2007): This project developed the concept of Areas of Maritime Archaeological Potential (AMAPs) by comparing areas with high potential for ship losses with areas with high potential for archaeological materials;
- Mapping Navigational Hazards as Areas of Maritime Archaeological Potential: The effects of sediment type on the preservation of marine archaeological materials (Gregory 2006): This project developed a sediment stability model focussing on preservation environments for shipwreck material. This report contributed to the 'Navigational Hazards' project detailed above. As part of this report, different types of seabed environment were rated 1-19 based on grade of preservation, with 1 being a good preservation environment and 19 being a poor preservation environment;
- Refining Areas of Maritime Archaeological Potential for Shipwrecks - AMAP 1 (Merrit 2008): This project aimed to compare shipwreck data to environmental, historical, and hydrographic datasets in order to refine AMAPs identified during the Navigational Hazards project; and
- Areas of Maritime Archaeological Potential 2 - Characterising the Potential for Wrecks (AMAP2) (SeaZone, 2011): This project built upon the Navigational Hazards and AMAP1 projects to further refine the baseline data and characterise the seabed environments surrounding the UK mainland. This project produced shapefiles with characterisations including sediment type, water depth, sediment transport rate, preservation level, and sediment thickness.

14.4.4 Site Visit/Surveys

14.4.4.1 Site specific surveys have also provided key sources of data. These include:

- Geophysical survey data;
- Remote Operated Vehicle (ROV) video and telemetry data;
- A ground model developed for the site;
- Geotechnical data;
- An archaeological intertidal walkover survey; and
- A drone survey.

14.4.4.2 Details on the specifications of these surveys and the methods used for archaeological review are included within the Technical Report (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report).

14.4.4.3 Geophysical data were collected over the Proposed Development. This includes two geophysical surveys (Rovco 2021a; GEOxyz Ltd 2021), acquiring Multibeam Bathymetry (MBES), Magnetometer, Side Scan Sonar (SSS), and Sub-Bottom Profiler (SBP) data (described further in the Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report). The data were reviewed by a qualified and experienced marine archaeologist with a background in geophysical data collection, processing, and interpretation.

14.4.4.4 In addition, an ROV survey was undertaken specifically for the investigation of two high potential archaeological anomalies (potential wreck sites ERS21_0123 and ERS21_0137) initially identified during the course of the archaeological assessment of geophysical survey data. These anomalies were investigated for the purposes of better understanding the character of the sites, and establishing with greater certainty whether the anomalies were wrecked vessels.

14.4.4.5 These anomalies were targeted for detailed pre-application investigation as they lie within Row's Rocks channel, a constrained area along the ECC. Thus, more information was required in order to establish the nature and extents of the anomalies in order to plan appropriate and proportionate mitigation. Two archaeologists were on board the ROV vessel for the survey and guided the ROV investigations. They reviewed the data as it was collected, and subsequently conducted further detailed reviews of the data once back in the office. Detailed methodology for the ROV survey and results of the archaeological reviews of ROV data have fed into this Chapter and Technical Report (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report).

14.4.4.6 The ground model produced for the Proposed Development has also undergone archaeological review, to inform understanding of the palaeolandscape. Detailed methods for these reviews are set out within the Technical Report (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report).

14.4.4.7 A geotechnical campaign was also undertaken in 2021; at the time of writing no results are available to incorporate into this assessment. There is ongoing geoarchaeological involvement with this campaign, which thus far has included input into core locations following review of seismic data, discussions with geotechnical contractors, and agreement on a way forward for the incorporation of geoarchaeological aims and methods, a toolbox talk and ongoing discussions on core material of interest. Geoarchaeological work is managed by MSDS Marine with specialist input from Dr Michael Grant at the University of Southampton Coastal and Offshore Archaeological Research Services (COARS).

14.4.4.8 An intertidal walkover survey was also undertaken on 27 May 2021, as part of the baseline assessment, with an initial review of the results of the drone survey of the intertidal area. Detailed methods for these reviews are set out within the Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report.

14.4.5 Assessment of Potential Effect Significance

14.4.5.1 Following identification of the historic assets within the site, this chapter identifies the proposed changes and assesses the magnitude of impact of these changes upon the historic environment. The assessment makes specific reference to any alterations to the evidential, historic, aesthetic, and communal values of the heritage assets. Effects are considered to include direct effects, indirect effects, inter-relationships between effects, and cumulative effects.

14.4.5.2 The approach to assessment is summarised here and described further in Chapter 2: Overview of EIA Methodology.

14.4.5.3 The assessment identifies receptors within the Study Area that are sensitive to that effect, and implements a systematic approach to understand the pathways and the level of impacts on given receptors. The process considers the following:

- Sensitivity;
- Magnitude; and
- Significance of effect.

14.4.5.4 The duration of an impact is also referred to. However, for historic assets direct physical impacts will be permanent and irreversible. Indirect impacts such as changes to sedimentation may be reversible, or subject to alteration following removal or decommissioning of the development. Any loss of sediment and erosion of heritage assets will not be reversible, but where heritage assets are protected by the accumulation of deeper sediment, this may be considered a reversible change.

Sensitivity

14.4.5.5 The overall receptor sensitivity is determined by considering a combination of value, adaptability, tolerance, and recoverability. This is achieved through applying known research and information on the status and sensitivity of the feature under consideration, coupled with professional judgement and past experience.

14.4.5.6 In summary, the sensitivity of a receptor is a function of its capacity to accommodate change, and reflects its ability to recover if it is affected, and is defined by the following factors:

- Tolerance is the susceptibility (ability to be affected or unaffected) of a receptor to an external factor;
- Adaptability relates to the ability of the receptor to adapt to, or avoid, an external factor;
- Recoverability is the ability of a receptor to return to a state close to that which existed before the activity or event caused change within a specified period of time; and
- Value: a measure of the receptor's heritage value.

14.4.5.7 In order to define the sensitivity of a receptor, the guidelines presented in Table 14.5 have been adopted in this ES. Note that for heritage assets, direct physical impacts will be permanent and irreversible. However, indirect impacts such as changes to sedimentation may be reversible or subject to alteration following removal or decommissioning of the development. Any loss of sediment and erosion of heritage assets will not be reversible, but where heritage assets are protected by the accumulation of deeper sediment, this may be considered a reversible change.

Table 14.5 – Sensitivity Levels for Receptors (Offshore Archaeology)

Sensitivity	Description
High	Individual receptor has very limited capacity to avoid, adapt to, accommodate, or recover from the anticipated impact.
Medium	Individual receptor has limited capacity to avoid, adapt to, accommodate, or recover from the anticipated impact.

Sensitivity	Description
Low	Individual receptor has some tolerance to avoid, adapt to, accommodate, or recover from the anticipated impact.
Negligible	Individual receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

14.4.5.8 It should be noted that the sensitivity criterion is a composite one; combining value (see Receptor Value) with sensitivity. In some instances, the inherent value of a receptor is recognised by means of designation, and the 'value' element of the composite criterion recognises and gives weight in the assessment to that designation. However, irrespective of the recognised value, all receptors will exhibit a greater or lesser degree of sensitivity to the potential changes brought about by the Project. It should be noted that the assessment of sensitivity is a matter of judgement applied by professional experts, based on the receptors within the relevant Study Area.

Receptor Value

14.4.5.9 The UK Marine Policy Statement indicates that authorities should take account of the particular nature of the interest in the (heritage) assets, and the value they hold for this and future generations.

14.4.5.10 Both designated and non-designated heritage assets can hold heritage value. Value considers whether, for example, the receptor is rare, has protected status or has importance at a local, regional, national, or international scale. Designated heritage assets, such as Protected Wrecks, have high value.

14.4.5.11 For non-designated assets, significance (value) is best defined by Cadw's 'Conservation Principles' (2011), which describe value as a combination of evidential value; historical value; aesthetic value; and communal value. Evidential value derives from the physical fabric of an asset, and its ability to provide evidence relating to how the asset was made and used, and how this changed through time. Historical value can derive from particular aspects of past ways of life, or association with notable families, persons, events or movements – it is the connection between past events and society with the present. Aesthetic value relates to the design, construction and craftmanship of an asset. It can include setting, and views to and from the asset, which may have changed through time. Communal value derives from the meanings that an historic asset has for the people who relate to it, or for whom it figures in their collective experience or memory. It may be commemorative, spiritual or symbolic, such as meaning for identity or collective memory.

14.4.5.12 It is important to understand that high value and sensitivity are not necessarily linked within a particular impact. A receptor could be of high value but have a low or negligible sensitivity to an effect. Table 14.6 provides definitions for the value afforded to a receptor based on importance regarding legislation and guidance.

Table 14.6 - Definitions of the Value Levels for Historic Assets.

Value	Definition
High	Internationally or nationally important. Within a marine or intertidal context, high value heritage assets include: World Heritage Sites and heritage assets of acknowledged international importance, or that can contribute significantly to acknowledged international research objectives; Sites designated under the Protection of Wrecks Act, Ancient Monuments and Archaeological Areas Act or Protection of Military Remains Act; Grade I and Grade II* structures designated under the Listed buildings and Conservation Areas Act. Additionally, in line with the UK Marine Policy Statement, any remains which are not currently designated but have equivalent significance to a designated asset are also considered to be of high value.
Medium	Within a marine or intertidal context, medium value receptors include: Heritage assets that are not designated and that do not meet the criteria for designation (e.g. as a Protected Wreck or scheduled monument) but display evidential, historic, aesthetic or communal value as identified by Conservation Principles; Heritage assets, or groups of assets or landscapes, that contribute to regional research objectives, particularly those identified in the research framework for South West Wales.
Low	Within a marine or intertidal context, low value receptors include: Heritage assets displaying limited evidential, historic, aesthetic or communal value as identified by Conservation Principles; Heritage assets, or groups of assets, that contribute to a limited degree to regional research objectives, particularly those identified in the research framework for South West Wales.
Negligible	Heritage assets with very little or no surviving archaeological interest, and little or no evidential, historic, aesthetic or communal value as identified by Conservation Principles; Heritage assets or groups of assets that cannot appreciably contribute to acknowledged regional research objectives.
Uncertain	Historic assets for which the importance of the resource has not been ascertained. Archaeological resources, the importance of which cannot be ascertained.

Magnitude

14.4.5.13 Magnitude is defined in terms of the level of the impact above background conditions and natural variability, by whatever parameters are measurable.

- Impact level above background: the nature of change relative to the baseline: positive or negative; and
- Impact level in the context of natural variability.

14.4.5.14 Table 14.7 is in line with the wider methods used in this EIA for judging exposure and magnitude of impact but relates specifically to heritage assets. Definitions have been established with reference to key documentation including the Marine Policy Statement (2011).

Table 14.7 – Magnitude of impact (change)

Sensitivity	Description
High	Substantial loss or harm to the heritage asset and/or integrity of the heritage asset; or severe damage to key characteristics, features or elements (adverse) such that the heritage asset is lost or its significance is totally altered. Permanent/irreplaceable change, which is certain to occur. Large scale improvement of resource or attribute quality; extensive restoration or enhancement (beneficial)
Medium	Loss of, or alteration to key characteristics, features or elements; measurable change in significance, attributes, quality or vulnerability (adverse) such that the heritage asset and its significance is altered. Improvement to, or addition of key characteristics, features or elements of the resource; improvement to attribute quality (beneficial).
Low	Minor loss of, or small alterations to, one or a small number of characteristics, features or elements; noticeable change in attributes, quality or vulnerability (adverse). Minor improvement to, or addition of, one or a small number of characteristics, features or elements; very minor improvement to attribute quality (beneficial).
Negligible	No change or unquantifiable change to the receptor and its significance.

Significance of Effect

14.4.5.15 The significance of the effect upon offshore archaeology is determined by correlating the magnitude of the impact and the sensitivity of the receptor as presented in Table 14.8. On this basis potential impacts are assessed as of negligible, minor, moderate and major significance (definitions are provided in Chapter 2: Overview of EIA Methodology).

14.4.5.16 For the purposes of this assessment, any effects with a significance level of major and/or moderate have been deemed significant in EIA terms, while those of minor or negligible are deemed non-significant.

Table 14.8 – Effect Significance Matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Magnitude	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Minor	Negligible	Negligible

14.4.5.17 Table 14.9 provides further rationalisation of the implications and definition of each level of effect set out in Table 14.8 in relation to historic assets.

Table 14.9 - Effect Significance Definitions

Value	Definition
High	Adverse: Substantial harm or total loss of the value of a designated heritage asset (or asset worthy of designation), such that Development should not be consented unless substantial public benefit is delivered by the Development. Beneficial: Development will deliver a positive contribution and/or better reveal the value of a heritage asset of recognised international value, such that an application should be treated very favourably.
Medium	Adverse: Less than substantial harm or total loss of the value of a designated heritage asset or an asset of designable quality, such that the harm should be weighed against the public benefit delivered by the Development to determine consent. Harm to a non-designated heritage asset of a greater degree than that perceived of as Minor Adverse, which should be taken into account in determining an application. Beneficial: Development will deliver a positive contribution and/or better reveal the value of a designated heritage asset (or asset worthy of designation), such that an application should be treated favourably
Low	Adverse: Less than substantial harm to the value of a designated heritage asset, of a lesser degree than that perceived as Moderate Adverse, but which should still be weighed against the public benefit delivered by the Development to determine consent. Harm to a non-designated heritage asset that can be adequately compensated through the implementation of a programme of industry standard mitigation measures. Beneficial: Development will deliver a positive contribution and/or better reveal the value of a non-designated heritage asset
Negligible	No discernible change in receptor.

14.4.6 Standard Mitigation

14.4.6.1 A range of standard mitigation measures has already been applied to the Project as part of the over-arching site selection and iterative design process (see below and Chapter 3: Site Selection and Alternatives). Following current policy set out within the WNMP (in particular SOC_05) mitigation aims first to avoid adverse impacts on historic assets and their settings, then to minimise impacts where they cannot be avoided, and to mitigate impacts where they cannot be minimised.

14.4.6.2 Standard mitigation measures which the Project has already implemented, or is committed to in the future, in order to avoid potential impacts to offshore archaeology are listed in Table 14.10 below.

Table 14.10 – Standard Mitigation

Strategy	Criteria
Archaeological Exclusion Zones (AEZs)	Archaeological Exclusion Zones (AEZs) allow for in situ preservation. For potentially archaeologically significant contacts, that are clearly identifiable in the survey data, and where the extents are largely known, AEZs will be recommended. AEZs will remain for the life of the project, or until ground truthing or higher resolution data determine a reduction in potential, significance, or extents.
Temporary Archaeological Exclusion Zones (TAEZs)	Where a contact is not visible in the survey data but likely to exist on the seabed at a known position, or where the extents of a contact are not fully identifiable, or the contact has been identified as of high potential but the significance has not been determined, 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, or further investigation has been undertaken to establish significance, 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 or data coverage, positions are not accurately known or there is potential for the presence of additional material not covered by the survey extents. Any additional material 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 an awareness of the potential within an area, and an expectation of further investigation, is considered appropriate at this phase.
Protocol for reporting finds of archaeological interest (e.g. The Crown Estate, 2014).	A suitable protocol for archaeological discoveries is a key element of the mitigation procedures, particularly for contacts identified as of low archaeological potential, or where unexpected discoveries may be made. A suitable protocol should also be implemented during any works that may visually inspect the seabed or recover material to deck;
Watching brief	A watching brief is a programme of archaeological monitoring and recording undertaken during groundworks. Watching brief(s) have been recommended for the intertidal zone under certain construction scenarios.

Geoarchaeological assessment and analysis	Geoarchaeological work is in progress, accompanying the 2021 geotechnical campaign. This work is following best practice guidance set out in Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector (Cowrie 2011), and Archaeological Written Schemes of Investigation: Offshore Renewables Projects (The Crown Estate 2021). Assessment will include review of core logs to determine the potential for deposits of palaeoenvironmental and archaeological interest. It will be a staged process determined by the results of the assessment and may include analysis, reporting and publication. While this work is primarily to further investigate deposits it also provides mitigation for potential impacts to the palaeolandscape. The mitigation is afforded through the assessment, analysis and recording of core material (and publication where warranted) which provides preservation by record of the palaeolandscape remains.

14.4.6.3 This mitigation will result in the avoidance of historic assets, and potential historic assets, following the preferred option in policy.

14.4.6.4 Methods for all mitigation are set out within Volume 3, Technical Appendix 14.2: Marine Archaeology Written Scheme of Investigation & Protocol.

14.4.7 Assessment for Residual Effect Significance

14.4.7.1 The impact assessments and conclusions on significance of effect presented in Section 14.6 assume that these standard mitigation measures listed above have been successfully implemented. Where significant environmental impacts remain even after these standard measures have been factored in, then project-specific mitigation measures are detailed, and the residual significance of effect is presented.

14.4.8 Limitations to Assessment

14.4.8.1 There are a number of limitations to the assessment, affecting geophysical survey data, the walkover survey, desk-based sources and the submerged prehistoric archaeology assessment.

14.4.8.2 The geophysical survey data collected varied in specification across the Proposed Development, however, the data from each area are considered comparable and appropriate to characterise the marine archaeological potential of the proposed consent area. Mobilised sensors are detailed in the Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report. Line spacing varied across the survey areas but achieved a minimum of 100% coverage of both multibeam bathymetry and sidescan sonar data. Magnetometer data were collected on all main survey lines within the array area, averaging *c*.75 m line spacing. Within the ECC and nearshore areas, the magnetometer coverage was less consistent and ranged approximately between 30 m and 100 m.

14.4.8.3 Magnetometer data were not collected over the full survey area. Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report includes figures showing line spacing. Limitations stemming from the current line spacing have been accounted for within the mitigation recommended for the site, and the extents of AEZs and TAEZs have been formulated taking into consideration these limitations. These limitations were further countered by the detailed ROV investigation of two anomalies, for which further information was required. The ROV investigations provided detailed data on these two sites and allowed mitigation, including the sizes of TAEZs, to be honed.

14.4.8.4 There were also some limitations to the walkover survey. The walkover survey was conducted on 27 May 2021, during a period of low spring tides and, as such, the area surveyed was as extensive as possible. However, during the survey it was noted that kelp cover was extensive on the lower parts of the intertidal zone where bedrock outcrops on either side of West Angle Bay. This impeded visibility of these areas, including the area where remains of the HMS *Leda* (including cannon balls and nails) have been reported. This is taken into account by the assessment, and robust mitigation recommended taking into account this limitation.

14.4.8.5 There are also some limitations of the desk-based sources. Positional accuracy within data records can be variable: loss records may be based on a general description of a loss location and may not relate to seabed remains at that location. Additionally, there is variability in the accuracy of positions used to record seabed features. UKHO records, for example, can be derived from diver sightings or older positional equipment with variable levels of accuracy, all of which affect the precision of the position and the likelihood of seabed remains at a specific location. Further discussion of UKHO data is included within Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report. Limitations of previous datasets are offset by the archaeological assessment and review of site-specific geophysical survey data.

14.4.8.6 Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report also highlighted the lack of dating for sedimentary units identified within the Study Area, affecting understanding of submerged prehistoric archaeological potential. While broad levels of archaeological potential can be discussed based on the nature of the units (i.e., sub glacial deposits have different potential from fluvial or channel edge deposits) lack of dating means that specific archaeological potential from particular periods cannot yet be fully established. Geoarchaeological work is therefore in progress, accompanying the 2021 geotechnical campaign. This work is following best practice guidance set out in Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector (Cowrie 2011); and Archaeological Written Schemes of Investigation for Offshore Renewables Projects (The Crown Estate 2021).

14.4.8.7 Assessment will include review of core logs to determine the potential for deposits of palaeoenvironmental and archaeological interest and, following a staged process determined by the results of the assessment, may include analysis, reporting and publication. Input into core locations has allowed cores to be targeted to address specific questions, including the date of deposits and extent of glaciation at different stages. Further information on the methods for geoarchaeological involvement are set out within Volume 3, Technical Appendix 14.2: Marine Archaeology Written Scheme of Investigation & Protocol.

14.5 Baseline Conditions

14.5.1.1 This section contains a summary of the archaeological baseline and sensitivity of the assets identified within the offshore consent boundary. It is split into the following sections:

- Submerged prehistory and palaeolandscapes;
- Maritime archaeology;
- Aviation archaeology; and
- Maritime infrastructure, intertidal and adjacent sites.

14.5.1.2 Full discussion of each area is set out within Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report; and key points are summarised here.

Submerged prehistory and palaeolandscapes

14.5.1.3 The UK has been affected by several glacial events over the last 1 million years; including the Anglian (480-430,000 BP), the Wolstonian (350-132,000 BP), and the Devensian (122-11,700 BP); and intervening marine transgressions, all of which have influenced archaeological potential. The region under study experienced extensive glaciation over the Late Quaternary period, with multiple phases of advance and retreat of the Irish Sea Glacier, which generally flowed through the St Georges Channel in the Irish Sea, to the west of the Proposed Development. The patterns of glaciation were complex and the extents of glaciation in different periods still under debate (e.g. Gibbard and Clark, 2011; Hughes *et al.*, 2011; Gibbard *et al.*, 2017; Roberts *et al.*, 2020; see discussion in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report). These large-scale events have influenced the geomorphology, geology, and archaeological potential of the area.

14.5.1.4 The dating for the climatic stages discussed within this report include both years before present (BP); and Marine Isotope Stages (MIS), which are alternating cool and warm periods defined by oxygen isotope data derived from deep sea core samples.

14.5.1.5 A number of geological units and horizons were identified in geophysical surveys within the Proposed Development; five units in the ECC and five in the array area. The deposits are summarised in Table 14.11 and comprise a sequence of glacial deposits, incisions and channel infills covered by recent sands.

Table 14.11 - Units and Horizons Identified on Seismic Data within the Array Area and ECC

Unit	Horizon	Interpretation	Volume 3, Technical Appendix 14.1
Array area			
	H1	Base of what are likely Holocene recent seabed sediments which are predominantly sandy in composition. Sand waves are present in places.	Figure 26
	H2	Base of a large channel system present between 1 m and 25 m below the seabed and underlies the recent sediments. Contains laminated sediments thought to be interbedded sand and mud. It is thickest in the north western part of the Array area.	Figure 27
	H3	Base of a channel system which is earlier than H2. Composed of a large channel in the north of the Array area (2.5 km at its widest point), a smaller channel in the south (950 m at its widest point), and a number of smaller channels in the central part. Cuts through a sheet deposit, comprised of mixed sediment that may be a glacial till, which sits above H4.	Figure 28
	H4	Top of a series of poorly defined channel features and also maps the base of a possible glacial till into which the older channel system is cut. The channel fill below H4 is formed of potential pre-glacial channels that are poorly defined	Figure 29

Unit	Horizon	Interpretation	Volume 3, Technical Appendix 14.1
	H5	Top of rock	Figure 30
ECC			
Unit A	H050	Recent sediments exhibiting a range of textures including layered (nearshore), grainy (often sandwaves), smooth (along route variability), dipping (along route variability).	Figure 31
Unit B2	H055	Late-stage channel fill or till, generally with grainy texture, sometimes heterogenous with internal reflectors	Figure 32
Unit B1	H060	Late-stage channel fill, generally with smooth/homogenous texture along the export cable corridor, sometime heterogenous with internal reflectors, stacked layered channel fill in WTG array	Figure 33
Unit C	H100	Glacial channel fill exhibiting a range of textures including high amplitude layered reflectors (nearshore), partially grainy (very common), stacked layers (observed in some fill packages beneath Unit B2) and hyperbolae (typically marks base of channels).	Figure 34
Unit D	Base not observed	Rock that exhibits either structureless, grain/dipping, or dipping textures	N/A

14.5.1.6 The deposits identified within the ECC have been tentatively phased; Unit A is possibly Holocene, while Units B1 and B2 are defined as ‘late-stage’ glacial channels with B2 being likely Pleistocene. Sea level index points in the wider area suggest that the sea level was at -25.66m at 10,075 BP. Units B1 and B2 are present in channels at depths greater than -60m OD, indicating that they were submerged by the early Holocene and the formation of the channels predates this (Massey, 2004). Unit C is defined as filling ‘early stage’ glacial channels (OWC, 2021a). Deposits within the array area have not been given tentative dates, though the upper deposit is likely to represent recent Holocene sands and multiple phases are evident within the channel systems.

14.5.1.7 However, no dating analysis has been undertaken and the units identified within the site are not yet correlated with known formations recorded within the area (e.g. Tappin *et al.*, 1994). The formations identified within the wider area are derived from the Pleistocene and Holocene and include the Surface Sands Formation (Holocene/Late Devensian), Western Irish Sea Formation (Devensian to Late Devensian), Cardigan Bay Formation (Wolstonian to Late Devensian), St Georges Channel Formation (Wolstonian), Caernarfon Bay Formation (Anglian to Wolstonian), and Bardsey Loom Formation (Cromerian). The units and horizons within the ECC and Array area could, feasibly, relate to a number of these known deposits from different periods.

14.5.1.8 While the age of the deposits within the Study Area is not certain, their characteristics provide some indication of archaeological potential. A number have properties indicative of glacial deposition, identified in Unit B2, C, and above H4 (OWC, 2021a; 2021b). These deposits are likely to have low archaeological potential, though dating of these deposits could constrain dates for glacial advances and retreats which would aid understanding of when the area was inhabitable by human populations. However, channel fill deposits with a fine-grained or interbedded nature (as seen in Unit B1 and the unit above H2) have heightened archaeological and palaeoenvironmental potential. There may also be archaeological potential associated with other channel deposits (e.g. above H3 and below H4), however, the nature of the fills associated with these channels is less clear and potential, therefore, more uncertain.

14.5.1.9 There is no known prehistoric archaeology within the Proposed Development, though worked flint flakes have been identified within the Study Area, and the coastal margins of southwest Wales are rich in prehistoric archaeological remains. There is, thus, potential for comparable evidence in the offshore region. The potential for submerged prehistoric archaeology within the Proposed Development is summarised chronologically below:

Lower and Middle Palaeolithic (c.970,000 – 45, 000 BC)

14.5.1.10 The environment within the Study Area varied considerably during the Lower to Middle Palaeolithic. During the Cromerian (970-480,000 BP, MIS 19-13), it is likely that the area was affected by fluvial to shallow marine processes, evidenced by the lithology of the Cromerian Bardsey Loom Formation, found in deep glacially-derived incisions on the Lundy Platform (Tappin *et al.*, 1994). Parts of the landscape may have been aerially exposed and habitable by humans, however subsequent glacial and marine processes are likely to have significantly reworked any remains present.

14.5.1.11 The Anglian glaciation (480-430,000 BP, MIS 12) followed the Cromerian stage and extended over the wider landscape, evidenced by Anglian-aged, glacially derived, members of the Caernarfon Bay Formation identified on the Lundy Platform (Tappin *et al.*, 1994; Gibbard and Clark, 2011).

14.5.1.12 Raised beach deposits on the Pembrokeshire coast indicate that the sea level was higher during the Hoxnian (430-350,000 BP, MIS 11) than it is today (Bowen, 1973; Stevenson and Moore, 1981). Potentially Hoxnian-age upper parts of the marine derived Incision Infill Member provide further evidence of marine conditions during this period (Tappin *et al.*, 1994). However, evidence of a Hoxnian temperate forest environment is present at West Angle, the location of the project landfall. Pollen analysis of clays and muds overlying a raised beach deposit produced evidence of temperate forest taxa, suggesting the area was terrestrial and wooded (Stevenson and Moore, 1982). This evidence likely dates to the late Hoxnian, during the marine regression associated with the onset of the Wolstonian, and the raised beach it lies upon likely dates to the early to middle Hoxnian, during a period of marine transgression.

14.5.1.13 The Wolstonian Complex (350-132,000 BP, MIS 10-6) was broadly glacial in nature, however, it was punctuated by two interstadials; the Purfleet (337-290,000 BP, MIS 9) (Bridgland *et al.*, 2013); and Aveley (243 - 150,000 BP, MIS 7) (Langford *et al.*, 2014; McNabb, 2007). Glacial till deposits found inland, and glaciomarine deposits within the St George's Channel and Caernarfon Bay Formations found on the Lundy Platform, suggest that the Study Area was likely covered by ice or sea during much of the Wolstonian (Bowen, 1973; John, 2016; Tappin *et al.*, 1994). However, the earliest evidence of humans found in Wales is a jaw fragment from *Homo neanderthalenis* from Pontnewydd, dated to 230,000 BP (placing it within the Aveley interstadial), suggesting that areas of South Wales were habitable during parts of the Wolstonian, likely focused around the interstadials (Green *et al.*, 1981).

14.5.1.14 The Study Area was likely a marine environment during the subsequent Ipswichian interglacial (135-115,000 BP, MIS 5e), with sea levels higher than today. This is evidenced by raised beach deposits on the Gower Peninsula and Poppit Sands, Pembrokeshire (Hiemstra *et al.*, 2008).

14.5.1.15 The early to middle parts of the Devensian glaciation (115-55,000 BP, MIS 5d-1) caused marine regression that, possibly, left parts of the wider landscape aerially exposed. The early to middle phase of the Devensian glaciation is believed, however, to have covered the Outer Bristol Channel region entirely (Bowen *et al.*, 2002; Rolfe *et al.*, 2012).

14.5.1.16 The wider landscape was, predominantly, covered by ice, or submerged, during Lower to Middle Palaeolithic and, as such, the potential for archaeological remains is limited. Remains may have been laid down in sediments deposited during interfaces between interglacial/interstadial and glacial stages when the seas were regressing or advancing, such as the Incision Infill Member of the Caernarfon Bay Formation, and the Bedded and Infill Member of the Cardigan Bay Formation. These deposits were possibly laid down during periods of aerial exposure of the current seabed; however, they are likely to have been disturbed by subsequent glacial and/or marine processes. It is also not known if these deposits are present within the site, though they are recorded from the wider area. Additionally, the earliest known evidence for hominid activity in Wales is dated to c. 230,000 BP, indicating very limited potential for remains from earlier dates. Thus, the potential for archaeological remains from this period is low. Remains may survive in sheltered areas such as cave sites, though other material is likely to have been heavily reworked and remains potentially redeposited. No cave sites are present within the Study Area, limiting the potential for *in situ* remains.

Upper Palaeolithic (c. 45,000 – 8, 500 BC)

14.5.1.17 The conditions within the Proposed Development are likely to have fluctuated between glacial, marine, and terrestrial during the Upper Palaeolithic as the Devensian ice sheet advanced and retreated. The Proposed Development was likely to have been mostly subglacial until the middle Devensian, when the nearshore area was possibly aerially exposed (Tappin *et al.*, 1994). The area is known to have been inhabitable during this period, human remains were identified in a cave in Gower (54 km to the east of the site) dated to *c.* 33,000 BP (Dinnis, 2012).

14.5.1.18 The onset of the Dimlington Stadial brought about major sea-level fall in the area as the ice advanced. The glacially-derived Upper Till Facies of the Cardigan Bay Formation has been identified in cores across the Lundy Platform, although the full extent of the Dimlington Stadial is debated - the ice may not have covered the Proposed Development (Gibbard and Clark, 2011; Hughes *et al.*, 2011; Gibbard *et al.*, 2017; Roberts *et al.*, 2020). The members of the Late Devensian Western Irish Sea Formation were mostly deposited in a glaciomarine environment, indicating that areas of the region were submerged at the end of the Devensian. Towards the end of the glaciation, during climatic amelioration following the Dimlington Stadial and prior to the Loch Lomond glaciation, inshore areas of the Proposed Development may have been aerially exposed and habitable, with the offshore area possibly submerged (Fitch *et al.*, 2011).

14.5.1.19 Late Upper Palaeolithic material has survived in cave deposits on the Pembrokeshire coast at sites as close as 10 km to the Proposed Development (NPRN: 92727). This evidence suggests that humans were present in the wider area during the Upper Palaeolithic period and, thus, indicates that there is potential for archaeological remains to be present within the Proposed Development, dating to periods when it was aerially exposed. Remains may be present in deposits laid sub-aerially such as the Seabed Depression Member and SL2 of the Surface Sands Formation, although these are likely to have been reworked by marine incursion following the melt of the Devensian ice at the beginning of the Holocene (Tappin *et al.*, 1994).

Mesolithic (c. 8,500 – 4,000 BC)

14.5.1.20 By 9,500 BP the array area was likely submerged, however, parts of the ECC were likely terrestrial until *c.* 6000 BCP, when the Severn estuary was submerged (Bell, 2007). Humans were likely exploiting coastal resources during this period, evidenced by Mesolithic flint flakes found at West Angle Bay (MSDS_Erebus_068), and flint working sites identified on the beach at Freshwater East (17 km from landfall site) and on Nab Head (10 km from landfall site) (NPRN: 308819, 424206, and 524741). There is potential for Mesolithic remains to be present within the site, particularly the ECC.

14.5.1.21 Although marine transgression is likely to have disturbed and reworked Mesolithic remains, it is possible for such remains to be preserved *in-situ* particularly within sheltered environments such as caves, and in channel deposits identified within the Proposed Development. These channels may date to this or earlier periods, and could have provided favourable locations for human activity. Channel fill deposits may contain preserved archaeological and palaeoenvironmental remains where they have been protected from reworking by marine action.

Submerged Prehistory and Palaeolandscapes Summary

14.5.1.22 Overall, there is considered to be potential for:

- *In situ* prehistoric archaeological sites particularly dating from the Late Upper Palaeolithic and Mesolithic period;
- Redeposited prehistoric archaeological remains from all periods; and
- Palaeoenvironmental and geoarchaeological material within the units identified within the Study Area.

Sensitivity of Receptors - Submerged Prehistory and Palaeolandscapes

14.5.1.23 Channel systems within the Study Area may have provided foci for prehistoric communities, and archaeological and palaeoenvironmental remains may be preserved in these areas. If present, deposits and potential archaeological remains could address research questions identified within the Palaeolithic and Mesolithic Research Framework for the Archaeology of Wales. In particular, palaeoenvironmental deposits could address questions relating to the survival of deposits from these periods and could provide evidence which allows Mesolithic sites to be better related to the environmental record in the coastal zone. Additionally, the remains would have the potential to contribute to questions in the Maritime Research Framework for the Archaeology of Wales, such as how the Welsh coastline altered during early prehistoric periods (CIfA Wales, 2008).

14.5.1.24 Till deposits have also been identified within the site. While sub-glacial deposits have no archaeological potential, dating of till deposition can constrain dates in which the area may have been inhabitable by hominid communities. Overall, these deposits could contribute to our understanding of research priorities identified by the Maritime Research Framework for the Archaeology of Wales, in particular *"To understand the early prehistoric colonisation and exploitation of the coastline of Wales as it changed through time, by studies of the terrestrial evidence and associated submerged landscapes"* (CIfA Wales, 2008). Taking into account their potential evidential value, the palaeoenvironmental remains could be of medium archaeological value. Any such remains would have no ability to recover from physical impacts, and their overall sensitivity is considered to be medium.

14.5.1.25 If archaeological sites are associated with these channels, their early date and potential evidential value and rarity indicates that they could be of high archaeological value, with a high level of sensitivity. Redeposited remains may also be present. While these remains may hold evidential value inherent within their physical form, without *in situ* contextual information their evidential value is limited, though secondary contexts can, in some cases, hold some evidential value. The overall sensitivity of redeposited material is considered to be low.

Maritime Archaeology

14.5.1.26 Maritime archaeological sites include locations where the remains of vessels have come to rest on the seabed or intertidal zone. These vessels may be lost as a result of collision, accident, wartime activity, or deliberate sinking. A maritime archaeological site might be present on the seabed in the form of an entire wreck, parts of wreck, cargo, or other isolated remains.

14.5.1.27 The potential for maritime archaeological remains to be present from early prehistory to the modern period is discussed in full in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report and summarised here.

Wreck sites and geophysical anomalies

14.5.1.28 Desk-based sources record 33 wrecks within the Study Area, of which one (HMS *Leda*) lies within the offshore consent boundary. This vessel reportedly wrecked on the rocks at West Angle Bay in 1808 and was salvaged at the time, though cannon balls, nails and wreckage were recovered from the rocks in this area in 1980. The UKHO records the position of this wreck on the rocks in northern part of West Angle Bay.

14.5.1.29 The gullies and rocky shoreline of West Angle Bay were searched during the intertidal visit for evidence of this wreck. No remains were found, though kelp cover was extensive on the lower shoreline impeding visibility. Likewise, no evidence of this wreck was identified within the drone footage; though, again, kelp covered the area. The geophysical surveys did not cover this area. As such it was not possible to ascertain with certainty the presence or absence of the wreck. Taking a precautionary approach, this assessment considers that there is potential for remains of this wreck to be present within the offshore consent boundary, particularly in gullies within the bedrock on which it reportedly wrecked. Any surviving remains would be expected to be fragmented.

14.5.1.30 Geophysical survey data provide further evidence of potential maritime archaeological sites (and potential aviation sites). A total of 197 anomalies of potential anthropogenic origin were identified using the multibeam bathymetry and sidescan sonar data, with any corresponding magnetic anomalies, within the Study Area where there was geophysical data coverage; 197 of which fall within the Proposed Development and Study Area. These are categorised by potential in Table 14.12.

Table 14.12 – Distribution of Anomalies by Potential within the Study Area

Potential	Proposed Development	1 km buffer (wider Study Area)	Total
High	3	2	5
Medium	11	11	22
Low	100	70	170
Total	114	83	197

14.5.1.31 Table 14.13 gives an overview of the nature of high and medium potential anomalies. Full details of each high, medium, and low potential anomaly are set out in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report.

14.5.1.32 Five anomalies of high archaeological potential were identified within the Study Area, three of which fall within the offshore consent boundary. The three anomalies within the offshore consent boundary are ERS21_0099, ERS21_0123 and ERS21_0137. The two which lie outside of the offshore consent boundary but within the Study Area are ERS21_0032 and ERS21_0222 (see Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report for further details). The anomalies identified as of high archaeological potential primarily relate to wrecked vessels (ERS21_0137; ERS21_0132; ERS21_0222; ERS21_0032); with one interpreted as unidentified debris, but of a size that may indicate a wrecked vessel (ERS21_0099). Of the five anomalies identified, one (ERS21_0032) is associated with a UKHO record (11902) but is not named. Full details of each anomaly are set out in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report.

Table 14.13 – High and medium potential anomaly categories within the Proposed Development and Study Area

Anomaly category	Proposed Development	1 km buffer (wider Study Area)	Total
High Potential			
Wreck	2	2	4
Unidentified debris	1	-	1
Medium Potential			
Anchor	1	1	2
Likely geological	-	2	2
Mound	1	1	2
Potential debris	3	3	6

Anomaly category	Proposed Development	1 km buffer (wider Study Area)	Total
Unidentified debris	6	2	8
Wreck debris	-	2	2

14.5.1.33 22 anomalies were identified as of medium archaeological potential within the assessment extents, 11 of which fall within the Proposed Development. The anomalies identified as of medium archaeological potential range from debris with potential association to a wrecked vessel, to mounds that may represent partially buried material. The precautionary approach used during the archaeological assessment means that possible geological features, where there is the potential they may represent anthropogenic debris, have been assessed as of medium archaeological potential. Full details of each anomaly are set out in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report.

14.5.1.34 Low potential anomalies represent a range of items including anchors, cables, chain or rope, potential marine mammals, potential geological features, mounds, debris, seabed disturbance, unidentified debris, towed equipment and fishing gear. Further details are set out in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report.

14.5.1.35 In addition, 1,355 magnetic anomalies, without strongly correlating anomalies of archaeological interest visible in the surficial datasets, were identified within the survey data; of which, 501 fall within the Proposed Development. Whilst the vast majority of these are unlikely to be of archaeological interest, some may represent archaeological material. 109 magnetic anomalies considered large (>100 nT) have been identified within the assessment extents, 46 of which lie within the Proposed Development. These anomalies have the potential to represent material of anthropogenic origin that may be of potential archaeological significance, though currently their form and origin is uncertain.

14.5.1.36 Archaeological potential for maritime archaeology is discussed further below, chronologically.

Early Prehistory (Palaeolithic to Mesolithic)

14.5.1.37 The potential for early prehistoric maritime remains is low; there are no known early prehistoric maritime sites in Wales and no evidence of seafaring predating the Mesolithic in Western Europe. However, indirect evidence of seafaring indicated by the migration of humans to Australia around 40,000-60,000 BP (Balme, 2013), and the colonisation of the island of Flores by *Homo erectus* 800,000-900,000 years ago (Rose, 1998) suggests that the technology for seafaring has been available for much of human history.

14.5.1.38 There is evidence of terrestrial human activity in the vicinity of the Proposed Development from the Palaeolithic and Mesolithic, as discussed above. It is possible that these people engaged in seafaring; however, there is currently no evidence to indicate as such and the potential for maritime remains from these periods is very limited given their rarity worldwide.

Neolithic and Bronze Age (4,000-700 BC)

14.5.1.39 Seaworthy dugout canoes have been identified in the UK dating to the Neolithic (Dunkley, 2012), and Bronze Age sewn plank built boats have been found in coastal contexts in England (Wright *et al.*, 2001; Van de Noort and Bayliss, 1999; Clark, 2013) which indicates that Neolithic and Bronze Age peoples were engaging in, at least, coastal seafaring. However, the rarity of Neolithic and Bronze Age maritime remains, nationally and globally, suggests the potential to for such remains to be present within the Proposed Development is low.

Iron Age and Roman (700 BC -410 AD)

14.5.1.40 Imported material found in terrestrial contexts provides evidence of trade between the UK and the continent during the Iron Age (Dunkley, 2012). Promontory forts within the project Study Area indicate that humans were active in the area during the Iron Age, although it is uncertain whether these communities engaged in seafaring. The Romans reached Wales in 48 AD, and there is evidence of a strong trading connection between Wales and the rest of the empire, with evidence of shipping to the continent and Ireland (Lewis, 2019). This increase in maritime activity raises the potential for remains dating to the Iron Age and Roman periods to be present within the Proposed Development, however this potential is limited by the general rarity of such remains.

Early Medieval and Medieval periods (410–1536 AD)

14.5.1.41 Local and regional developments in maritime technology, as well as new boat building styles brought by Scandinavian invaders and settlers, facilitated an increase in maritime activity during the early medieval period. Coastal and cross-channel trade remained prevalent after the fall of the Roman empire (Wooding, 2019). Residents of an early medieval settlement at West Angle Bay (Cadw ID: PE554), within the project Study Area, may have engaged in maritime activity.

14.5.1.42 The Milford Haven area was a centre of trade during the medieval period; French and Iberian wine was a frequently traded commodity in Pembroke, Milford Haven, and Tenby, and vessels from a number of places, including Milford, carried out the main trade with Ireland (Redknap, 2019). The area also sheltered large naval forces during the medieval period; in 1405 a French fleet was housed in Milford Haven, present in support of Owain Glyndŵr, and in 1485 the Haven hosted a fleet held by Henry Tudor (Redknap, 2019).

14.5.1.43 Despite an increase in maritime activity during the early medieval and medieval periods, the generally rarity of remains nationally, and the generally low rates of preservation of materials of such age, indicates that there is limited potential for maritime remains from these periods to be present.

Post Medieval (1536-1900)

14.5.1.44 There was a boom in maritime activity during the post medieval period. The number of trade routes continued to increase; industries including fishing, lime, and coal became established in south Wales and these resources were shipped all over the UK and Europe, and military and naval structures were built on the coasts in response to the rising threat posed by Napoleon III of France (Jenkins, 2019a; Scott *et al.*, 2019; Groom, 2019; Vousden and Groom, 2019; Nash, 2019; Hughes, 2019; Davies, 2019). Evidence of these industries is evident at West Angle Bay; a lime kiln, brickworks, and quarry are adjacent to the beach, and a channel cut into the bedrock to facilitate access to a natural harbour suggests that West Angle Bay was a hive of activity during the post medieval period.

14.5.1.45 The advent of the steam engine, and the use of iron and steel in shipbuilding meant that ships were able to transport more cargo, travel faster and further, and do so more safely than wooden built ships.

14.5.1.46 A total of 126 vessels have been recorded as lost within the Study Area. Most positions do not correlate with seabed remains, however, known wreck sites are discussed above.

14.5.1.47 These records, along with the increase in shipping traffic and naval activity, and the developments in shipbuilding indicate that the potential for post medieval archaeological remains to be present in the area is relatively high.

Modern (1900-present)

14.5.1.48 The last century has seen a further boost in maritime activity. The transport of people for recreational purposes, the economic reliance on sea-trade, and the two World Wars increased the maritime traffic in the area. The industries established during the post medieval period continued to flourish into the 20th century; in 1913, 26 million tonnes of coal were shipped from southern Welsh ports (Jenkins, 2019b).

Maritime Archaeology Summary

14.5.1.49 The assessment identified:

- Known wreck sites and high potential anomalies with the Proposed Development and Study Area;
- Medium potential geophysical anomalies within the Study Area which may represent maritime archaeological remains;
- Low potential geophysical anomalies;
- Magnetic anomalies of uncertain origin; and
- Further potential for wreck sites and isolated maritime remains within Study Area indicated by documented losses and Receiver of Wreck records.

Sensitivity of Receptors - Maritime Archaeology

14.5.1.50 With the exception of HMS *Leda*, the identity of the wrecks and other high potential anomalies identified within the offshore consent boundary is unknown. Wreck sites can be designated under the Protection of Wrecks Act 1973, or as Scheduled monuments under the Ancient Monuments and Archaeological Areas Act 1979. The value assigned to a particular wreck is case-specific, depending on a number of factors including its historical importance, rarity, and level of survival. Any wreck sites dating from pre-1815 are likely to be of high archaeological significance, based on the rarity of surviving vessels from this period.

14.5.1.51 Wrecks dating from 1816 to the present day may still be considered to be of high archaeological significance, where they specifically contribute to understanding of technological developments or particular events, people, and places (see Wessex Archaeology, 2008b). As the identity of these wrecks is unknown, or not proven, the remains could be of up to high archaeological value; this is also the case for other high potential anomalies. Additionally, the remains would have no ability to recover from physical impacts, and as such the overall sensitivity of the wreck sites is considered to be high. This would also be the case for any wreck sites which are currently unknown.

14.5.1.52 While wrecks and high potential anomalies are currently considered to be of high sensitivity, further investigation of two high potential anomalies, identified as wreck sites (ERS21_0123 and ERS21_0137), has been undertaken by ROV. These investigations were undertaken to clarify the nature and extents of the sites, and to shed further light on the potential significance of the wrecks. Investigations focused on these two sites as they lie in an area where offshore export cable installation is constrained by the Row's Rocks channel and further information was required to feed into mitigation strategies.

14.5.1.53 The ROV investigations of ERS21_123 showed the presence of a single boiler, incoherent metal structure, heavily corroded metal plating, an Admiralty pattern style anchor, and various unidentified ferrous features consistent with a wrecked vessel. The remains demonstrate that ERS21_0123 was a metal-hulled steam-powered vessel. The advent of steam-powered vessels was during the late 18th century, ruling out an earlier date, and this form of propulsion became common during the 19th century. The metal hull is consistent with a vessel dating from this period or later.

14.5.1.54 The extents of the wreck (16.7 x 7.8 m, with a measurable height of 1.0 m) were identified within the geophysical survey data and supported by the ROV investigations. The ROV footage further demonstrated that the wreck remains were incoherent but generally contained within a well-defined, and restricted, area of the seabed.

14.5.1.55 The likely 19th century or later date of the vessel and damaged remains suggest limitations to the significance of the wreck. However, further investigation into the identity, historical associations and technology of the vessel are required to inform the assessment of significance.

14.5.1.56 Investigation of ERS21_0137 showed the presence of a number of features. The most prominent was a probable hydraulic windlass (sitting upright) with probable anchor chain extending from the windlass away from the main wreck site (for a distance of c. 6 m). A mound of corroded chain was also identified adjacent to the windlass. Potential evidence of timber framing was also identified, in the form of three adjacent upright worn timbers which may represent frames. Ferrous debris was also present on the site but was generally isolated and incoherent. No evidence for the form of propulsion was identified. While timber frames are found on early vessels, their use has continued into the modern era and timber framing can still be found on some modern craft such as coastal fishing vessels. As such the potential timber framing does not constrain the date of the vessel. However, other features of the site (including hydraulic windlass) would not indicate a vessel of significant age.

14.5.1.57 The extents of the wreck (25.6 x 9.9 m and with a measurable height of 0.4 m) were identified within the geophysical survey data. The visible extents were lesser at the time of the ROV survey. Sandwaves were visible during the ROV survey and it is thought that part of the wreckage may have been covered by sand at the time of the ROV survey. However, as with ERS21_0123 the visible remains were clustered within a relatively restricted area. Further investigation of ERS21_0123 is required to inform the assessment of significance. Based on the current data the potential sensitivity of both wrecks has been maintained as high.

14.5.1.58 Further investigation of these two sites will be undertaken during the determination period of the Proposed Development in order to enhance understanding of the sites and their significance. These further investigations will involve: desk-based research to attempt to clarify identities and thus the histories of the vessels; and additional underwater investigations to further hone understanding of the extent of the wreck remains, their current condition and extent of survival in addition to identification of features which may aid desk-based research and identification. These will feed into a revised assessment of significance and continued refinement of mitigation strategies.

14.5.1.59 The identity of HMS *Leda* is known. However, the extent of any surviving remains is uncertain, though remains are unlikely to be intact or extensive. The vessel was salvaged following the initial wrecking, and the shoreline location on exposed bedrock would leave the wreck vulnerable to rapid decay. No remains of this vessel were observed during the intertidal walkover (though kelp cover was extensive in this area, impeding attempts to see into gullies where wreck material could be lodged).

14.5.1.60 As a ship of the line with a known identity, the vessel would be considered to have historic value, though the evidential value may be more limited given the likely poor condition and extent of any surviving remains. The overall sensitivity of the wreck is considered to be medium, taking into account high historic value and lower potential evidential value.

14.5.1.61 The anomalies identified as of medium archaeological potential range from debris with potential association to a wrecked vessel, to mounds that may represent partially buried material. The precautionary approach used during the archaeological assessment means that possible geological features, where there is the potential they may represent anthropogenic debris, have been assessed as of medium archaeological potential. While these anomalies could represent wreck material in some cases, their remains are not considered to have potential for high levels of evidential value. As with high potential anomalies, the remains would have no ability to recover from physical impacts, as such the overall sensitivity of the sites is considered to be medium.

14.5.1.62 The anomalies identified as of low archaeological potential are a mixture of small features, often boulderlike, or isolated linear features and modern debris such as rope, chain, fishing gear or seabed anomalies with associated magnetic anomalies. Low potential anomalies have been assessed against all available evidence and are deemed to be unlikely to be of archaeological significance, with low levels of heritage value. The overall sensitivity of the sites is considered to be low.

14.5.1.63 Further potential for isolated finds also exists. While the value of such remains is dependent upon period, rarity and a range of other factors, the likely disarticulated nature of the remains indicates their evidential value may be more limited, and up to a medium level of value is most likely, depending on the nature of the find. Any such remains would also have no ability to recover from physical impacts and, as such, the overall sensitivity of these potential remains would be medium.

14.5.1.64 Magnetic anomalies have also been identified within the Proposed Development. These anomalies have the potential to represent material of anthropogenic origin that may be of potential archaeological significance. These anomalies are generally buried items and their significance and sensitivity of these remains is uncertain.

Aviation Archaeology

14.5.1.65 There are two recorded losses of aircraft within the Study Area, and one recorded find of aircraft material; however, there are no records of aviation archaeological remains within the Proposed Development.

14.5.1.66 Southwest Wales has a rich history of aviation; during the 20th century a total of twelve Royal Air Force (RAF) or Royal Navy Air Service (RNAS) bases were constructed during World War I and World War II (John, 2003). These airfields operated a great variety of aircraft during wartime. Post-war, the majority of the military airfields were decommissioned, however a few remained and were converted to civilian airfields and operated into the 1950s.

14.5.1.67 Aircraft casualties rarely result in articulated aircraft remains on the seabed. Due to the traumatic nature of an aircraft crashing into the sea, the remains of an aircraft are usually scattered on the seabed (Wessex Archaeology, 2008). Aircraft, particularly military aircraft, are typically small and built of light materials; crashed remains may travel on the sea surface before sinking and settling on the seabed. Therefore, it is rare for remains to be identified articulated and *in situ*.

14.5.1.68 However, the high numbers of aircraft passing over the area (particularly during wartime) suggests that there is potential for the remains of the aircraft recorded as lost in the area and further aircraft to be present within the Proposed Development.

Sensitivity of receptor - Aviation Archaeology

14.5.1.69 While no remains are currently known from within the Proposed Development, if aviation remains did occur, such remains can automatically fall under the Protection of Military Remains Act 1986. They represent archaeological remains of high value. The remains would have no ability to recover from physical impacts and, as such, the overall sensitivity would be high. Identification of these remains, should they occur within the Proposed Development, is therefore important.

Maritime Infrastructure, Intertidal and Adjacent Sites

14.5.1.70 The assessment identified 19 sites relating to maritime infrastructure, intertidal and adjacent sites which lie within the Proposed Development. These represent a variety of remains from maritime infrastructure to terrestrial archaeological sites, and are summarised below. One wreck (HMS *Leda*) is also recorded in the intertidal zone. This asset has been discussed above.

14.5.1.71 Maritime infrastructure is represented within the intertidal area and is principally associated with the outcropping bedrock on the northern and southern sides of West Angle Bay. In the north a rock-cut channel leads to a natural embayment used as a harbour, and associated features were identified including a slipway, mooring points, concrete path and a possible crane base. A second natural embayment is also present immediately eastward of these features and may have been used to moor vessels though there is no evidence for a rock cut channel associated with this bay. Further evidence of maritime infrastructure is present on the southern side of West Angle Bay, represented by mooring points embedded within the outcropping bedrock. Seawalls are also present on the eastern side of the bay.

14.5.1.72 Aerial photographs of the site dating to the 1940s also showed a long, sub-linear, feature crossing the sandy part of the bay (MSDS_Erebus_304). It may represent a jetty, blockade, or other wartime feature. No remains of this feature were seen in the intertidal walkover. It is possible that the feature was removed after the war, however, evidence of the feature may survive below the sand.

14.5.1.73 The margins of the bay are also bounded by numerous archaeological sites which lie above the MHWS line. There is evidence of active erosion on the coastline and terrestrial remains may therefore occur as eroded finds within the intertidal zone. Such remains would not be *in situ*. Remains in the surrounding area include Mesolithic or Neolithic flint flakes found eroding from a clay pit next to the beach, two Iron Age promontory forts, and an early medieval settlement and chapel site, the remains of which are Scheduled and eroding. The Scheduled site contains human remains.

14.5.1.74 A series of later features including post-medieval and modern quarries, a lime kiln and brickworks and structures are also depicted on OS maps. While these were not seen to be actively eroding at the time of the site visit, there is potential for previously eroded remains to be present. Likewise military features shown on historic maps may also occur as eroded remains, though none was noted within the intertidal survey. A charcoal horizon (MSDS_Erebus_346) was identified eroding from the bank to the east of the beach, and on the eastern side of the larger harbour. Undated post-medieval/modern glass was found within the deposit, suggesting a relatively recent origin.

Sensitivity of Receptors - Maritime Infrastructure, Intertidal and Adjacent Sites

14.5.1.75 The sensitivity of HMS *Leda* has been discussed above. Other sites represent maritime infrastructure and sites within the Proposed Development which lie above the highwater mark and represent general use of the landscape around the bay.

14.5.1.76 Within the Proposed Development, evidence of maritime infrastructure may hold evidential value relating to the use of this bay as an historic landing place. The research framework for South West Wales identifies the following as a priority: *"To obtain a greater appreciation of the utilisation of the Welsh shores for trade and settlement, coastal and estuarine navigation, and the development of the coastal infrastructure of ports and harbours"* (CIfA Wales, 2008). Investigation of small harbours and the local hinterland (which includes evidence of industrial activities such as a brickworks and lime kilns) may contribute to this research priority indicating that maritime infrastructure sites could be of medium archaeological value. Such remains would not have the ability to recover from physical impacts, and their overall level of sensitivity is considered to be medium.

14.5.1.77 The nature of the linear feature, see section 14.5.1.72 is unknown but may represent a jetty, blockade, or other wartime feature. Although its nature is unknown, the location of the feature and its general form and date suggest a wartime and, possibly, maritime connection. If remains of this feature survive, they may hold some evidential value, though this may be limited. Overall, it is unlikely that the feature would represent an asset of more than medium sensitivity.

14.5.1.78 Eroded remains from the adjacent coast may also be present. In general, redeposited material can provide some evidence for the activities of past populations, however, without *in situ* contextual information this evidential value is limited, though secondary contexts can, in some cases, hold some evidential value. Mesolithic and later remains which may have eroded out of the adjacent coasts are most likely to occur within the site and would provide some evidence allowing us to understand activities at the time.

14.5.1.79 Redeposited remains such as this would be considered to have a low level of value in most cases. Additionally, redeposited material is already out of context, and as such has tolerance to accommodate removal from its current context. The overall sensitivity of these assets is considered to be low. However, the potential for human remains eroded from the nearby Scheduled early medieval settlement and chapel site demonstrates that some of the eroded material may be of up to high value and sensitivity.

Milford Haven Waterway: Landscape of Outstanding Historic Interest

14.5.1.80 The Proposed Development intersects the westernmost part of the Milford Haven Waterway Landscape of Outstanding Historic Interest in Wales. The onshore area also intersects within this Registered Landscape, and impacts are further considered within Chapter 23: Onshore Archaeology and Cultural Heritage.

14.5.1.81 The waterway is characterised as a ria, a drowned river valley, with evidence of activity from the prehistoric periods onwards and including evidence of settlement, military activity and defence, maritime remains and post-medieval to modern industrial installations.

14.5.1.82 Detailed characterisation of distinct areas within the registered landscape was undertaken by Dyfed Archaeological Trust. The offshore consent boundary intersects with one of the Character Areas: The West Angle to Freshwater West Coastal Strip. This area is characterised by the narrow coastal strip, with evidence of variety of archaeological sites, including military sites representing the historic defensive role of the area, in addition to other sites including Iron Age promontory forts, early medieval remains and evidence of flint working.

Sensitivity of receptors - Milford Haven Waterway: Landscape of Outstanding Historic Interest

14.5.1.83 Although the Historic Landscape is not designated the registered area contains evidence demonstrating the time depth and longevity of human activity within this landscape. The landscape is of high value and sensitivity. The value of the landscape is principally bound up in its physical form as a ria, archaeological sites, patterns of land use and current character.

14.6 Potential Environmental Effects

14.6.1.1 A series of activities during construction, operation and decommissioning have the potential to impact historic assets. The following section gives an overview of potential interactions between the proposed development and historic assets, and potential impacts to each asset type are set out within Table 14.14.

14.6.1.2 At the array area potential impacts are associated with anchoring and mooring for the semi-submersible floating platforms and offshore export cable installation. Anchoring will either be by drag embedment (DE) anchor, suction piling, driven or drilled piles. Use of piling or DE anchors all have the potential to impact archaeological remains. Mooring lines connecting the semi-submersible floating platforms to the anchor points on the seabed also have potential to impact archaeological sites. The mooring lines will include chains and clump weights on the seabed, and lines passing through the water column connecting to the semi-submersible floating platforms. These lines will move with the tide and will be associated with a 'swept' area, within which archaeological remains may be impacted by the movement of the lines.

14.6.1.3 Cable installation for array cables and offshore export cables also has the potential to impact archaeological sites both within the array area and ECC. Cable installation would include pre-lay grapnel runs, boulder clearance, trenching and sandwave levelling in some areas. The cables will be buried where possible though cable protection will be used in areas where burial cannot be achieved.

14.6.1.4 Sandwave levelling within the array area and ECC will also be undertaken to allow for use of DE anchors and cable installation. Sandwave levelling will be achieved using a mass flow excavator (MFE) or trailing suction hopper dredger (TSHD) both of which have potential to impact archaeological remains in their paths. The material excavated will either be deposited on a local (marine) disposal site(s) including three potential sites along the ECC and within the array area, or taken away onshore. If deposited on the seabed the dredged material also has the potential to impact archaeological remains, though the nature of the impact will be dependent on the deposition scenario and nature of the sediment deposited (see Chapter 6: Marine and Coastal Processes).

14.6.1.5 The cable will make landfall in West Angle Bay. There are currently two landfall options within West Angle Bay and the offshore consent boundary. Cable installation within this area will be by HDD or open cut trenching. The former would require excavation of exit pits above MHWS and below the waterline (excavated using vessels which would require anchoring or a jack up barge). Nearshore floatation pits (NFP) may be required to allow the vessel to float at low tide, and these pits would be installed using an excavator. Alternatively, open cut trenching may be used in the intertidal zone. This would involve installation of coffer dams or sheet piles and excavation of a linear trench. All methods have the potential to impact archaeological remains.

14.6.1.6 During construction the anchoring of vessels associated with the project have the potential to impact archaeological remains, as does the installation and mooring of ancillary equipment such as navigational markers.

14.6.1.7 Once constructed, seabed installations also have the potential to cause scouring of seabed sediments. The potential for scour has been assessed by Chapter 6: Marine and Coastal Processes. Scour protection is to be used where infrastructure cannot be buried as part of the embedded mitigation associated with the project. Embedment anchors will be buried and will not interact with waves or currents, and therefore will not lead to scour, though drilled piles, clump weights and mooring chains may. However, scour will be localised (Chapter 6: Marine and Coastal Processes).

14.6.1.8 During the operation and maintenance phase cable repair and remediation activities have the potential to impact archaeological remains where they fall beyond the footprint of construction impacts. Anchoring of vessels may also impact remains. This is also the case for decommissioning activities.

14.6.1.9 In summary, the following activities have the potential to impact archaeological remains:

- Anchoring: drilling or piling for anchor installation or use of DE anchors;
- Mooring lines: including chain, clump weights and swept area of catenary;
- Cable installation including array cables and offshore export cables;
- Sandwave levelling and disposal of material;
- HDD in the nearshore and intertidal area and associated exit pits and NFPs;
- Open cut trenching in the intertidal zone;
- Mooring/ anchoring of vessels and ancillary equipment;
- Scour associated with installations; and
- Cable repair and remediation and decommissioning.

14.6.1.10 Table 14.14 sets out the potential pathways for change to archaeological remains, in addition to the realistic worst-case scenario for each aspect of the project design and a justification in each case.

Table 14.14 – Project Design Envelope Parameters Relevant to Offshore Archaeology

Potential Pathway Change / Impact	Realistic Worst Case Scenario	Justification
Construction		
Potential impacts to known and potential wreck sites, aviation crash sites and geophysical anomalies	<u>Anchoring: Drilling or piling for anchor installation or use of drag embedment (DE) anchors:</u> • DE anchors: Maximum number: 63. Dimensions 8.5 m (L) x 9 m (W) x 5 m (H). Depth of penetration is TBC however the current estimation is 3 m – 25 m. Maximum anchor footprint: 3,476 m^2	Direct physical impacts to the seabed and sub-surface deposits have the potential to impact known and potential wreck sites and geophysical anomalies. Indirect physical impacts including scour caused by particular aspects of the construction also have the potential to effect known and potential wrecks and anomalies.

Potential Pathway Change / Impact	Realistic Worst Case Scenario	Justification
	• Suction piles: Maximum number: 35. Maximum dimensions: 6.5 m diameter, 20 m height. Penetration 8 – 17 m, with surface exposure of 3-4 m. Maximum anchor footprint: 1,161 m^2 • Driven pile anchors: Maximum number: 35. Maximum dimensions: 2.5 m diameter, 55 m length. Penetration 52 m, surface exposure of 3 m. Maximum footprint 175 m^2. Maximum volume of material removed from all pile footprints: 11,340 m^3 <u>Mooring lines: including chain, clump weights and swept area of catenary;</u> • Maximum number of lines: 35. Maximum mooring line length: 870 m • Movement of catenary (swept area, per line): up to 50 m in two predominant directions (swept area up to 100 m wide per mooring line, in a sector or arch shaped pattern) • Total swept area of catenary (all lines): 1,303,194 m^2 (37,234 m^2 per line) <u>Array cables</u> • Maximum number of cables: 10 • Cable diameter: up to 300 mm • Total length on seabed: 22.5 km • Maximum total area of seabed impacted with array cables and cable protection: 115,200 m^2	

Potential Pathway Change / Impact	Realistic Worst Case Scenario	Justification
	Export cables • Total length: 49 km • Maximum total area of seabed impacted by cable installation: 650,000 m^2 Sandwave levelling and disposal of material • Area of sandwave levelling in array: 20,300 m^2 • Area of sandwave levelling in ECC: 150,000 m^2 • Disposal within array and ECC HDD in the nearshore and intertidal area and associated exit pits; • Maximum number of bores: 6 • Bore diameter maximum 1200 mm • Maximum length: 1000 m • Sub-tidal exit pit: 360 m^2 • HDD exit pit protection (rock): 210 m^2 Open cut trenching with cofferdam/ sheet piling in the intertidal zone; • Maximum dimensions: (L) 650 m x (D) 3 m x (W) 10 m Nearshore flotation pits (NFP) • Area: 7,200 m^2 Mooring/ anchoring of vessels and ancillary equipment; • Area: 1,000 m^2	
Potential impacts to potential submerged prehistoric archaeological sites and palaeoenvironmental remains	See above for worst-case scenarios associated with:	Where activities have the potential to affect sub-surface deposits they may impact upon potential submerged prehistoric and palaeoenvironmental remains.

Potential Pathway Change / Impact	Realistic Worst Case Scenario	Justification
	• Anchoring: Drilling or piling for anchor installation or use of drag embedment (DE) anchors; • Cable installation including array cables and export cables; • Sandwave levelling and disposal of material • HDD in the nearshore and intertidal area and associated exit pits; • Open cut trenching with cofferdam/ sheet piling in the intertidal zone; • NFP • Mooring/ anchoring of vessels and ancillary equipment; and • Scour associated with installations.	
Potential impacts to maritime infrastructure, intertidal and adjacent sites.	• Cable installation including export cables; • HDD in the nearshore and intertidal area; and • Open cut trenching with cofferdam/ sheet piling in the intertidal zone;	Where activities will cause disturbance within the intertidal zone these have potential to impact intertidal remains.
Potential impacts to Milford Haven Waterway: Landscape of Outstanding Historic Interest.	• Cable installation including export cables; • HDD in the nearshore and intertidal area; and • Open cut trenching with cofferdam/ sheet piling in the intertidal zone;	These activities will occur within the footprint of the Milford Haven Waterway Landscape of Outstanding Historic Interest and therefore have the potential to cause impacts to the registered landscape.
Operation and Maintenance		
All receptors	<u>Cable repair and remediation</u> • Maximum EC repair during lifespan: 5.	All receptors have the potential to be impacted by cable repair, depending on the location of repair and remediation and whether it

Potential Pathway Change / Impact	Realistic Worst Case Scenario	Justification
	• Total area of disturbance x 5 EC repairs: 250,000 m^2 • Maximum IAC repairs in lifetime: 5 • Total area of disturbance x 5 IAC repairs: 1,505.250 m^2 • Maximum EC remediation events during lifespan: 12 • Total area of disturbance x 12 remediation events: 600,000 m^2	results in impacts beyond the zone of construction impacts.
Decommissioning		
All receptors	<u>Decommissioning</u> • As per above for construction	All receptors have the potential to be impacted by decommissioning, depending on the location of impacts and whether it results in impacts beyond the zone of construction, operation and maintenance impacts.

14.6.2 Construction

<u>Possible Effects to Potential Submerged Prehistoric Archaeological Sites and Palaeoenvironmental Remains</u>

Magnitude and significance of effect

14.6.2.1 Channel and glacial deposits are present within the array area and ECC. Depths are varied, but some are close to the surface (e.g., H2, marking the base of a channel system, is present from 1 m below seabed). Depending on the final design, these remains may therefore be impacted by anchoring (drilling, piling or use of DE anchors), cable installation, sandwave levelling (though likely focused within the recent Holocene sands and thus with limited impacts to earlier deposits), works around the landfall site (HDD, trenching, and NFPs), the mooring and anchoring of vessels and ancillary equipment and scour associated with installations. This represents a worst-case scenario, and some of the construction options may not impact the remains. Lower deposits are also less likely to be impacted. Additionally, the layout has not yet been fixed and channel features may not fall within the final area of impacts. However, in the worst-case scenario the impacts arising from construction activities could lead to the loss and disturbance of sediment around the anchor points and cables. The footprints of the impacts would be restricted. However, these impacts would be permanent and irreversible. They would occur at the time of construction and installation, though if cable repair and remediation and decommissioning activities extend outside of the area impacted during construction additional impacts may take place.

14.6.2.2 If these impacts were to occur within the areas of channels they would result in the loss of restricted areas of sediment from within the channels. Likewise, loss of restricted areas of glacial deposits could occur. This partial loss of restricted areas with such palaeoenvironmental or dating potential would result in a low magnitude of change. This would result in an effect significance of **minor adverse** effect, which is not significant in EIA terms.

14.6.2.3 While minor impacts do not strictly require mitigation geoarchaeological assessment can be a form of mitigation for these impacts. Geoarchaeological work is currently ongoing on the 2021 geotechnical cores, and this work will take steps to offsetting the impacts of the development on palaeoenvironmental remains and deposits of geoarchaeological interest.

14.6.2.4 If submerged prehistoric archaeological sites are present associated with the palaeolandscape this may result in a loss of these sites. This loss could affect an entire prehistoric site and could result in a high magnitude of change. This would result in an effect significance of **major adverse** effect, which is significant in EIA terms.

14.6.2.5 However, at present no such sites are known, and as such prospection and identification of such sites is important. If sites are identified, specific mitigation would be required. The mitigation strategy therefore allows for the recognition of sites, and implementation of subsequent mitigation.

14.6.2.6 If present, redeposited remains may be impacted by construction activities. These impacts may result in the movement or removal of finds that are not in situ. These impacts would be permanent and irreversible. They would occur at the time of construction. The key aspects of significance of these finds relate to the physical properties of the artefacts rather than contextual information. The impacts will not alter these characteristics, however if these finds are not perceived this information could be lost. Overall, this would result in a medium magnitude of change, resulting in a **minor adverse** effect, which is not significant in EIA terms.

14.6.2.7 Where possible, channels will be avoided by foundation design, in particular if piling is chosen for foundations, and cable burial. Avoidance, limiting contact or design resulting in no or low impact to the potential channels would provide mitigation such that there would be no significant effect on these potential channel features and any associated palaeoenvironmental and archaeological remains. Avoidance is a form of Standard Mitigation, and this will be applied wherever possible.

14.6.2.8 Where this is not possible additional mitigation is required, in particular to ensure that any prehistoric archaeological sites are identified, and impacts mitigated.

14.6.2.9 Due to the potential major adverse (significant) effect of loss of potential prehistoric archaeological sites (though none are currently known within the offshore consent boundary), standard mitigation will be applied. It is recommended that the following measures are adopted:

- Implement a protocol for the reporting of archaeological finds, for the duration of the Project (e.g., The Crown Estate 2014). Protocols provide a system for identifying, recording, reporting and investigating any unexpected discoveries made during the course of the project, including prehistoric material. If material is found, there is a range of next-step mitigation options including creation of temporary or permanent exclusion zones around areas in which archaeological sites or remains may exist. Implementation of the protocol would mitigate impacts upon channel features, potential unknown associated archaeological remains and isolated finds.

14.6.2.10 Following the application of these mitigation measures the Proposed Development would result in a residual impact upon potential submerged prehistoric archaeological sites which is of reduced from a major to **minor adverse** effect, which is not significant in EIA terms. The minor effect which remains stems from the initial impacts to the site allowing for its identification and reporting under the protocol.

Known and potential wreck sites, aviation remains and geophysical anomalies

Magnitude and significance of effect

14.6.2.11 The known and potential wreck sites and maritime archaeological remains of high and medium sensitivity have been summarised above. These remains lie within the ECC, intertidal area and array area (see positions in Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report) and may therefore be impacted by anchoring (drilling, piling or use of DE anchors), mooring lines and swept area of catenary, offshore export cable installation, sandwave levelling and disposal of material, works around the landfall site (HDD, trenching, and NFPs), the mooring and anchoring of vessels and ancillary equipment and scour associated with installations.

14.6.2.12 These receptors may also be impacted during operation, maintenance, and decommissioning. This represents a worst-case scenario, and some of the construction and layout options may not impact the remains. In the worst-case scenario the impacts arising from construction activities could lead to the loss and disturbance of parts of the wrecks. These impacts would be permanent and irreversible. They would primarily occur at the time of construction, although impacts may be incurred from mooring vessels and anchoring throughout the operation, maintenance, and decommissioning phases. If these impacts were to occur on the wreck sites they would result in the loss and disturbance of parts of the wreck remains. This would result in a high magnitude of change and an effect significance of **major adverse** effect, which is significant in EIA terms.

14.6.2.13 While major effects could occur, the use of AEZs has been embedded within the design of the project and will be applied to known and potential wreck sites and anomalies of high and medium potential (see Table 14.15 and Volume 2, Figures 14.1 – 14.4). No impacts will take place within these zones, from any activities set out above. Use of AEZs (including TAEZs) implements the requirements of WNMP Policy SOC_05 which stipulates that development should aim, in the first instance, to avoid impacts to historic assets. AEZs ensure that physical impacts will be avoided.

Table 14.15 – Recommended AEZs, Positions Relative to WGS84 UTM Zone 30N

MSDS ID	Potential	Description	X	Y	AEZ
ERS21_0032	High	Wreck	322809.0	5702192.5	Outside area
ERS21_0099	High	Wreck	346455.1	5718238.0	50 m extents
ERS21_0123	High	Wreck	352719.9	5727917.7	25 m extents
ERS21_0137	High	Unidentified debris	351655.3	5726857.8	25 m extents
ERS21_0222	High	Wreck	352897.7	5729037.3	Outside area
ERS21_0013	Medium	Unidentified debris	320329.2	5701692.1	15 m radius

MSDS ID	Potential	Description	X	Y	AEZ
ERS21_0017	Medium	Potential debris	320758.2	5704324.4	15 m radius
ERS21_0019	Medium	Unidentified debris	321145.8	5704254.3	15 m radius
ERS21_0024	Medium	Unidentified debris	315665.6	5706366.1	Outside area
ERS21_0035	Medium	Unidentified debris	322268.1	5701978.8	15 m radius
ERS21_0051	Medium	Unidentified debris	316469.5	5702932.7	15 m radius
ERS21_0063	Medium	Unidentified debris	321332.0	5708034.0	Outside area
ERS21_0071	Medium	Wreck debris	322862.8	5702130.9	Outside area
ERS21_0083	Medium	Potential debris	332862.6	5705175.1	Outside area
ERS21_0091	Medium	Likely geological	346006.2	5717330.6	Outside area
ERS21_0093	Medium	Potential debris	348602.8	5719723.0	Outside area
ERS21_0094	Medium	Potential debris	348571.0	5719691.5	Outside area
ERS21_0096	Medium	Potential debris	343315.5	5715644.0	15 m extents
ERS21_0097	Medium	Likely geological	348579.7	5719905.3	Outside area
ERS21_0103	Medium	Mound	341392.0	5713917.5	25 m extents
ERS21_0106	Medium	Potential debris	337286.5	5710386.1	25 m extents
ERS21_0114	Medium	Unidentified debris	350635.9	5725211.2	25 m extents
ERS21_0125	Medium	Anchor	353252.1	5729471.9	Outside area
ERS21_0132	Medium	Anchor	353305.3	5728706.1	15 m radius
ERS21_0205	Medium	Mound	354603.3	5729274.8	Outside area
ERS21_0265	Medium	Unidentified debris	350231.3	5725047.9	15 m radius
ERS21_0273	Medium	Wreck debris	352938.6	5729049.6	Outside area
MSDS_Erebus_245	Medium	Potential Wreck Debris	353960.5	5728442.9	50 m radius

14.6.2.14 The size of the AEZs has been determined following detailed assessment of each site based on the available survey data. Three AEZs have been recommended for the three high potential contacts identified within the offshore consent boundary, ERS21_0099, ERS21_0123 and ERS21_0137. All three contacts are similar in that they are visible within the SSS and MBES data, but fall outside the extents of the magnetometer coverage, they are also not associated with any recorded heritage assets or UKHO records.

14.6.2.15 ERS21_099 was identified and assessed based on geophysical survey data and interpreted as a possible wreck site defined as a high potential anomaly. The nature of the visible remains indicates the presence of a mound with outlying features. The remains are incoherent and the nature of the seabed in this location indicate that there may be additional sub-surface remains which lie beneath the sand. This sand coverage places limitations on the interpretation of the extents of the feature and (in the absence of magnetometer data to inform potential sub surface extents) an AEZ, 50 m from the extents of the visible remains, has been recommended. This large AEZ has been recommended to ensure associated buried remains are protected. The size of the AEZ ensures robust but proportional mitigation.

14.6.2.16 Like ERS21_099 high potential anomalies ERS21_0123 and ERS21_0137 were initially identified in the geophysical survey data. However, due to the narrow nature of the Row's Rocks channel in this area additional investigation using an ROV was undertaken to further refine understanding of the sites and recommend appropriate mitigation strategies. Detailed investigation such as ROV surveys specifically for archaeological purposes are not undertaken as standard at the pre-application stage. However, it was felt in this case that such surveys were warranted to provide a robust understanding of these high potential anomalies and their extents to enable accurate assessment of the impacts and mitigation planning required for the EIA process.

14.6.2.17 Seabed remains on both sites were observed to be clustered in restricted areas and as such AEZs of 25 m around the visible extents of the wrecks are currently recommended for both wreck sites. The aims of these AEZs are to avoid damage to the archaeological remains in line with WNMP Policy SOC_05 which stipulates that avoidance of historic assets is the preferred option. The 25 m buffers from the visible extents of the wrecks have been recommended to protect all known remains associated with the sites in addition to allowing for a 25 m buffer protecting any potential sub-surface remains. As the visible remains on both sites are contained within a well-defined, and restricted, area of the seabed this 25 m buffer is considered robust and appropriate.

14.6.2.18 In addition, further investigation will be undertaken during the determination period of the Proposed Development. This further investigation will aim to gather information to determine the precise extents and significance of the wreck sites. Underwater surveys will be undertaken to identify key features and determine the condition of the remains, and to further hone understanding of the extents of the wrecks (particularly any remains which lie sub-surface). Surveys will also seek to gather information to aid in the identification of the remains through subsequent detailed desk-based research.

14.6.2.19 If appropriate, following these further surveys mitigation will be revised. Any recommendations for revised mitigation will have regard to the significance of the wreck sites, which will be reassessed following the additional underwater surveys and desk-based research. Any revisions to mitigation will always seek first to avoid remains (wherever possible) and secondly to minimise any harm to the historic assets, in line with WNMP Policy SOC_05. Revised mitigation strategies will be produced in consultation with the archaeological curators and any investigation and alteration to AEZs would be in line with the processes set out within the Written Scheme of Investigation (see Volume 3, Technical Appendix 14.2: Marine Archaeology Written Scheme of Investigation & Protocol).

14.6.2.20 The further investigation of these sites will also provide an enhanced understanding of the wrecks. This strategy is therefore fully in line with WMNP Policy SOC_05 in its plans to avoid areas where foreseeable impacts could occur, then minimise and mitigate potential impacts and enhance the understanding of these historic assets.

14.6.2.21 An AEZ has also been recommended to protect the area in which the probable remains of HMS *Leda* were reported. HMS *Leda* was a fifth-rate ship of the line, built in 1800 and lost in 1808, when the vessel reportedly wrecked on the rocks at West Angle Bay. The UKHO consider the position vague, derived from diver sightings and the loss record. However, the position given is 'live' and reports from the RCAHMW indicate that after the vessel went aground on the rocks it was accessible for a period of three weeks, during which time the stores and equipment were salvaged, after which it was abandoned, and the vessel broke up. Wreckage, cannon balls and nails were reported from the area in 1980. The gullies and rocky shoreline of West Angle Bay were searched during the intertidal visit. No remains were found, though kelp cover was extensive on the lower shoreline impeding visibility.

14.6.2.22 While remains of HMS *Leda* may be present it is likely that the majority of the wreck was removed through contemporary salvage and any remaining evidence is likely to be scattered and situated within rocky gullies on the margins of West Angle Bay. An AEZ is therefore proposed as a precautionary measure to protect potential remains in this area. The AEZ forms a 50 m buffer around the reported location of the wreck and is focused on the exposed bedrock and gullies where remains of the vessel may survive. Thus, as with other wrecks, the size of the AEZ has been formulated taking into account the likely extent of any remains. Additional mitigation for works within the intertidal zone is also proposed. This includes implementation of a reporting protocol for any finds of archaeological interest, to be applied across the whole project, and recommendations for a watching brief should open cut trenching be undertaken within the intertidal zone. Mitigation for the intertidal zone is discussed in more detail below.

14.6.2.23 Other AEZs have been recommended in order to protect other medium potential anomalies identified within geophysical survey data covering the offshore consent boundary. All AEZs are listed in Table 14.15. The recommendations for each AEZ, and its size, have been formulated through the archaeological review of geophysical survey data, and recommendations have been made on a case-by-case basis.

14.6.2.24 Following the use of standard mitigation there would be no impacts to known and potential wreck sites. Potential effects would therefore be reduced from a major to a **negligible** effect, which is not significant in EIA terms.

14.6.2.25 Buried magnetic anomalies are of an uncertain level of significance. In the worst-case scenario the impacts arising from construction activities could lead to the loss and disturbance of the anomalies. These impacts would be permanent and irreversible. They would primarily occur at the time of construction, although impacts may be incurred from mooring vessels and anchoring throughout the operation, maintenance, and decommissioning phases. These activities could potentially result in a high magnitude of change.

14.6.2.26 This would result in an uncertain significance of effect, due to the uncertainty regarding their origin and form. As such Temporary AEZs (TAEZs) have been put in place as Standard Mitigation, to allow for investigation and potentially alterations of AEZs where features are not of archaeological significance, resulting in a **negligible** effect, which is not significant in EIA terms.

14.6.2.27 130 TAEZs are recommended for magnetic anomalies with no corresponding seabed feature, or corresponding seabed features that are likely to be geological in origin such as boulders. TAEZs have been recommended as a radius from the centre point of the anomaly.

14.6.2.28 108 anomalies have been recommended a 15 m TAEZ and 77 anomalies a 25 m TAEZ. TAEZs are detailed in Table 14.16 and the distribution presented in Volume 2, Figure 14.5 to 14.10.

Table 14.16 – Temporary Archaeological Exclusion Zones positions relative to WGS84 UTM Zone 30N

MSDS ID	Amplitude (nT)	X	Y	TAEZ (m)
ERS21_MAG_0044	161.4	321592.0	5703418.3	15
ERS21_MAG_0047	67.0	321203.3	5703778.3	15
ERS21_MAG_0052	90.6	319962.0	5704398.3	15
ERS21_MAG_0053	77.1	319684.0	5704705.3	15
ERS21_MAG_0070	739.4	320378.8	5707460.0	25
ERS21_MAG_0152	56.5	316343.8	5706563.2	15
ERS21_MAG_0154	121.7	319009.8	5701128.2	15
ERS21_MAG_0182	55.6	316534.8	5705262.5	15
ERS21_MAG_0183	138.2	316539.0	5705798.3	15
ERS21_MAG_0201	69.0	316670.3	5704194.5	15
ERS21_MAG_0213	60.7	316912.5	5702287.3	15
ERS21_MAG_0214	63.6	316913.0	5700802.5	15
ERS21_MAG_0216	54.7	316915.3	5702755.5	15
ERS21_MAG_0244	52.1	317284.5	5700533.8	15
ERS21_MAG_0248	75.0	317383.3	5705142.8	15
ERS21_MAG_0250	111.3	317384.0	5705711.0	15
ERS21_MAG_0267	57.8	317610.0	5705078.3	15
ERS21_MAG_0282	159.0	317885.0	5706878.8	15
ERS21_MAG_0286	147.5	317934.5	5702995.0	15
ERS21_MAG_0297	74.3	318217.0	5703703.8	15
ERS21_MAG_0299	86.6	318281.5	5701348.0	15
ERS21_MAG_0338	102.2	319208.0	5704062.3	15
ERS21_MAG_0339	115.2	319209.8	5704137.3	15
ERS21_MAG_0342	84.2	318553.0	5704279.0	15
ERS21_MAG_0350	95.0	319174.8	5705316.0	15
ERS21_MAG_0354	59.4	318472.8	5705917.3	15

MSDS ID	Amplitude (nT)	X	Y	TAEZ (m)
ERS21_MAG_0368	67.6	319945.8	5707801.8	15
ERS21_MAG_0402	86.3	320287.5	5701437.3	15
ERS21_MAG_0411	66.5	317526.3	5702035.3	15
ERS21_MAG_0418	62.0	320824.0	5702581.3	15
ERS21_MAG_0420	69.6	320700.3	5702809.3	15
ERS21_MAG_0422	55.6	321071.3	5702861.8	15
ERS21_MAG_0431	150.0	320318.8	5703293.0	15
ERS21_MAG_0434	50.5	320221.3	5703419.5	15
ERS21_MAG_0445	127.6	318764.5	5703778.0	15
ERS21_MAG_0463	82.2	319261.0	5704597.5	15
ERS21_MAG_0503	68.4	320006.3	5707575.5	15
ERS21_MAG_0505	50.4	320419.8	5707798.5	15
ERS21_MAG_0571	64.5	322438.6	5700681.6	15
ERS21_MAG_0587	282.7	321953.2	5700978.2	25
ERS21_MAG_0615	66.0	322498.4	5702331.8	15
ERS21_MAG_0616	182.6	322424.6	5702246.5	15
ERS21_MAG_0617	80.5	322032.3	5702362.1	15
ERS21_MAG_0621	164.1	321616.0	5702398.3	15
ERS21_MAG_0624	60.4	321494.5	5702816.0	15
ERS21_MAG_0625	239.3	321954.7	5702905.0	25
ERS21_MAG_0639	78.8	322505.7	5703737.3	15
ERS21_MAG_0653	125.3	321953.2	5704437.5	15
ERS21_MAG_0662	71.7	321920.4	5704783.8	15
ERS21_MAG_0731	185.7	319636.0	5701496.1	15
ERS21_MAG_0742	195.5	318958.7	5706316.9	15
ERS21_MAG_0934	119.1	353318.2	5729050.5	15
ERS21_MAG_0955	138.2	353154.3	5728788.0	15
ERS21_MAG_0970	57.3	353236.1	5728445.5	15

MSDS ID	Amplitude (nT)	X	Y	TAEZ (m)
ERS21_MAG_0991	51.9	352690.1	5727951.2	15
ERS21_MAG_0999	104.3	352578.3	5727821.1	15
ERS21_MAG_1000	68.7	352570.7	5727811.8	15
ERS21_MAG_1001	212.4	352559.1	5727798.0	25
ERS21_MAG_1004	54.5	352520.2	5727753.4	15
ERS21_MAG_1008	86.3	352316.8	5727588.5	15
ERS21_MAG_1014	88.3	352266.7	5727458.1	15
ERS21_MAG_1021	67.2	351976.0	5727106.6	15
ERS21_MAG_1022	339.8	351934.1	5727049.9	25
ERS21_MAG_1025	259.8	351692.2	5726781.0	25
ERS21_MAG_1026	51.8	351730.6	5726781.0	15
ERS21_MAG_1058	100.5	350974.0	5725485.0	15
ERS21_MAG_1059	1022.8	350397.4	5725432.4	25
ERS21_MAG_1060	1022.8	350421.9	5725425.2	25
ERS21_MAG_1061	755.7	350429.3	5725422.5	25
ERS21_MAG_1062	181.5	350372.8	5725400.9	15
ERS21_MAG_1063	106.5	350558.0	5725356.0	15
ERS21_MAG_1064	213.8	350595.6	5725347.1	25
ERS21_MAG_1065	1471.5	350524.8	5725343.0	25
ERS21_MAG_1066	106.1	350461.0	5725330.0	15
ERS21_MAG_1067	139.3	350584.5	5725328.0	15
ERS21_MAG_1068	218.8	350280.6	5725286.2	25
ERS21_MAG_1069	138.4	350557.5	5725281.5	15
ERS21_MAG_1070	210.7	350237.8	5725232.8	25
ERS21_MAG_1071	153.1	350248.3	5725203.2	15
ERS21_MAG_1072	761.0	350249.3	5725189.6	25
ERS21_MAG_1073	116.9	350403.6	5725175.8	15
ERS21_MAG_1074	166.4	350205.0	5725149.3	15

MSDS ID	Amplitude (nT)	X	Y	TAEZ (m)
ERS21_MAG_1075	116.6	350427.5	5725119.0	15
ERS21_MAG_1076	159.8	350375.1	5725104.6	15
ERS21_MAG_1077	107.6	350624.0	5725023.0	15
ERS21_MAG_1078	153.3	350304.7	5724959.0	15
ERS21_MAG_1079	149.9	350225.9	5724854.6	15
ERS21_MAG_1080	131.2	350234.5	5724849.5	15
ERS21_MAG_1081	163.7	350446.9	5724792.6	15
ERS21_MAG_1082	121.5	350417.4	5724753.6	15
ERS21_MAG_1083	251.8	349879.3	5724722.5	25
ERS21_MAG_1084	208.6	349956.5	5724553.5	25
ERS21_MAG_1085	102.5	349955.3	5724481.9	15
ERS21_MAG_1086	158.6	349910.9	5724418.4	15
ERS21_MAG_1087	271.2	349821.9	5724379.2	25
ERS21_MAG_1088	143.8	349840.5	5724321.5	15
ERS21_MAG_1089	132.5	349800.0	5724268.5	15
ERS21_MAG_1097	58.0	349510.9	5724090.8	15
ERS21_MAG_1098	182.6	349662.3	5724087.0	15
ERS21_MAG_1107	66.2	349354.5	5723892.1	15
ERS21_MAG_1108	83.2	349371.2	5723868.2	15
ERS21_MAG_1113	77.6	349145.8	5723621.3	15
ERS21_MAG_1115	54.4	349287.0	5723593.0	15
ERS21_MAG_1117	84.2	349533.0	5723588.0	15
ERS21_MAG_1152	150.0	348404.0	5722156.5	15
ERS21_MAG_1165	93.0	348332.5	5721205.0	15
ERS21_MAG_1167	75.7	348384.5	5721201.5	15
ERS21_MAG_1181	62.0	348399.3	5720751.0	15
ERS21_MAG_1189	89.7	348138.5	5720187.0	15
ERS21_MAG_1204	77.7	347990.7	5719398.0	15

MSDS ID	Amplitude (nT)	X	Y	TAEZ (m)
ERS21_MAG_1208	59.5	347902.7	5719281.7	15
ERS21_MAG_1209	56.8	347807.5	5719275.5	15
ERS21_MAG_1213	315.7	347785.0	5719144.0	25
ERS21_MAG_1229	54.1	346974.6	5718457.2	15
ERS21_MAG_1234	272.4	346939.5	5718406.5	25
ERS21_MAG_1237	99.0	346561.5	5718257.0	15
ERS21_MAG_1238	54.2	346897.0	5718246.0	15
ERS21_MAG_1241	357.4	346641.0	5718032.5	25
ERS21_MAG_1249	80.8	345595.5	5717469.0	15
ERS21_MAG_1258	50.8	343127.7	5715485.1	15
ERS21_MAG_1280	138.2	339478.5	5712590.0	15
ERS21_MAG_1287	180.6	338432.1	5711131.9	15
ERS21_MAG_1296	156.4	336576.0	5709107.5	15
ERS21_MAG_1298	125.4	336492.5	5708563.1	15
ERS21_MAG_1312	78.3	335568.0	5705872.0	15
ERS21_MAG_1314	374.3	334903.0	5705575.0	25
ERS21_MAG_1316	112.5	334567.5	5705448.5	15
ERS21_MAG_1324	395.6	322096.0	5704160.9	25
ERS21_MAG_1347	165.1	330297.0	5703880.4	15

14.6.2.29 An Area of Archaeological Potential (AAP) has also been defined around a complex area of magnetic anomalies (Volume 2, Figures 14.5 and 14.7). While this cluster of magnetic anomalies may relate to a disused spoil ground, without further investigation this is not certain. AAPs are primarily reserved for magnetic anomalies where, due to line spacing or data coverage, positions are not accurately known or there is potential for the presence of additional material not covered by the survey extents. Any additional material 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 an awareness of the potential within an area, and an expectation of further investigation, is considered appropriate at this phase. Following further investigation mitigation will be revised in line with the anticipated effects.

14.6.2.30 Low potential anomalies of possible anthropogenic debris of negligible sensitivity may also be physically impacted by the laying of anchors and offshore export cables, and by mooring and anchoring of vessels. In the worst-case scenario the impacts arising from construction activities could lead to the loss and disturbance of parts of the anomalies. These impacts would be permanent and irreversible. They would primarily occur at the time of construction, although impacts may be incurred from scour, mooring vessels and anchoring throughout the operation, maintenance, and decommissioning phases. If these impacts were to occur, they would result in a medium magnitude of change. This would result in an effect significance of **negligible** effect, which is not significant in EIA terms.

14.6.2.31 While these effects do not require mitigation a protocol for reporting archaeological finds should be employed across the scheme. This is primarily to ensure significant remains are reported and additional mitigation implemented where necessary, however, it will also allow for reporting of all other material including low potential contacts. Thus, the negligible effect will be mitigated.

Known and potential maritime infrastructure, intertidal and adjacent sites

Magnitude and significance of effect

14.6.2.32 The majority of the features of archaeological interest within the intertidal zone are situated on the bedrock outcrops. Impacts will be focused away from these areas and as such these features would not undergo impacts associated with the scheme. The exceptions are the sea wall within West Angle Bay (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report, Annex 1: MSDS_Erebus_237) and the linear feature identified on aerial photographs within West Angle Bay (Volume 3, Technical Appendix 14.1: Marine Archaeology Combined Desk Based Assessment & Technical Report, Annex 1: MSDS_Erebus_304). Open cut trenching may affect both of these features. This may lead to the loss of a small part of the sea wall, already affected by erosion, and may truncate any potential remains of the linear feature. This may lead to a medium magnitude of change at most, arising from potential loss of part of the area of both features. This would result in a **moderate** significance of effect, which is significant in EIA terms.

14.6.2.33 Redeposited remains within the intertidal zone may be impacted by offshore export cable installation, including by HDD or open cut trenching, and associated activities. These impacts may result in the movement or removal of finds which are not *in situ*. These impacts would be permanent and irreversible. They would occur at the time of construction.

14.6.2.34 The key aspects of significance of these finds relate to the physical properties of the artefacts rather than contextual information. The impacts will not alter these characteristics, however if these finds are not perceived this information could be lost. Overall, this would result in a medium magnitude of change, resulting in a **minor adverse** effect (not significant) in most cases, increasing to **major** (significant) where human remains are involved.

14.6.2.35 Mitigation is therefore required for potential moderate and major effects. It is recommended that the following mitigation measures are adopted:

- Implementation of a watching brief in the intertidal zone should open cut trenching be undertaken. The purpose of this watching brief would be to mitigate impacts to potential maritime or intertidal remains identified at West Angle Bay including potential remains of the linear feature and sea wall, and to allow archaeological input in case any such remains are found. A method statement would be produced prior to any such work in order that all actions and outcomes are agreed with archaeological curators prior to work taking place. The method statement would adhere to, and sit beneath, the umbrella document for mitigation: the archaeological Written Scheme of Investigation which contains details of the broad methodology for a watching brief (Volume 3, Technical Appendix 14.2: Marine Archaeology Written Scheme of Investigation & Protocol), in addition to all relevant legislation, policy and guidance; and
- Implement a protocol for reporting finds of archaeological interest (e.g., The Crown Estate 2014) for the duration of the Project. This protocol provides a system for identifying, recording, reporting, and investigating any unexpected discoveries made during the course of the Project. If material is found, there is a range of next-step mitigation options including creation of temporary or permanent exclusion zones around areas in which archaeological sites or remains may exist. Implementation of the PAD would provide a mechanism by which impacts upon potential eroded remains including human remains can be recorded. The protocol would ensure that the key aspects of the significance of eroded finds (i.e., their physical properties, rather than any *in situ* information which would already have been lost) is perceived and recorded.

14.6.2.36 Following the application of these mitigation measures the Proposed Development would result in a residual impact upon known and potential maritime infrastructure, intertidal and adjacent sites which is reduced from potentially major to **negligible** effect, which is not significant in EIA terms.

Milford Haven Waterway: Landscape of Outstanding Historic Interest

Magnitude and significance of effect

14.6.2.37 The Proposed Development would result in the installation of an offshore export cable within the western part of the Milford Haven Waterway Landscape of Outstanding Historic Interest in Wales, and within the West Angle to Freshwater West Coastal Strip. The work would not challenge or alter the natural character of the area as a ria, nor would it lead to the loss of any known archaeological sites within the Proposed Development which contribute to the character of the area.

14.6.2.38 Specific sites including wrecks will be protected by AEZs (and these sites are not specifically noted as forming part of the character of the area, though they do demonstrate past maritime activity which forms part of the character of the landscape generally). Additionally, maritime infrastructure within the intertidal zone including the natural harbours and rock cut channels, mooring points, pathways and associated features will all be beyond the area of impacts. Archaeological remains above high water are assessed within Chapter 23: Onshore Archaeology and Cultural Heritage.

14.6.2.39 A potential maritime or military feature seen crossing West Angle Bay in historic aerial photographs may be intersected by cable installation in the intertidal zone if below-ground remains of this feature exist (though no remains were identified in the site visit). This may be considered to form part of the military and maritime character of the area. However, mitigation for this potential impact in the form of a watching brief has been recommended above.

14.6.2.40 During construction, vessels associated with the Proposed Development would also be present within the area. Additionally open-cut trenching may be undertaken, potentially with use of a cofferdam or sheet piling. These features and intrusions would represent a temporary alteration to activity within the West Angle Bay area and adjacent seascape. However, they will be associated with construction of an energy generating scheme, and a power station already present within the Registered Landscape demonstrates that energy generation and industry already forms part of the character of the area. As such, while the specific Project activities will represent new works, they will not alter the overall character of the area. Neither will the development result in the loss of any specific features associated with the character of the Registered Landscape as a whole, or features which characterise the specific area of West Angle to Freshwater West Coastal Strip.

14.6.2.41 Overall, the Proposed Development may lead to partial truncation of a potentially buried feature which could form part of the wider military and maritime character of the area. This impact would be mitigated by monitoring and recording during a watching brief. This would result in a negligible change (at most) to the HLC and Registered Landscape of Outstanding Historical Interest, resulting in a **minor adverse** effect, which is not significant in EIA terms.

14.6.3 Operational Phase

14.6.3.1 Impacts to archaeological sites and landscapes will primarily be incurred during the construction phase. However, there is some potential for additional impacts to be incurred during the operation and maintenance phase if associated activities extend beyond the area of construction impacts, for example if cables are repaired, replaced or reburied in areas beyond their original routing, or by the anchoring of vessels.

14.6.3.2 Due to the potential for additional impacts, the same mitigation is recommended for the assets discussed above. In particular AEZs and TAEZs should be respected for the lifetime of the Project, including during operation and maintenance activities. Retention of AEZs will ensure there are no impacts to known sites of high and medium potential.

14.6.3.3 The Protocol for reporting finds of historic interest should also remain in place for the scheme to ensure identification, reporting and (where required) additional mitigation for any remains identified during operation and maintenance works.

14.6.3.4 Additionally, should any repair and remediation events result in the need for trenching within the intertidal zone these may require a watching brief where they fall outside of the area of construction impacts.

14.6.3.5 Use of Standard Mitigation would result in **negligible** to **minor adverse** effects, which are not significant in EIA terms.

14.6.4 Decommissioning

14.6.4.1 The parameters of decommissioning activities are not yet fixed. However, such activities may have the potential to impact archaeological remains if they involve intrusive works beyond the area of construction, maintenance, and operation impacts. Mitigation should be discussed in detail with the regulator prior to decommissioning. However, at this stage it is recommended that the AEZs and TAEZs are maintained during this phase, and the protocol for reporting finds of historic interest remains in place during decommissioning.

14.6.4.2 Use of Standard Mitigation would result in **negligible** to **minor adverse** effects, which are not significant in EIA terms.

14.6.5 Effects on Human Health and Population

14.6.5.1 There will be no effects on population or human health in relation to Offshore Archaeology.

14.7 Additional Mitigation

14.7.1.1 Following implementation of Standard Mitigation (as outlined in Section 14-18) effects would not exceed minor adverse levels. As such no Additional Mitigation is required.

14.8 Additional Monitoring

14.8.1.1 Monitoring will align with the processes set out in Volume 3, Technical Appendix 14.2: Marine Archaeology Written Scheme of Investigation & Protocol. Monitoring will include the review of the operational-phase geophysical data to assess success of the TAEZs and AEZs.

14.9 Inter-Related Effects

14.9.1.1 No inter-related effects have been identified.

14.10 Cumulative Effects Assessment

14.10.1.1 A Cumulative Effects Assessment (CEA) has been made based on existing and proposed developments in the Study Area (Chapter 30: Cumulative Effects). The approach to the CEA is described in Chapter 30: Cumulative Effects. Cumulative effects are defined as those effects on a receptor that may arise when the development is considered together with other reasonably foreseeable projects.

14.10.1.2 The key offshore projects have been defined in Chapter 30: Cumulative Effects as:

- Greenlink Interconnector;
- The Marine Energy Test Area (META) project;
- Pembroke Dock Slipway Ground Investigation;
- Bombora Wave Energy (mWave);
- Milford Haven Port Authority (MHPA) maintenance dredging; and
- Project Valorous.

14.10.1.3 These developments would not affect known archaeological sites within the Proposed Development and there are no anticipated cumulative impacts to known sites including wrecks and geophysical anomalies.

14.10.1.4 The main potential cumulative impacts relate to the potential for these schemes to affect areas of palaeolandscape. Following mitigation there are no significant impacts posed to this potential receptor by the Proposed Development.

14.10.1.5 The ECC will cross the Greenlink Interconnector cable route and therefore the latter has the potential to impact palaeolandscape features identified within the Study Area. However, following mitigation, the impacts upon palaeolandscape features and palaeoenvironmental remains identified within the Greenlink Interconnector site and Study Area were considered to be of slight significance (Greenlink Interconnector Ltd. 15-16). Both projects would result in impacts with small footprints and overall, the cumulative effects of these developments on potential palaeolandscape features are considered to a **minor adverse** effect and not significant in EIA terms.

14.10.1.6 The potential cumulative effects of the Pembrokeshire Demonstration Zone (PDZ) have not been considered at the time of writing due to the lack of detail with which to assess the effects of the proposed project. An EIA Scoping Report was produced and issued to NRW in 2018 for a proposed wave/floating wind project however based on discussions with Celtic Sea Power (the 3rd party agents for the PDZ) and recent public presentations by members of Celtic Sea Power, it is understood the PDZ will be repurposed as an offshore electrical hub. In the absence of an updated EIA Scoping Report and insufficient project information to allow the effects to be reasonably understood and a cumulative assessment undertaken, it has been omitted from this assessment.

14.10.1.7 For those reasons identified above, including the absence of EIA Scoping Reports, the potential cumulative effects of the recently announced Llyr 1, Llyr 2 and Whitecross FLOW projects are also omitted from this cumulative assessment.

14.10.1.8 As set out in PINS Guidance Note 17: Cumulative Effects Assessment, the Project proposed an assessment cut-off date of 1 October 2021 to allow the finalisation of the EIA and HRA assessments, even if project information came forward between the cut-off date and submission. This was agreed with NRW Marine Licensing, noting that in the absence of S.36/Marine Licence guidance the Project was drawing upon the best available advice. It is understood that should sufficient detail of these projects come forward following submission the Project may be requested to provide additional information during the determination period.

14.10.1.9 The consideration of projects that could result in potential cumulative effects is assessed based on the results of the assessment, a review of the status of other projects, together with the professional judgement of the specialist consultants.

14.10.1.10 Reference to other developments planned for the area is noted above however none intersect with the Proposed Development, therefore lowering the potential for effects upon the same features.

14.11 Transboundary

14.11.1.1 No transboundary effects to historic assets have been identified by this assessment.

14.12 Summary

14.12.1.1 This assessment identified a series of known and potential remains relating to offshore archaeology, regarding submerged prehistory and palaeolandscapes, maritime and aviation archaeology and maritime infrastructure, intertidal and coastal sites.

14.12.1.2 Assessment of geophysical survey data and the Project ground model demonstrates that a series of units are present within the Study Area, including potential channel features and fills, and likely glacial deposits. These deposits are undated but may relate to a series of different Pleistocene and Holocene geological formations. There is potential for palaeoenvironmental remains particularly within channel deposits, and other sediments may hold datable material. Mesolithic archaeological sites in the vicinity demonstrate the potential for in situ remains from this period, particularly associated with landscape features such as channels. There is also potential for *in situ* material from other prehistoric periods, including Late Upper Palaeolithic. Earlier remains are more likely to have been reworked and there is potential for redeposited remains of all periods.

14.12.1.3 Maritime archaeological sites and geophysical anomalies are present within the Proposed Development. Desk based sources indicate the presence of the remains of one wreck (HMS *Leda*) on the rocks at West Angle Bay, of which remains may survive in gullies (though none were observed during the walkover survey). Numerous potential maritime sites (n=114) were identified within the geophysical survey data within the offshore consent boundary, including 3 high potential anomalies including two confirmed wreck sites and one possible wreck site and 11 medium potential anomalies. Other wrecks were also identified within the Study Area. There are also large numbers of buried magnetic anomalies of uncertain origin, which may represent archaeological remains. Additionally, there is further potential for wreck remains from all periods, though particularly from the post-medieval and modern periods, to be present within the Study Area.

14.12.1.4 2 aircraft losses are also reported within the Study Area, and aircraft material has been found within the Study Area. Due to the high number of aircraft passing over the area during wartime, in particular, there is a relatively high potential for remains of wrecked aircraft to be present within the Offshore Consent Boundaries.

14.12.1.5 Features relating to maritime infrastructure were also reported in the intertidal zone on the northern side of West Angle Bay including a rock cut channel leading to an embayment used for mooring vessels, and other associated features such as a jetty, possible crane base, pathway and mooring points. Other mooring points were also found on the south side of the bay, and most maritime infrastructure features were associated with the outcropping bedrock on the bay's margins. However, aerial photos from the 1940s demonstrated the presence of a sub-linear feature crossing the sandy part of the bay, interpreted as a military or maritime feature (possibly a blockade or jetty) of which below ground remains could exist.

14.12.1.6 There are also numerous coastal archaeological sites in the area including prehistoric remains, early medieval scheduled remains and later remains which are actively eroding from the coastline or have been subject to erosion in the past. There is therefore potential for eroded remains to be present within the site, including potential for human remains from a scheduled early medieval cemetery (discussed in detail in Chapter 23: Onshore Archaeology and Cultural Heritage).

14.12.1.7 The Proposed Development also intersects the western edge of the Milford Haven Waterway, a Registered Landscape of Outstanding Historic Interest. The waterway is characterised as a ria, with evidence of activity on its margins from the prehistoric period onwards. Characterisation within the Proposed Development demonstrates that this area forms the West Angle to Freshwater Coastal Strip, characterised by the narrow coastal strip, with evidence of variety of archaeological sites. These include military sites representing the historic defensive role of the area, in addition to other sites including Iron Age promontory forts, early medieval remains and evidence of flint working.

14.12.1.8 A range of scenarios are included within the Project Design Envelope, and potential impacts to archaeological sites and palaeolandscape remains could be posed by a number of different Project components. These include anchoring of the semi-submersible floating platforms (through drag embedment anchors or piling), mooring weights, chains and lines and the area of swept by the lines.

14.12.1.9 Cable installation (array and offshore export cable) and associated activities including sandwave levelling and potential offshore disposal sites for dredged material also have the potential to impact archaeological remains. Additionally, HDD or open cut trenching within the intertidal zone and potential associated features such as the excavation of nearshore floatation pits and HDD exit pits, and the mooring of vessels and ancillary equipment across the scheme could also impact archaeological remains. Scour associated with the installations also has the potential to cause impacts, as do operation, maintenance and decommissioning activities.

14.12.1.10 Standard mitigation has been employed, including use of AEZs, TAEZs and AAPs. Additionally, it is recommended that a protocol for reporting finds of archaeological interest be implemented across all activities associated with the development and that a watching brief be carried out in the intertidal zone if open cut trenching is undertaken. Additionally, ongoing geoarchaeological work associated with geotechnical cores also serves to mitigate potential effects to palaeolandscape remains.

14.12.1.11 Following mitigation, the Proposed Development would result in no significant effects to known and potential archaeological remains within the Proposed Development.

Table 14.17 – Summary of Effects

Description of Effect	Significance of Potential Effect (assuming standard mitigation implemented)		Additional Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction					
Potential impacts to known and potential wreck sites, aviation crash sites and geophysical anomalies	Negligible	-	n/a	Negligible	-
Potential impacts to potential submerged prehistoric archaeological sites and palaeoenvironmental remains.	Minor	Adverse	n/a	Minor	Adverse
Potential impacts to maritime infrastructure, intertidal and adjacent sites.	Negligible	-	n/a	Negligible	-
Potential impacts to Milford Haven Waterway: Landscape of Outstanding Historic Interest.	Minor	Adverse	n/a	Minor	Adverse

Description of Effect	Significance of Potential Effect (assuming standard mitigation implemented)		Additional Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Operation					
All receptors	Minor	Adverse	n/a	Minor	Adverse
Decommissioning					
All receptors	Minor	Adverse	n/a	Minor	Adverse

Table 14.18 – Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	Significance of Cumulative Effect	
			Significance	Beneficial/ Adverse
Palaeolandscape remains	Loss of palaeoenvironmental material from restricted footprints	Greenlink Interconnector	Minor	Adverse

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