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Morecambe Offshore Windfarm: Generation Assets

Environmental Statement

Volume 5

Chapter 15 Marine Archaeology and Cultural Heritage

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Glossary of Acronyms

AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
BC	Before Christ
BCE	Before Common Era
BGS	British Geological Survey
BH	Borehole
BMAPA	The British Marine Aggregate Producers Association
BP	Before Present
CEA	Cumulative Effects Assessment
CIfA	Chartered Institute for Archaeologists
CHIA	Cultural Heritage Impact Assessment
CPTU	Cone Penetrometer Testing[1]
DCO	Development Consent Order
Defra	Department for Environment, Food & Rural Affairs
DESNZ	Department for Energy Security and Net Zero
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Groups
GBS	Gravity Based Structure
GIS	Geographic Information Systems
HAT	Highest Astronomical Tide
HER	Historic Environment Record
HRA	Habitat Regulations Assessment
HSC	Historic Seascape Character
IEMA	Institute of Environmental Management and Assessment
IHBC	Institute of Historic Building Conservation
IPMP	In Principle Monitoring Plan
JNAPC	Joint Nautical Archaeology Policy Committee

[1] A cone penetration test with pore water pressure measurement, or CPTU, is a static penetration test with water pressure measurement.

LB	Listed Building
LGM	Last Glacial Maximum
LSE	Likely Significant Effects
MBES	Multi-beam Echo Sounder
MHCLG	Ministry for Housing, Communities and Local Government
MMO	Marine Management Organisation
MPS	Marine Policy Statement
Mya	Million years ago
NHER	National Historic Environment Record
NHLE	National Heritage List for England
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NRHE	National Record of the Historic Environment
NSIP	Nationally Significant Infrastructure Project
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
ORR	Offshore Regional Report
OS	Ordnance Survey
OSP	Offshore substation platform
OWSI	Offshore Written Scheme of Investigation
PAD	Protocol for Archaeological Discoveries
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
PINS	Planning Inspectorate
PPG	Planning Practice Guidance
RPG	Registered Parks and Gardens
SBP	Sub-bottom Profiler
SM	Scheduled Monument
SLVIA	Seascape, Landscape and Visual Impact Assessment
SSC	Suspended sediment concentrations
SSS	Side-scan Sonar
TEZ	Temporary Archaeological Exclusion Zone
UK	United Kingdom
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance
WCPS	West Coast Palaeolandscape Survey
WHS	World Heritage Site

WSI	Written Scheme of Investigation
WTG	Wind turbine generator
WWI	World War I
WWII	World War II
ZoI	Zone of Influence

Glossary of Unit Terms

Km	Kilometre
Km^2	Kilometres Squared
M	Metre
nT	Nano Tesla

Glossary of Terminology

Applicant	Morecambe Offshore Windfarm Ltd
Aviation archaeology	The remains of crashed aircraft and archaeological material associated with historic aviation activities.
Dead Wreck	Wrecks which have not been detected by repeated surveys and are therefore considered not to exist.
Devensian	The Last Glacial Period (LGP), also known colloquially as the last ice age or simply ice age, occurred from the end of the Eemian to the end of the Younger Dryas, encompassing the period c. 115,000 – c. 11,700 years ago. British geologists refer to the LGP as the Devensian.
Disposal area	A designated area of the seabed of the disposal of dredged materials.
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the Environmental Impact Assessment (EIA) and Habitats Regulations Assessment (HRA) for certain topics. The EPP provides a mechanism to agree the information required to be submitted to the Planning Inspectorate (PINS) as part of the Development Consent Order (DCO) application. This function of the EPP helps Applicants to provide sufficient information in their application, so that the Examining Authority can recommend to the Secretary of State whether or not to accept the application for examination and whether an appropriate assessment is required.
Expert Topic Group (ETG)	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Fisherman's Fastener	An unidentified seabed obstruction reported by fishermen.
Generation Assets (the Project)	Generation assets associated with the Morecambe Offshore Windfarm. This is infrastructure in connection with electricity production, namely the fixed foundation wind turbine generators (WTGs), inter-array cables, offshore substation platform(s) (OSP(s)) and possible platform link cables to connect OSP(s).
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record. Includes the study of soils and sediments and of natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes and the effects on buried sites and artefacts.
Glacial/interglacial	A glacial period is a period of time within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last 1 million years, the Elsterian, the Saalian and the Weichselian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.

Historic seascape character	The attributes that contribute to the formation of the historic character of the seascape.
Holocene	The Holocene is the current geological epoch. It began approximately 11,650 calibrated years Before Present (BP) (c. 9700 Before Common Era (BCE)), after the Last Glacial Period, which concluded with the Holocene glacial retreat.
Inter-array cables	Cables which link the WTGs to each other and the OSP(s).
Landfall	Where the offshore export cables would come ashore.
Marine isotope stage	Marine isotope stages are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.
Maritime archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
Mesolithic	10000 to 4000 Before Christ (BC) The Middle Stone Age, falling between the Palaeolithic and Neolithic and marking the beginning of a move from a hunter gatherer society towards a food producing society.
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	The transmission assets for the Morgan Offshore Wind Project and the Morecambe Offshore Windfarm. This includes the OSP(s)[2], interconnector cables, Morgan offshore booster station, offshore export cables, landfall site, onshore export cables, onshore substations, 400kV cables and associated grid connection infrastructure such as circuit breaker infrastructure. Also referred to in this chapter as the Transmission Assets, for ease of reading.
Neolithic	4000BC to 2000BC often referred to as the New Stone Age, this period marks the transition from a hunter gatherer society to that of a farming society.
Offshore export cables	The cables which would bring electricity from the OSP(s) to the landfall.
Offshore substation platform(s)	A fixed structure located within the windfarm site, containing electrical equipment to aggregate the power from the WTGs and convert it into a more suitable form for export to shore.
Palaeoenvironmental analysis	The study of sediments and the organic remains of plants and animals to reconstruct the environment of a past geological age.
Palaeogeographic features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing

[2] At the time of writing the Environmental Statement (ES), a decision had been taken that the offshore substation platforms (OSP(s)) would remain solely within the Generation Assets application and would not be included within the Development Consent Order (DCO) application for the Transmission Assets. This decision post-dated the Preliminary Environmental Information Report (PEIR) that was prepared for the Transmission Assets. The OSP(s) are still included in the description of the Transmission Assets for the purposes of this ES as the Cumulative Effects Assessment (CEA) carried out in respect of the Generation/Transmission Assets is based on the information available from the Transmission Assets PEIR.

	prehistoric physical landscape features such as former river channels (palaeochannels).
Palaeolithic	500000 to 10000BC The Old Stone Age defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into Lower, Middle and Upper Palaeolithic.
Platform link cable	An electrical cable which links one or more OSP(s).
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.
Seabed features	Features seen on the seafloor in the side-scan sonar (SSS) or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Seabed prehistory	Archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower.
Study area	This is an area which is defined for each EIA topic which includes the windfarm site as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each EIA topic is intended to cover the area within which an effect can be reasonably expected. For this chapter the study area corresponds to the footprint within which development activities could occur.
Setting assessment study area	50km radius around the windfarm site to assess the potential effects to the setting of onshore heritage assets as a result of the Project.
Technical stakeholders	Technical consultees are considered to be organisations with detailed knowledge or experience of the area within which the Project is located and/or receptors which are considered in the EIA and HRA. Examples of technical stakeholders include Historic England, Marine Management Organisation (MMO), local authorities, Natural England and Royal Society for the Protection of Birds (RSPB).
Triassic Period	The Triassic is a geologic period and system which spans 50.6 million years from the end of the Permian Period 251.902 million years ago (Mya), to the beginning of the Jurassic Period 201.36 Mya.
Wind turbine generator (WTG)	A fixed structure located within the windfarm site that converts the kinetic energy of wind into electrical energy.
Windfarm site	The area within which the WTGs, inter-array cables, OSP(s) and platform link cables would be present.
Wolstonian Stage	The Wolstonian Stage is a middle Pleistocene stage of the geological history of Earth from approximately 374,000 until 130,000 years ago. It precedes the Eemian Stage in Europe and follows the Hoxnian Stage in the British Isles.

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15 The future of renewable energy

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15 Marine Archaeology and Cultural Heritage

15.1 Introduction

15.1 This chapter of the Environmental Statement (ES) considers the potential effects of the Morecambe Offshore Windfarm Generation Assets (the Project) on marine archaeology and cultural heritage. This chapter provides an overview of the existing environment, followed by an assessment of the potential effects and associated mitigation, where identified, for the construction, operation and maintenance, and decommissioning phases.

15.2 The Project includes the Generation Assets to be located within the windfarm site (wind turbine generators (WTGs), inter-array cables, offshore substation platform(s) (OSP(s)) and possible platform link cables to OSP(s)). The Environmental Impact Assessment (EIA) of the transmission assets, including offshore export cables to landfall and onshore infrastructure, is part of a separate Development Consent Order (DCO) application as outlined in **Chapter 1 Introduction** (Document Reference 5.1.1).

15.3 This assessment has been undertaken with specific reference to the relevant legislation and guidance, of which the primary sources are:

- Marine Policy Statement (MPS)
- North West Inshore and North West Offshore Marine Plans
- National Policy Statements (NPS)

15.4 Details of these and the methodology used for the EIA and Cumulative Effects Assessment (CEA) are presented in **Chapter 6 EIA Methodology** (Document Reference 5.1.6) and **Section 15.4** of this chapter.

15.5 Marine archaeology and cultural heritage assessments are made with reference to Principles of Cultural Heritage Impact Assessment (CHIA) in the United Kingdom (UK), jointly authored by the Institute of Environmental Management and Assessment (IEMA), the Institute of Historic Building Conservation (IHBC) and the Chartered Institute of Archaeologists (CIfA) and published in July 2021. The relationship between these principles and the overarching approach to EIA is described in **Section 15.4**.

15.6 Baseline conditions set out in this ES chapter provide an account of the known archaeological and cultural heritage resource (including designated and non-designated heritage assets), a summary of the potential for currently unrecorded heritage assets and finds to exist within the windfarm site and a review of the Historic Seascape Character (HSC). The known and potential offshore archaeological resource is identified with respect to:

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

15.7 The assessment has been informed by impacts assessed in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (Document Reference 5.1.7) and **Chapter 18 Seascape, Landscape and Visual Impact Assessment (SLVIA)** (Document Reference 5.1.18). Inter-relationships with these chapters are further described in **Section 15.9**.

15.8 Additional key information to support the assessment includes:

- **Appendix 15.1 Archaeological Assessment of Geophysical Data and Hydrographic Data** (Document Reference 5.2.15.1)
- **Appendix 15.2 Seismic Data Review** (Document Reference 5.2.15.2)
- **Appendix 15.3 Generation Assets Setting Assessment** (Document Reference 5.2.15.3)
- Outline Offshore Written Scheme of Investigation (OWSI) (Document Reference 6.10)

15.2 Consultation

15.9 Consultation with regard to marine archaeology and cultural heritage has been undertaken in line with the general process described in **Chapter 6 EIA Methodology**. The key consultation elements undertaken to inform this ES have included scoping (Scoping Opinion from the Planning Inspectorate (PINS) received on 2nd August 2022 (PINS, 2022), EIA Method Statement (comments received 2nd September 2022), comments received on the Preliminary Environmental Information Report (PEIR) which was published for statutory consultation in April 2023, and the Evidence Plan Process (EPP) via the Historic Environment Expert Topic Group (ETG) meetings.

15.10 ETG meetings were held in May 2022, August 2022, November 2022, June 2023 and January 2024, with attendees including Cadw, the Marine Management Organisation (MMO) and Historic England. Historic England and

the MMO were present for all meetings, with Cadw only attending ETG 2. This is because the nearest infrastructure to the Welsh coast is over 50km away. As such it would be only in exceptional circumstances (if then) that the windfarm would be visible from Wales and therefore Cadw did not envisage that the proposed windfarm would have any significant impact on the setting of any designated historic asset in Wales.

15.11 Feedback received throughout the above consultation has been considered when preparing the ES. The key elements pertinent to this chapter are shown in **Table 15.1** alongside details how the Project team has had regard to the comments received and how these have been addressed within this chapter.

15.12 The consultation process is described further in **Chapter 6 EIA Methodology.** Full details on the consultation undertaken throughout the EIA process is presented in the Consultation Report (Document Reference 4.1) which is included with the DCO Application.

Table 15.1 Consultation responses received in relation to marine archaeology and cultural heritage and how these have been addressed in the ES

Consultee	Date	Comment	Response/where addressed in the ES
Scoping Opinion responses			
PINS/ Historic England (ref 3.9.1)	2nd August 2022	Indirect transboundary impacts associated with changes to marine physical processes: The Scoping Report seeks to scope this matter out on the grounds that indirect transboundary impacts would only occur as a result of changes to marine processes, and these would not affect an EEA [European Economic Area] State. As noted above, the Inspectorate agrees that transboundary impacts on marine processes can be scoped out. Consequently, the Inspectorate also agrees that indirect transboundary impacts on marine archaeology can also be scoped out in further assessment.	Noted.
PINS/ Historic England (ref 3.9.2)	2nd August 2022	The Scoping Report describes the Study Area but does not explain why the area chosen is sufficient to reflect the likely zone of influence of the Proposed Development. The ES should be based on a defined Study Area, which is sufficient to identify the Likely Significant Effects (LSE) of the Proposed Development, including any potential setting effects to any offshore heritage assets within the English coastal zone. The ES should confirm whether the Study Area aligns with relevant policy and guidance and provide justification for any divergences. A figure showing the extent of the final Study Area should be provided in the ES.	The study area for marine archaeology and cultural heritage is defined as the footprint within which development activities could occur. A 50km study area is also included to consider the LSE the Project could have on the setting of coastal heritage (see **Section 15.3.1** and **Figure 15.1**). This approach was determined in consultation with Historic England during the second ETG meeting held on 31st August 2022.
PINS/ Historic	2nd August 2022	The Applicant's attention is drawn to the comments of Historic England (see Appendix 2) about the scope and planning of desk-based assessment and surveys,	Geotechnical investigations were undertaken in 2023 for which an archaeological method statement was produced and issued to and

Consultee	Date	Comment	Response/where addressed in the ES
England (ref 3.9.3)		with regards to informing the marine archaeological mitigation strategy. Unless otherwise agreed with relevant stakeholders the assessment should include: ▪ Geoarchaeological considerations into the geotechnical investigations and providing the geoarchaeologist with direct access to core material. ▪ A specialist palaeoenvironmental assessment, where surveys indicate potential for survival of palaeoenvironmental remains. ▪ A preliminary deposit model as part of the desk-based assessment to assist in identification of the potential depth and character of Palaeolithic archaeology. ▪ Use of data generated by monitoring programmes for oil and gas infrastructure in the area.	agreed with Historic England. A summary of the 2023 investigations is provided **Section 15.5.1**. Further geotechnical survey is planned in 2024. The data collected from these investigations would be made available to a suitably qualified archaeological subcontractor for detailed assessment. Consultations with oil and gas operators have been undertaken, no information has been made available at the time of writing, but lines of communications have been established by the Applicant and any data made available, as appropriate, would be considered as the Project progresses. Embedded mitigation measures are set out in **Section 15.3.3**.
PINS/ Historic England (ref 3.9.4)	2nd August 2022	It is noted that mitigation measures likely to be considered include a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries. Unless otherwise agreed with relevant stakeholders, the ES should explain how it will be ensured that a professional, accredited archaeological consultant will be involved in assessing the risk to archaeological remains during seabed levelling. The Applicant's attention is drawn to the comments from Historic England in Appendix 2 on this matter.	Within this ES, there is a commitment to the production and delivery of a Written Scheme of Investigation (WSI) and a Protocol for Archaeological Discoveries (PAD) by a suitably experienced professional archaeological consultant (see **Section 15.3.3**). An Outline OWSI accompanies the ES and DCO Application. The Offshore Outline WSI, as submitted within the DCO Application, would be followed by a Draft WSI (based on the Outline WSI) to be agreed with Historic England to ensure archaeological objectives are taken into account. A Final agreed WSI would be produced post-consent to be followed by

Consultee	Date	Comment	Response/where addressed in the ES
			Method Statements for each works package undertaken during all future phases of development.
Historic England	15th July 2022	We noted in Table 8.28 (Data sources to inform marine archaeology and cultural heritage assessment) that while data and information generated by archaeological studies conducted for other renewable energy development will be utilised, there was no specific attention given to any legacy of survey data as produced by the oil and gas sector. For example, the use of data generated by monitoring programmes for the South Morecambe Gas Fields infrastructure, which could assist the identification of other anomalies of possible archaeological interest.	Consultations with oil and gas operators have been undertaken, no information has been made available at the time of writing but lines of communications have been established by the Applicant and any data made available would be considered, as appropriate, as the Project progresses.
Historic England	15th July 2022	Table 8.29 (Proposed baseline surveys) includes a brief mention of the geophysical survey conducted in 2021, comprising Multibeam Echo Sounder (MBES), Side Scan Sonar (SSS) and Sub-bottom Profiler (SBP) and that geotechnical survey work (including vibrocore and borehole) will be conducted in 2022/23. We concur that all these survey data generated are to be reviewed by an experienced archaeological consultant with the analysis reported to the ETG during pre-application consultation and included within any PEIR and/or ES produced. Detailed, technical reporting should be provided through accompanying appendices to the PEIR and ES.	Geophysical survey data from SSS, MBES and magnetometer) has been processed and assessed by MSDS Marine (see **Appendix 15.1**). The analysis and interpretation of sub-bottom profiler (SBP) data has been undertaken (**Appendix 15.2**). Geotechnical surveys were undertaken in 2023. A summary of the results of the geotechnical surveys is provided in **Section 15.5.1**.
Historic England	15th July 2022	Paragraph 645 mentions access by geo-archaeologists to any "…engineering led boreholes" that might be acquired and that "…allowance will be made for archaeological involvement in the planning of the survey…" However, in consideration of the desk-based	Mitigation measures are set out in **Section 15.3.3.** The approach to mitigation is set out in the Outline OWSI. The Outline OWSI would be followed by a pre-commencement Draft WSI (based on the

Consultee	Date	Comment	Response/where addressed in the ES
		sources of information already used to determine the risk of encountering in-situ prehistoric terrestrial environmental evidence, we recommend that to support realisation of the matters covered in Part 1, Section 7.4 (Embedded and additional mitigation, impact significance and residual impact), that archaeological-led geotechnical data acquisition may also be necessary with the requisite professional standards set for data acquisition that supports analysis to optimise all relevant techniques and methodologies available.	Outline OWSI) to be agreed with Historic England prior to surveys taking place, to ensure archaeological objectives are taken into account. A final agreed WSI would be produced post-consent to be followed by Method Statements for each works package undertaken during all future phases of development.
Historic England	15th July 2022	Regarding the guidance referred to in paragraph 651, we offer the following publication updates which should be used in the production of any subsequent PEIR and ES: ▪ Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects, as published by The Crown Estate in July 2021 (which now replaces the version published in 2010) ▪ Gribble J. and Leather S. (2011) Guidance for Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector. Published by the former COWRIE Group ▪ Historic Environment Advice Note 15 Commercial Renewable Energy Development and the Historic Environment (2021). Published by Historic England.	Noted and included in this chapter (see **Section 15.4.1.2**).
Historic England	15th July 2022	Section 8.9.6 (Potential impacts) – we concur with the potential impacts identified, as summarised in Table 8.30. We add that it is our advice that in consideration of the risk of encountering presently unknown cultural	Mitigation measures are set out in **Section 15.3.3**. The approach to mitigation is set out in an Outline OWSI.

Consultee	Date	Comment	Response/where addressed in the ES
		heritage (prehistoric environmental evidence or historic vessels and aircraft), that measures and procedures are established at an early stage of project planning. The benefit of adopting this approach is to ensure capacity is built in to inform design and to best deliver UK policy objectives for the protection of underwater cultural heritage.	The Outline OWSI would be followed by a pre-commencement Draft WSI (based on the Outline OWSI) to be agreed with Historic England prior to the surveys taking place to ensure archaeological objectives are taken into account. A Final agreed WSI would be produced post-consent to be followed by Method Statements for each works package undertaken during all future phases of development.
Historic England	15th July 2022	The attention given in Sections 8.9.6.4 (Potential cumulative effects) is important and we will consider such matters further as they are addressed through PEIR and in any ES submitted with any Development Consent Order (DCO) application. It is therefore relevant that full consideration is given to the following relevant publication: ▪ COWRIE (2008), Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy. Commissioned by COWRIE Ltd (project reference CIARCH-11-2006). Project contractors: Oxford Archaeology with George Lambrick Archaeology and Heritage.	Noted and included in this chapter (see **Section 15.4.1.2**).
Historic England	15th July 2022	It is stated in section 8.9.7 (Potential mitigation measures) that the mitigation measures adopted will focus on the implementation of archaeological exclusion zones, the development of a WSI and a Protocol for reporting Archaeological Discoveries and the commitment to undertake a full archaeological review of geophysical and geotechnical data. We recommend a joined-up approach so that the geoarchaeologists and geophysicists are included in	Mitigation measures are set out in **Section 15.3.3**. The approach to mitigation is further set out in the Outline OWSI. This includes a PAD. The Outline OWSI would be followed by a pre-commencement Draft WSI (based on the Outline OWSI) to be agreed with Historic England prior to the surveys taking place to

Consultee	Date	Comment	Response/where addressed in the ES
		the design of these assessments to maximise opportunities and to ensure the information obtained is also suitable for archaeological assessments.	ensure archaeological objectives are taken into account. A final agreed WSI would be produced post-consent to be followed by Method Statements for each works package undertaken during all future phases of development.
Historic England	15th July 2022	We agree that the potential mitigation measures, as described in this section, should be embedded within the design of the proposed development whereas other measures might be necessary in response to impact assessments as they are conducted. We, therefore, consider such action as adaptive mitigation which should enable the project to continually adjust as the project develops through the EIA exercise.	This is noted and is set out in the Outline OWSI. The WSI would form an umbrella document, for all survey, investigation and assessment supported by activity-specific Method Statement.
Historic England	15th July 2022	Regarding the outline provided in paragraph 679, it is important to distinguish the different roles played by a marine archaeological WSI and a PAD, such that: ▪ An outline marine archaeological WSI provides a suite of methodological approaches to optimise post-consent and preconstruction survey data acquisition programmes to best serve archaeological analysis and interpretation, a subsequent WSI, tailored accordingly, will be required for any operations and maintenance phases of the proposed development. ▪ A PAD is a means to ensure efficient lines of communication between key identified parties, should the project encounter unexpected archaeological materials during construction or operations and maintenance phases of the proposed project.	Noted. Mitigation measures are set out in **Section 15.3.3**. The approach to mitigation is further set out in the Outline OWSI. This includes a PAD.

Consultee	Date	Comment	Response/where addressed in the ES
EIA Method Statement			
Historic England	2nd September 2022	In reference to the attention directed at Historic Seascape Character (HSC), as included in Table 5.1 (Data sources to inform marine archaeology and cultural heritage assessment), whereby mention is made of the published national database for HSC. It is important that the finalised methodological approach for generating perceptions of HSC is employed by this project and that spatial data, as relevant to activities and changes that have occurred in more recent years, are included in your HSC assessment.	The assessment of HSC is set out in **Sections 15.4.4**, **15.5.4**, **15.6** and **15.7**.
Historic England	2nd September 2022	It is relevant that planning of geotechnical survey campaigns within the WTG array area should seek to address published research questions. This approach should draw upon 'grey literature' to strategically plan and deliver targeted geo-archaeological investigations, as mentioned in paragraph 35, to inform this proposed development.	2023 geotechnical investigations have been informed by existing research such as the West Coast Palaeolandscapes Project. The results of the 2023 geotechnical investigations are presented in **Section 15.4.2.1**.
Historic England	2nd September 2022	We offer the advice that producing a draft WSI during pre-application liaison and consultation could be helpful to the project and that its drafting should be done in reference to *Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects* published by The Crown Estate in 2021.	The Outline OWSI has been prepared in accordance with *Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects* published by The Crown Estate in 2021 and included in the DCO Application.

Consultee	Date	Comment	Response/where addressed in the ES
Historic England	2nd September 2022	An effective method for identifying the potential depth and character of Palaeolithic archaeology would be to undertake a preliminary deposit model as part of the desk-based assessment. This should be prepared by a geoarchaeologist using available stratigraphic information. The deposit model will help to illustrate the depth, characteristics, and potential of the deposits of archaeological interest and should inform any subsequent borehole sampling. It is therefore relevant that the planning of the geotechnical survey campaign planned for Q1/Q2 2023 is informed by such a model produced from presently available SBP data, so that targeted investigations, including direct sampling by borehole or vibro-core are aligned with locations of potential palaeo-environmental interest. We therefore encourage action to be taken to complete a full review of SBP data to substantiate the initial identification that "…five stratigraphic seismic units were identified within the data". We recommend this approach so that an early indication is available about whether any further geo-archaeological objectives should inform the planning of the follow-on geotechnical survey planned for Q1 and Q3 2024, as described at the ETG meeting on 31st August. In particular, refinement of the deposit model will also help to guide the proposed mitigation strategy as set out within an outline WSI prepared for this project.	Geophysical data has been assessed and interpreted by MSDS Marine. SBP data analysis was based on the interpretation of ground models provided by the geophysical contractor. The assessment of these was completed by MSDS Marine and it was determined that a full assessment of the raw SBP data was warranted. This was undertaken (**Appendix 15.2**) and informed the 2023 geotechnical investigations and the planning of the further geotechnical investigations in 2024. Data is available from the 2023 survey and no deposits of archaeological interest were identified, including at Borehole (BH)112 which was relocated to target a potential channelised feature.
Historic England	2nd September 2022	Section 4.5 (Limitations) raises an important matter about the identification of a significant area by mobile sands across the proposed WTG array area. It is therefore a relevant matter that consideration is given	Further geophysical data would be acquired during the pre-construction and post-construction phases of the Project. Additionally, a PAD would be implemented

Consultee	Date	Comment	Response/where addressed in the ES
		to the risk of encountering presently buried and unknown archaeological materials, as not presently detected by more spatially restricted magnetometer or SBP data. It is also important that a risk assessment is presented regarding archaeological potential as it may exist within 850m to 900m radius of the two gas production platforms (vis. repurposing of existing structures).	throughout the lifetime of the Project to ensure that if unexpected archaeological materials are encountered during construction or operations and maintenance phases of the Project, they are properly reported and recorded (see **Section 15.3.3**). It is acknowledged that there are two areas without data in the most recent survey coverage, and these correspond to locations of existing oil and gas infrastructure. Only one of these areas is now within the windfarm site and should development be planned in this area following decommissioning gas field infrastructure, a survey programme would be planned.
Statutory consultation feedback on the PEIR			
Historic England	30th May 2023	The attention given to a contemporary vessel loss (from 1982) was not relevant to assessment of the historic environment and should not be included in the ES.	This vessel no longer lies within the windfarm site and has been scoped out of any assessment.
Historic England	30th May 2023	Section 15.1 (introduction), paragraph 15.3 states consideration of the National Planning Policy Framework (NPPF) and in consideration that this PEIR is exclusively for the proposed offshore generation area, it would be helpful to understand why the NPPF is used given the existence of the UK Marine Policy Statement and published North West Marine Plans.	Reference to the NPPF has been removed from the ES. The North West Marine Plan is referenced in **Section 15.4.1**.
Historic England	30th May 2023	Section 15.3.3 (summary of mitigation embedded into the design), Table 15.3 described the use of Archaeological Exclusion Zones (AEZs) for "archaeologically significant anomalies that are clearly	**Section 15.5.2.1** and **Section 15.6.1** include a description of the archaeological interest of heritage assets to which an AEZ has been assigned.

Consultee	Date	Comment	Response/where addressed in the ES
		identifiable in the survey data and where the extents are largely known". It is important to clarify that if it is the intention to use AEZs for archaeologically significant anomalies, that the ES is to include detailed assessments of identifiable interest for which we can advise as to the archaeological significance	
Historic England	30th May 2023	Section 15.2 (Consultation). it is our advice that survey work completed as part of any decommission programme for the South Morecambe Gas Fields is planned inclusive of archaeological objectives.	Morecambe Offshore Windfarm is not involved with the South Morecambe Gas Fields decommissioning programme, although liaison on activities does occur between the operator and the Applicant.
Historic England	30th May 2023	Table 15.2, Impact 4 "Impacts to the setting of heritage assets", it is important to qualify heritage assets for which setting contributes to their significance whether such heritage assets are submerged, buried, exposed on the seabed.	To date, no marine heritage assets have been identified that have a setting which contributes to their significance.
Historic England	30th May 2023	We note the description provided in paragraph 15.25, that the proposed Morecambe Offshore Wind Farm array area spans the English North West Inshore and Offshore Marine Plan areas. It would therefore be appreciated if any subsequent ES produced for this proposed development includes a figure to illustrate where the marine planning boundary runs through the array area.	The Project only spans the North West Offshore Marine Plan area (**Figure 15.2**).
Historic England	30th May 2023	It is important to confirm that while presently there are no designated heritage assets, should material of archaeological and/or historic significant interest be encountered within the North West Inshore Marine Planning area, that a recommendation for designation could be made to DCMS Secretary of State.	Noted. The Project is not located within the North West Inshore Marine Planning Area (see **Figure 15.2**).

Consultee	Date	Comment	Response/where addressed in the ES
Historic England	30th May 2023	Section 15.4.3 (Impact assessment methodology) – paragraph 54 includes a bullet point about "the perceived heritage importance of identified assets". However, importance is scaled, not perceived using defined criteria (e.g., national or international importance) and therefore, this bullet point should be revised in any ES prepared for submission. Paragraph 15.54 should reference UK MPS, Section 2.6.6 as the relevant planning policy document. In this regard, the assessment offered in the ES will need to determine whether an anomaly encountered on, within or under the contemporary seabed of can be considered to represent a heritage asset (i.e., its significance and what contributes to that significance). The determination of cultural heritage importance can only occur thereafter which in turn, will have a bearing on the matters detailed in Sub-section 15.4.3.4 (Effect significance).	The importance of a cultural heritage asset is a measure of the degree to which cultural significance of that asset is sought to be protected. Legislation and planning is based on concepts of national/regional/local 'importance'. The use of the word perceived denotes professional judgement. Cultural significance is not scaled, but articulates what is valued about it, which in turn informs a professional judgement on importance and the 'perceived' sphere of interest in which it is valued (discussed in ETG Meeting 4 – 14th June 2023).
Historic England	30th May 2023	Section 15.11 (Potential monitoring requirements) – We are pleased to see that monitoring requirements will be described within an In-Principle Monitoring Plan (IPMP), as well as the use of the Outline WSI (Offshore). However, we require clarification regarding the preparation of a phase specific WSI rather than referral to an Outline WSI. We request that clarification regarding this matter is provided in the ES. For example, to deliver the commitments set out in paragraphs 15.278 – 15.280 and if a post-consent WSI (subject to authorisation), will be produced to steer archaeological analysis and interpretation by a professional, accredited and experienced marine archaeological contractor/consultant.	An Outline OWSI has been produced. The WSI would form an umbrella document, for all survey, investigation and assessment supported by activity-specific Method Statements. The Outline OWSI would be followed by a pre-commencement Draft WSI (based on the Outline WSI) to be agreed with Historic England prior to the surveys taking place to ensure archaeological objectives are considered. A final agreed WSI would be produced post-consent to be followed by Method Statements

Consultee	Date	Comment	Response/where addressed in the ES
			for each works package undertaken during all future phases of development.
Historic England	30th May 2023	Paragraph 15.17 explains how negative impacts associated with the proposed development can be achieved through further geophysical and geoarchaeological investigations to reduce as far as possible "unintended impacts". It seems to also suggest that such impacts can be offset by professionally executed and published archaeological studies. We must add that fully demonstrating and delivering this expectation is essential to implement mitigation that is required for heritage assets.	Mitigation strategies are set out in an Outline OWSI.
Historic England	30th May 2023	Paragraphs 15.29 – 15.32 (under the sub-heading "Policy") explains the inclusion of this historic environment within the NPPF. However, no element of this proposed development occurs within terrestrial planning authority jurisdiction, so it is not apparent why this information is included. Furthermore, paragraph 15.33 states that the assessment takes account of the UK Marine Policy Statement (UK MPS) which does not appear to reflect that the UK MPS has equivalent (planning policy) status to NPPF. Paragraph 15.34 mentions the published North West Marine Plans objectives which are inclusive of heritage assets and the accompanying policy (Table 15.5). We must therefore recommend that detail is included within the ES to fully explain your strategy of avoidance. The application of AEZs is to be included with an explanation about an adaptive approach whereby the detailed design phase is informed by professional, accredited and experienced archaeological contractors/consultants, so that presently unknown	Reference to the NPPF has been removed from the ES. The North West Marine Plan is referenced in **Section 15.4.1**. Embedded mitigation measures (including avoidance strategies) are set out in **Section 15.3.3**.

Consultee	Date	Comment	Response/where addressed in the ES
		elements of the historic environment can be avoided without harm. On this point we must make it clear that attempting to "repair damage" to archaeological sites can never be considered as mitigation.	
Manx National Heritage	2nd June 2023	MNH would expect that the forthcoming EIA would consider the following issues: An EIA would need to contemplate the following issues: Visual impact of proposals on the setting of protected monuments on the east side of the watershed of the Island, is estimated at approximately 25 monuments. However, given the significantly longer distance involved, this impact may be limited. Moreover, there remain some flagship sites such as Castle Rushen and Laxey Wheel which are major tourist assets of national and economic significance to the Island where the impact would need to be considered more holistically	With the Isle of Man being located outside the setting assessment study area, approximately 65km from the Project windfarm site and given the presence of existing operational offshore windfarms in the intervening seascape there is no potential for significant effects.
Manx National Heritage	2nd June 2023	The potential direct impact on historical shipwrecks would also need to be assessed. MNH has recently acquired some shipwreck data and whilst this is still being evaluated and integrating it into MNH data system however it would appear that this data we have does not extend as far as the Morecambe development site. The developer would have to consult other sources in England. MNH can provide the developer with access to this data upon request.	The United Kingdom Hydrographic Office (UKHO), the National Heritage List for England (NHLE) and Historic England Marine Historic Environment Record (HER) have all been consulted and incorporated into the baseline. Additionally, the Windfarm Site geophysical data has been archaeologically assessed by MSDS Marine.
Manx National Heritage	2nd June 2023	In addition, MNH provides the following general comments: ▪ The need for protection of the seabed with particular reference to areas of high conservation or carbon sequestration value, such as sea grass	See **Chapter 9 Benthic Ecology** (Document Reference 5.1.9) for an assessment of the effects on benthic habitats.

Consultee	Date	Comment	Response/where addressed in the ES
		beds, Zostera marina, as highlighted in the Manx Marine Nature Reserves	
Manx National Heritage	2nd June 2023	Protection of sensitive coastal areas such as Dhoon, Laxey and Maughold headlands which are noted for their nesting sea bird communities.	See **Chapter 12 Offshore Ornithology** (Document Reference 5.1.12) for an assessment of the effects on birds.
Manx National Heritage	2nd June 2023	Protection of the seabed from scour and silt during the positioning of rock berms and trench digging and removing boulders.	See **Chapter 7 Marine Geology, Oceanography and Physical Processes** for an assessment of the effects on the seabed.
Manx National Heritage	2nd June 2023	Limiting noise pollution as cetaceans are regularly recorded between Ramsey and Laxey Bays.	See **Chapter 11 Marine Mammals** (Document Reference 5.1.11) for an assessment of the effects on marine mammals.
Manx National Heritage	2nd June 2023	Limiting disturbance of marine species and coastal sea birds during any boat trips from the Island to the arrays, as and where necessary.	See **Chapter 12 Offshore Ornithology** for an assessment of the effects on birds.
ETG meetings			
Historic England	20th May 2022	Data audit on the quality and suitability of the 2021 geophysical survey for archaeological assessment and interpretation to be provided to Historic England.	A data audit of the geophysical survey data for its suitability for archaeological assessment was undertaken. This was reviewed and confirmed by Historic England. The assessment of geophysical data is summarised in **Section 15.4.2.1** and is detailed in **Appendix 15.1**.
Historic England	31st August 2022	Medium potential anomalies are difficult to qualify in terms of historical interest given survey resolution, but in subsequent phases of analysis can confirm whether actual tangible historical interest is present. Although something may not appear high potential, the medium sites may well be changed to high potential further down the line. The distance on these readings is	This is noted. The survey resolution to date is considered suitable for EIA characterisation. Higher resolution survey and investigation would be progressed in accordance with the programme to be confirmed. This would help to identify or provide clarification on smaller anomalies of potential archaeological interest.

Consultee	Date	Comment	Response/where addressed in the ES
		narrow and there is great uncertainty either side. Historic England are constantly dealing with projects where subsequent resolution are discovering aircraft much too late as some don't appear in earlier data sets but do in later sets.	Mitigation measures are set out in **Section 15.3.3**. The approach to mitigation is further set out in an Outline OWSI which is included in the DCO Application. The Outline OWSI would be followed by a pre-commencement Draft WSI (based on the Outline WSI) to be agreed with Historic England prior to the surveys taking place to ensure archaeological objectives are taken into account. A final agreed WSI would be produced post-consent to be followed by Method Statements for each works package undertaken during all future phases of development.
Historic England	31st August 2022	In this area of the Irish Sea what has been alluded to regarding desk study and survey analysis –It would be in everyone's interest to link with target investigation as this could quickly qualify if there will be real geoarchaeological potential in this area or not. To get this in early would save considerable time later. Negative results are as important as positive results.	A summary of geotechnical assessment undertaken to date is presented in **Section 15.5.1**.
Historic England	31st August 2022	The Historic Seascape Characterisation Programme was conducted in phases with many projects aiming to produce methodology on how different datasets can be used to spatially generate a perception of character. Multiple programmes to produce a national data set have been undertaken and it is important to understand how the HSC was conducted (e.g., the disconnect between pilot study for HSC of the Irish Sea in around 2009 compared to the availability of the actual dataset produced in 2011). The characterisation work done to date is a point in time study. Additional	The assessment of HSC is set out in **Sections 15.4.4**, **15.5.4** and **Section 15.6**. and **Section 15.7.**

Consultee	Date	Comment	Response/where addressed in the ES
		data, the changes and how the character continues to change, must be added to the methodology to develop the dataset. The co-location and complexities of multiple seascape use, and how the character can accommodate further change must be addressed. It is down to the project to say what needs to be added to create our current HSC, and what changes the project may have. The HSC and Historic England approach to characterisation in particular, in perception of character and accommodation of change, is different to sensitivity, which rests with the structures of the EIA. The seascape character is based on cumulative change and how the space is used and how we can attribute historic interest.	
Historic England	31st August 2022	Historic England agreed the approach presented in the ETG (initial screening assessment) is a sensible first step. Plenty of sites in the buffer maybe scoped out if there are no views or relationship to the sea, as settings for many will be greatly restricted.	The full Setting Assessment is included as **Appendix 15.3**, with Annex 1 of **Appendix 15.3** presenting the results of the initial screening assessment
Cadw	31st August 2022	As the Windfarm Site will be 50km off the Welsh coast, Cadw can't see there will be any impact to the setting of coastal designated heritage assets.	Potential impacts to the setting of Welsh coastal heritage assets have been scoped out of further assessment.
Historic England	14th November 2022	Update on geotechnical investigations timings.	Geotechnical investigations were undertaken between July and October 2023. A summary of geotechnical assessment undertaken to date is presented in **Section 15.5.1**. The method statement for the 2023 geotechnical survey campaign was submitted to Historic England on the 28th April 2023. Historic England concurred with the

Consultee	Date	Comment	Response/where addressed in the ES
			approaches and methodologies set out in the Method Statement. Further geotechnical surveys are to be undertaken in 2024 for which a Method Statement has been provided to Historic England.
Historic England	21st April 2023	Notification by Applicant to Historic England of the planned commencement of offshore geotechnical survey campaign in July 2023 and that an archaeological method statement is to be provided to Historic England for comment.	N/A
Historic England	28th April 2023	Archaeological Method Statement (Offshore) for the Assessment of Geotechnical Survey Data. Doc Code: FLO-MOR-MS-0014 for 2023 geotechnical investigation provided by Applicant to Historic England for comment.	N/A
Historic England	14th June 2023	Update provided by Applicant on the status of the Project, including the revised (reduced) windfarm site boundary, the status of the geotechnical investigations and the approach to this ES chapter. A discussion on Historic England's PEIR response was also undertaken.	This chapter has been undertaken in consideration of the PEIR response provided by Historic England, as set out in **Table 15.1**.
Historic England	16th June 2023	Archaeological Method Statement (Offshore) – Assessment of Geotechnical Survey Data. Doc Code: FLO-MOR-MS-0014. Comments received from Historic England on the Archaeological Method Statement for geotechnical investigation. Historic England advised that focus is directed more towards setting the objective of the Quaternary (sedimentary) deposit model to be produced and therefore what data is required to achieve that objective. This is as a longer-	Further objectives and strategies would be determined once the geotechnical surveys have been completed and assessment commences if required.

Consultee	Date	Comment	Response/where addressed in the ES
		term objective for this project and Historic England encourage discussions to progress with them once the geotechnical data obtained has been and processed by a suitably qualified geoarchaeologist.	
Fylde Borough Council Lancashire County Council Sefton Met Borough Council Historic England	4th July 2023	Setting screening assessment provided by Applicant to stakeholders.	No technical responses received.
Historic England, MMO	18th January 2024	It was agreed that the Outline OWSI would be provided as part of the DCO submission.	An Outline OWSI has been provided as part of the DCO Application.

15.3 Scope

15.3.1 Study area

15.13 The study area for marine archaeology and cultural heritage is defined by the windfarm site and has been developed in consultation with Historic England. This study area corresponds to the footprint within which development activities could occur and, consequently, the area of potential impacts to the marine archaeology and cultural heritage existing environment as shown in **Figure 15.1**.

15.14 A 50km area around the windfarm site is also included to consider the effect the Project could have on the setting of coastal heritage, also shown in **Figure 15.1** and thus encompasses all indirect effects. This was selected in consultation with Historic England (see **Section 15.4.6**).

15.3.2 Realistic worst-case scenario

15.15 The final design of the Project would be confirmed through detailed engineering design studies that would be undertaken post-consent to enable the commencement of construction. To provide a precautionary but robust impact assessment at this stage of the development process, realistic worst-case scenarios have been defined. The realistic worst-case scenario (having the most impact) for each individual impact has been derived from the Project Design Envelope (PDE) to ensure that all other design scenarios would have less or the same impact. Further details are provided in **Chapter 6 EIA Methodology**. This approach is common practice for developments of this nature, as set out in PINS Advice Note Nine: Rochdale Envelope (PINS, 2018).

15.16 The realistic worst-case scenarios for the marine archaeology and cultural heritage assessment are summarised in **Table 15.2**. These are based on the PDE described in **Chapter 5 Project Description** (Document Reference 5.1.5), which provides further details regarding specific activities and their durations. The envelope presented has been refined as much as possible between PEIR and ES, presenting a project description with design flexibility only where it is needed.

Table 15.2 Realistic worst-case scenarios for marine archaeology and cultural heritage

Impact	Worst-case scenario	Notes and rationale
Construction phase		
Impact 1: Direct impact to known heritage assets	N/A	Direct impacts to known heritage assets would not occur due to the application of embedded mitigation i.e., the application of AEZs and the avoidance of any currently known heritage assets (**Section 15.3.3**).
Impact 2: Direct impact to potential heritage assets	**Largest seabed disturbance (footprint)** ▪ 35 x WTGs with Gravity Based Structure (GBS) foundations (including jack-up vessel footprint) = 303,625m^2 ▪ Two x OSPs with GBS foundations (including jack-up vessel footprint) = 17,350m^2 ▪ Anchoring for 35 WTGs and two OSPs = 26,640m^2 ▪ Inter-array cables = 1,750,000m^2 ▪ Platform link cables = 250,000m^2 Total seabed disturbance footprint = **2,347,615m^2 (approximately 2.4km^2)**	The worst-case scenario represents the maximum area and/or volume of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits. Given that the worst-case scenario for the largest disturbance of seabed area and volume are different, both scenarios are represented. Given the seabed preparation is the same per foundation for smaller and larger WTGs, the worst-case assumes 35 x smaller WTGs with GBS foundations. GBS foundations are assumed to have a diameter of 65m + 10m disturbance either side. The worst-case scenario is for two jack-up visits per WTG/OSP foundation in different positions over the construction period (each jack-up with 6 legs, each with a 250m^2 footprint). This equates to a total footprint of 1,500m^2 per jack-up vessel visit and 3,000m^2 over the construction period per WTG/OSP foundation.

Impact	Worst-case scenario	Notes and rationale
		The worst-case scenario is for two anchor positions per foundation (including resetting), with up to 12 anchors per location. Each anchor width is estimated to be 6m, with an approximate seabed footprint of 30m^2 per anchor. The worst-case scenario for physical disturbance for cables is based on a maximum length of 70km of inter-array cables and 10km of platform link cables, with a 25m wide installation corridor in which cable preparation activities may take place (this encompasses pre-lay activities (e.g., boulder removal), trenching and spoil width).
	Largest seabed disturbance (sediment volume) ▪ 35 x WTGs with GBS foundations = 455,438m^3 ▪ Two x OSPs with GBS foundations = 26,025m^3 ▪ Inter-array cables (sandwave levelling) = 70,000m^3 ▪ Platform link cables (sandwave levelling) = 10,000m^3 ▪ Inter-array cables (installation) = 472,500m^3 ▪ Platform link cables (installation) = 67,500m^3 Total sediment volume disturbance = **1,101,463m^3**	Seabed preparation (e.g., excavation using a trailing suction hopper dredger (TSHD) or other specialist bed leveller/trencher such as mass flow excavation) may be required. This is a volume of sediment that is disturbed prior to installation of WTG/OSP foundation and involves the removal of sediment from the seabed. The worst-case scenario assumes that sediment would be removed and returned to the water column at the sea surface (e.g., during disposal from a dredger vessel[3]) for WTGs and OSPs. The seabed preparation area would be dredged to a depth of up to 1.5m. Drill arisings from a drive-drill-drive installation methodology would result in a lower volume of sediment being disturbed (55,865m^3 – based on

[3] It is possible that seabed preparation would be undertaken by plough and sediment would therefore not be released at the surface, however disposal at the surface has been retained for the worst-case scenario.

Impact	Worst-case scenario	Notes and rationale
		monopile foundations) and are therefore not presented. The worst-case length of inter-array cables is 70km and platform link cables is 10km. The worst-case assumes that 10% of the length of inter-array and platform link cables would require sandwave clearance/levelling. A clearance width of 10m and height of 1m is used. The worst case assumes sediment would be released at the water surface. The worst-case for cable installation assumes that 50% of inter-array and platform link cables are buried at 3m and 50% length is buried at 1.5m by jetting in a box-shaped trench, with a 3m trench width.
Impact 3: Indirect impact to heritage assets from changes to physical processes	The worst-case scenarios for marine physical processes are set out in **Chapter 7 Marine Geology, Oceanography and Physical Processes**. The following impacts are relevant to the worst-case for Marine Archaeology and Cultural Heritage (i.e., increased exposure of buried archaeological material to marine processes due to loss of sediment cover): ▪ Construction Impact 4: Change in seabed level due to sandwave clearance/levelling and installation of inter-array and platform link cables ▪ Construction Impact 5: Interruptions to bedload sediment transport due to sandwave levelling for inter-array and platform link cable installation ▪ Construction Impact 6: Indentations on the seabed due to installation vessels Conversely, marine physical processes impacts which correspond to increased bed-level and consequent increased potential for the protection of heritage assets which are currently exposed through additional sediment cover (sediment deposited from plume) are: ▪ Construction Impact 2a: Changes in seabed level due to seabed preparation for foundation installation ▪ Construction Impact 2b: Changes in seabed level due to drill arisings for installation of piled foundations	

Impact	Worst-case scenario	Notes and rationale
Impact 4: Impacts to the setting of heritage assets	▪ Construction phase duration of 2.5 years. ▪ Maximum number of annual vessel return trips: **2,583** ▪ Maximum number of vessels on site at any time: **37**	The worst-case scenario represents the maximum intrusive effect of construction activities on heritage assets for which setting contributes to their cultural significance whether they are submerged, buried, exposed on the seabed, for the longest duration.
Operation and maintenance phase		
Impact 1: Direct impact to known heritage assets	N/A	Direct impacts to known heritage assets are not anticipated to occur due to the retention of AEZs throughout the Project lifespan and restriction of activities to red line boundary. Any currently unknown heritage assets which are identified during pre-construction surveys would be subject to avoidance, if required (**Section 15.3.3**).
Impact 2: Direct impact to potential heritage assets	**Jack-up vessel deployments:** ▪ Jack-up vessel footprint every other year = 1,500m² **Cable repair/replacement and reburial:** ▪ Average cable repair/replacement footprint per year = 2,000m² ▪ Average cable reburial footprint per year = 1,000m² **Anchoring:** ▪ Average temporary anchor footprint per year = 720m² Total per year (noting jack-ups are only assumed every other year) = **5,220m²** Total over operational period = **155,700m²**	The worst-case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits. The worst-case scenario for jack-up deployments assumes the use of one jack-up vessel with a seabed footprint of 1,500m² (up to six legs, each with a footprint of up to 250m²) every other year. The worst-case is based on an average of 200m of cable repaired/replaced every year and an average of 100m of cable reburied every year, with a 10m disturbance width. The worst-case for anchoring is anticipated to be on average one anchoring event per year.

Impact	Worst-case scenario	Notes and rationale
		Disturbance is shown on average per year; however, repair/replacement and reburial activities could vary across years during the operation and maintenance phase and therefore an approximate total disturbance is shown for the operational lifetime, which is expected to be 35 years.
Impact 3: Indirect impact to heritage assets from changes to physical processes	The worst-case scenarios for marine physical processes are set out in **Chapter 7 Marine Geology, Oceanography and Physical Processes**. The following impacts are relevant to the worst-case for Marine Archaeology and Cultural Heritage (i.e., increased exposure of buried archaeological material to marine processes due to loss of sediment cover): ▪ Impact 1: Changes to the tidal regime due to the presence of structures on the seabed (WTG and OSP foundations) ▪ Impact 2: Changes to the wave regime due to the presence of structures on the seabed (WTG and OSP foundations) ▪ Impact 3: Changes to the bedload and suspended sediment transport regimes due to the presence of structures on the seabed (WTG and OSP foundations) ▪ Impact 4: Loss of seabed area due to the footprint of WTG and OSP foundation structures ▪ Impact 5: Morphological and sediment transport effects due to cable protection measures within the windfarm site ▪ Impact 6: Cable and WTG/OSP maintenance activities	
Impact 4: Impacts to the setting of heritage assets	▪ Presence of infrastructure including maximum WTG blade tip height of 310m (above Highest Astronomical Tide (HAT)) in addition to two OSPs, as described in **Chapter 5 Project Description** ▪ Maximum number of vessel movements per year (during a standard year): **384 vessels** ▪ Maximum number of vessel movements per year (during a 'heavy maintenance' year): **832 vessels** ▪ Maximum number of vessels anticipated to be on site at one time (standard year): **3 vessels**	The worst-case scenario represents the maximum intrusive effect of installed infrastructure, operation and maintenance activities for the longest duration (heavy maintenance years assumed to be on average every 5 years). Operational lifetime is assumed to be 35 years.

Impact	Worst-case scenario	Notes and rationale
	▪ Maximum number of vessels anticipated to be on site at one time (heavy maintenance year): **9 vessels**	
Impact 5: Impacts to the setting of coastal (terrestrial) designated heritage assets	As per Operation and Maintenance Impact 4.	The worst-case scenario represents the maximum intrusive effect of installed infrastructure, operation and maintenance activities for the longest duration. Operations lifetime is assumed to be 35 years.
Decommissioning phase		
Impact 1: Direct impact to known heritage assets	The decommissioning policy for the Project infrastructure is not yet defined, however, it is anticipated that structures above the seabed would be removed. The following infrastructure is likely be removed, reused, or recycled where practicable: ▪ WTG's and foundations ▪ OSP(s) including topsides and foundations The following infrastructure is likely to be decommissioned and could be left in-situ depending on available information at the time of decommissioning: ▪ Inter-array and platform link cables ▪ Scour protection ▪ Crossings and cable protection ▪ Part of the foundations (e.g., some foundation material below the seabed may be left in-situ)	The detail and scope of the decommissioning works would be determined by the relevant legislation and guidance at the time. Decommissioning arrangements would be detailed in a Decommissioning Programme, which would be drawn up and agreed with the relevant authority, prior to decommissioning. For the purposes of the worst-case scenario, it is anticipated that the impacts would be comparable to those identified for the construction phase.
Impact 2: Direct impact to potential heritage assets		
Impact 3: Indirect impact to heritage assets from changes to physical processes		
Impact 4: Changes to the setting of heritage assets		

15.3.3 Summary of mitigation embedded in the design

15.17 This section outlines the embedded mitigation relevant to the marine archaeology and cultural heritage assessment, which has been incorporated into the design of the Project (as summarised in **Table 15.3**). Where additional mitigation measures are proposed, these are detailed in the impact assessment (**Section 15.6** and **Section 15.7**).

Table 15.3 Embedded mitigation measures related to marine archaeology and cultural heritage

Parameter	Mitigation measure embedded into the design of the Project	Description
Known heritage assets	AEZs (see **Section 15.6.1.1**)	For archaeological significant anomalies that are clearly identifiable in the survey data and where the extents are largely known, AEZs would be employed. AEZs would remain for the life of the Project or until ground truthing or higher resolution data determines a reduction in potential, significance, or extents.
	Temporary Exclusion Zones (TEZs) (**see Section 15.6.1.1**)	Where an anomaly is not visible in the survey data but likely to exist on the seabed at a known position or where the extents of an anomaly are not fully identifiable, TEZs would be employed. TEZs have been identified as highly likely to be altered following higher resolution or full coverage data assessment, however, they would remain in place until alterations have been formally agreed.
Potential heritage assets (maritime or aviation)	Avoidance by micro-siting of design following the acquisition of high-resolution geophysical data, to be acquired post-consent to inform detailed project design.	Avoidance, where possible, of identified anomalies.
		Avoidance by micro-siting where possible of previously recorded sites that have not been seen in the geophysical data and at which the presence of surviving material is considered unlikely.
		Further investigation of any identified anomalies and previously recorded sites that cannot be avoided by micro-siting of design and the application of either embedded mitigation (avoidance) or additional mitigation (**Section 15.6**).

15.18 The proposed approach to the delivery of this embedded mitigation, undertaken post-consent, and how the outcomes of additional investigation would influence the final design of the Project, is set out in an Outline OWSI. This has been prepared in accordance with industry good practice guidance on Archaeological WSIs (The Crown Estate, 2021).

15.19 In order to account for unexpected discoveries of archaeological material during construction, operation and decommissioning, a formal protocol would be required. It is recommended that if any objects of possible archaeological interest are encountered, that they should be reported using a PAD (set out in the OWSI).

15.4 Impact assessment methodology

15.4.1 Policy, legislation, and guidance

15.4.1.1 National Policy Statements

15.20 The assessment of potential impacts on marine archaeology and cultural heritage has been made with specific reference to the relevant NPS. These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to the Project are:

- Overarching NPS for Energy (EN-1) (Department for Energy Security & Net Zero (DESNZ), 2023a)
- NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023b)
- NPS for Electricity Networks Infrastructure (EN-5) (DESNZ, 2023c)

15.21 The specific assessment requirements for marine archaeology and cultural heritage, as detailed in the NPS, are summarised in **Table 15.4,** together with an indication of the section of the ES chapter where each is addressed.

Table 15.4 NPS assessment requirements for marine archaeology and cultural heritage

NPS requirement	NPS reference	ES reference
NPS for Energy (EN-1)		
As part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development, including any contribution made by their setting. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum, the applicant should have consulted the relevant Historic Environment Record (or, where the development is in English or Welsh waters, Historic England or Cadw) and assessed the heritage assets themselves using expertise where necessary according to the proposed development's impact.	Paragraph 5.9.10	The significance of the archaeological receptors considered in this chapter, and the contribution of setting to that significance, have been detailed in **Sections 15.5.1.1**, **15.5.1.2**, **15.5.2.4** and **15.7**.
Where a site on which development is proposed 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. Where proposed development will affect the setting of a heritage asset, accurate representative visualisations may be necessary to explain the impact.	Paragraph 5.9.11	**Section 15.5** of this document provides a full assessment of the baseline environment.
The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents. Studies will be required on those heritage assets affected by noise, vibration, light and indirect impacts, the extent and detail of	Paragraph 5.9.12	This chapter provides an account of the potential impacts of the Project upon heritage assets and their cultural heritage significance (**Sections 15.6** and **15.7**).

NPS requirement	NPS reference	ES reference
these studies will be proportionate to the significance of the heritage asset affected.		
The applicant is encouraged, where opportunities exist, to prepare proposals which can make a positive contribution to the historic environment, and to consider how their scheme takes account of the significance of heritage assets affected. This can include, where possible: ▪ Enhancing, through a range of measures such as sensitive design, the significance of heritage assets or setting affected ▪ Considering where required the development of archive capacity which could deliver significant public benefits ▪ Considering how visual or noise impacts can affect heritage assets, and whether there may be opportunities to enhance access to, or interpretation, understanding and appreciation of, the heritage assets affected by the scheme	Paragraph 5.9.13	The potential for enhancement of the archaeological record for the Irish Sea is discussed in **Section 15.6**.
NPS for Renewable Energy Infrastructure (EN-3)		
Applicants should submit an outline archaeological Written Scheme of Investigation (WSI) as part of the DCO submission, with a commitment to complete a project specific WSI postconsent in consultation with Historic England.	Paragraph 2.8.78	An Outline OWSI accompanies the ES and DCO Application. The Offshore Outline WSI, as submitted within the DCO Application, would be followed by a Draft WSI (based on the Outline WSI) to be agreed with Historic England to ensure archaeological objectives are taken into account. A Final agreed WSI would be produced post-consent to be followed by Method Statements for each works package undertaken during all future phases of development.

NPS requirement	NPS reference	ES reference
Applicants should consult with the relevant statutory consultees, such as Historic England or Cadw, on the potential impacts on the marine historic environment at an early stage of development during pre-application, taking into account any applicable guidance (e.g., offshore renewables protocol for archaeological discoveries). Providing proposed schemes have been carefully designed, and that the necessary consultation with relevant bodies and stakeholders has been undertaken at an early stage, mitigation measures may be possible to negate or reduce effects on other offshore infrastructure or operations to a level sufficient to enable the Secretary of State to grant consent.	Paragraph 2.8.168 and Paragraph 2.8.348	Consultation has been undertaken with relevant statutory consultees during pre-application, as outlined in **Section 15.2**. Consultation would be on going throughout the development process. Mitigation measures are outlined in **Section 15.3.3**.
Assessment of potential impacts upon the historic environment should be considered as part of the Environmental Impact Assessment process undertaken to inform any application for consent. Desk based studies to characterise the features of the historic environment that may be affected by a proposed development and assess any likely significant effects should be undertaken by competent archaeological experts. These studies should consider any geotechnical or geophysical surveys that have been undertaken to aid the wind farm and/or offshore transmission design.	Paragraphs 2.8.169 to 2.8.171	**Section 15.5** of this document provides the results of the desk-based assessment and the archaeological assessment of marine geophysical and geotechnical data undertaken to date for Offshore Archaeology and Cultural Heritage. **Appendix 15.1** and **15.2** show this has been taken account into geophysical survey campaigns to date. **Section 15.6** and **15.7** details the results of the impact assessment undertaken for the Project.
Assessment may also include the identification of any beneficial effects on the marine historic environment, for example through improved access or the contribution to new knowledge that arises from investigation.	Paragraph 2.8.176	Any potential beneficial effects to the marine archaeology and cultural heritage resource resulting from the Project have been identified and incorporated as part of **Section 15.6** and **15.7**.

NPS requirement	NPS reference	ES reference
Where elements of a proposed project (whether offshore or onshore) may interact with historic environment features that are located onshore, applicants should assess the effects in accordance with Section 5.9 in EN-1.	Paragraph 2.8.177	Potential impacts to the setting of onshore designated assets as a result of the Project are discussed in **Section 15.4.6** and are assessed in **Appendix 15.3.** No onshore infrastructure is planned under the scope of this DCO Application. Onshore infrastructure is being progressed under a separate DCO Application which includes Transmission Assets (as described in **Section 15.7.3**).
NPS for Electricity Networks Infrastructure (EN-5)		
As well as having duties under Section 9 of the Electricity Act 1989, (in relation to developing and maintaining an economical and efficient network), applicants must take into account Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical features of special interest and of protecting sites, buildings and objects of architectural, historic or archaeological interest; and …do what [they] reasonably can to mitigate any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, sites, buildings or objects.	Paragraph 2.2.10	Potential impacts upon sites and objects of archaeological interest are set out in **Section 15.6**, along with a proposed approach to mitigation further detailed in the Outline OWSI.

15.4.1.2 Additional relevant policy and guidance

15.22 In addition to the NPS, there are a number of pieces of legislation, policy and guidance applicable to the assessment of marine archaeology and cultural heritage. Further detail where relevant is provided in **Chapter 3 Policy and Legislation** (Document Reference 5.1.3).

Legislation

15.23 The Project is located within the UK Exclusive Economic Zone (EEZ). The following legislation applies to marine heritage within the UK EEZ:

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

15.24 The above legislation provides protection for wrecks of high historical, archaeological, or artistic value, as well as allowing military wrecks and aircraft remains to be protected. There are currently no known protected wrecks within the windfarm site, although, if encountered, all military aircraft crash sites are automatically protected under the Protection of Military Remains Act 1986. Ownership of any wreck remains is determined in accordance with the Merchant Shipping Act 1995.

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

- Article 1: Definition of archaeological heritage
- Article 2: Identification and designation
- Article 3: Control of archaeological work
- Article 4: Physical protection of archaeological heritage
- Article 5: Integration of archaeology in development planning
- Article 6: Funding of archaeological work (public and private)
- Article 7: Collection and dissemination of information
- Article 8: National and international exchange of information
- Article 9: Promotion of public awareness

- Article 10 and 11: Prevention of illicit circulation of elements of the archaeological heritage
- Article 11: Mutual technical and scientific assistance

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

Policy

15.27 This assessment takes account of the UK MPS (Department for Environment, Food and Rural Affairs (Defra), 2011). The MPS sets out high level objectives for marine planning, which have directed development of the Plan at a local level. Marine Plans must be in accordance with other relevant national policy and are intended to contribute to the achievement of sustainable development in the UK marine area.

15.28 The North West Offshore Marine Plans (Defra, 2021) is relevant to the Project, which outlines the objective "*to conserve and enhance marine and coastal heritage assets by considering the potential for harm to their significance*". This objective recognises the need to consider whether developments are appropriate to the area they are located in and have an influence upon, and seeks to ensure that, as far as possible, the value of such assets and characteristics are not compromised. Policies specific to heritage assets and where they are addressed in this chapter are outlined in **Table 15.5**.

Table 15.5 Summary of the Northwest Marine Plans

Plan policies specific to heritage assets	ES Section reference
NW-HER-1: Proposals that demonstrate they will conserve and enhance the significance of heritage assets will be supported. Where proposals may cause harm to the significance of heritage assets, proponents must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - any harm to the significance of heritage assets. If it is not possible to mitigate, then public benefits for proceeding with the proposal	The primary method of mitigation when dealing with the archaeological resource as set out in this chapter is based on the prevention of damage to receptors by putting in place protective measures rather than attempting to repair damage. Avoidance by means of AEZs would serve to ensure that such assets would not be compromised. Potential archaeological receptors are safeguarded or the effects upon them minimised by means of mitigation measures outlined in **Section 15.3.3**.

Plan policies specific to heritage assets	ES Section reference
must outweigh the harm to the significance of heritage assets.	

Guidance

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

- Principles of CHIA in the UK (IEMA, IHBC and CIfA, 2021)
- The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition) (Historic England, 2017a)
- Planning Practice Guidance (PPG): Historic Environment (Ministry for Housing, Communities and Local Government (MHCLG), July 2019)
- CIfA Standard and Guidance for Historic Environment Desk-Based Assessments (2020)
- CIfA Code of Conduct (2022)
- Environmental Archaeology, A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition) (Historic England, 2011)
- Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Historic England, 2013)
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011)
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008)
- Historic Environment Guidance for the Offshore Renewable Energy Sector Guidance (Wessex Archaeology, 2007)
- Code for Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC), 2006)
- Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021)
- Historic Environment Advice Note 15 Commercial Renewable Energy Development and the Historic Environment (Historic England, 2021).
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011)

15.4.2 Data and information sources

15.4.2.1 Site-specific surveys

Marine geophysical investigations

15.30 To provide site-specific and up to date information on which to base the impact assessment, a geophysical site characterisation survey was conducted. The geophysical survey area covered the Project Agreement for Lease (AfL) area (**Figure 15.1**) and encompasses the windfarm site assessed within this ES (noting that the windfarm site boundary has been refined since PEIR[4]). The survey was conducted by the marine survey company MMT during October and November 2021, and consisted of SSS, MBES, Magnetometer, and SBP (**Appendix 7.1 Offshore Geophysical Survey**; Document Reference 5.2.7.1).

15.31 Data was acquired with a line spacing of 85m for the main lines, and 5km for the cross lines. The spacing ensured 100% coverage of the surveyable area with SSS data was achieved. Data could not be collected within a 500m radius of the oil and gas infrastructure located within the windfarm site, namely the (now decommissioned and removed) DP3 platform.

15.32 MSDS Marine were appointed to undertake the archaeological assessment of the acquired geophysical survey data (**Appendix 15.1**). MSDS Marine are a specialist marine and coastal contractor and are a CIfA registered organisation.

15.33 The geophysical survey data provided to MSDS Marine is set out in **Table 15.6**.

Table 15.6 Geophysical survey data deliverables provided to MSDS Marine

Sensor	Data type	Format
SSS	Raw lines (LF and HF)	.jsf
	Processed lines (HF)	.xtf
	Mosaic (HF) 0.2 ppm	.tif
	Contacts	.csv, shp
SBP	Raw lines	.sgv
	Processed lines	.sgy

[4] The windfarm site assessed within the Project PEIR reflected the Project AfL boundary (125km^2). This has subsequently been reduced to a windfarm site of 87km^2 through a reduction in the western boundary.

Sensor	Data type	Format
	Grids	.dat
	Horizons	.dat
	Contours	.dxf
Magnetometer (MAG) (TVG)	Raw lines	.txt
	Processed lines (individual)	.txt
	Processed lines (merged)	.csv
	Grids (residual and altitude)	.xyz
	Mosaic (residual and altitude)	.tif, .png
	Contacts	.csv, .shp
MBES	Raw lines	.xyz
	Grids (at 0.2 m)	.txt
Geographic Information System (GIS)	SSDM	.gdb
Reports	Survey report	.pdf
	Operations report	.pdf

15.34 MSDS Marine undertook an initial audit of the survey data in order to assess its suitability for archaeological assessment (refer to Annex B of **Appendix 15.1**). The data collected across the windfarm site (and wider geophysical survey area) was found to be of good quality overall, and in the case of SSS and MBES provided 100% coverage. SBP data was collected to a pre-determined line plan, providing suitable coverage and penetration for the interpretation of the palaeoenvironment. The magnetometer data was collected to a pre-determined line plan suitable for the identification of ferrous material >50kg along the tracklines, with the minimum detection size increasing with distance from the tracklines.

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

15.36 As part of their assessment, MSDS Marine applied a 500m buffer to the extents of the survey area in order to incorporate the full extents of the survey coverage and to provide additional historic environment data searches and information. This was done to provide a wider context to the assessment. It should be noted that all data collected for the survey area were assessed by MSDS Marine, fully encompassing the windfarm site (the revision of the

windfarm site boundary is further detailed in **Chapter 4 Site Selection and Assessment of Alternatives** (Document Reference 5.1.4)).

15.37 The assessment of SBP data was undertaken in two phases as follows:

- Phase 1 comprised a review of the SBP geophysical interpretative report prepared by MMT to inform the engineering design of the Project. The report was reviewed by MSDS Marine to understand the wider geology and stratigraphy and to identify units of potential archaeological interest. A sub-set of SBP profiles were reviewed to corroborate the findings in the MMT geophysical interpretative report. Horizon maps created by MMT were plotted in relation to wider palaeo-landscape features to understand the context of the units of archaeological interest (see **Appendix 15.1**).
- Phase 2 comprised further bespoke SBP interpretation of units of archaeological interest to resolve localised variations and identify deposits of potential archaeological interest to be targeted in the Project geotechnical survey campaign that was undertaken between June and October 2023. This information is presented in **Appendix 15.2**.

Marine Geotechnical Investigations

15.38 Gardline Limited (Gardline) were commissioned by the Applicant to acquire geotechnical data to inform WTG and OSP foundation design and installation methodology.

15.39 Mobilisation of Gardline's drilling vessel, the M.V. Horizon Geodiscovery, was carried out in the port of Barrow-In-Furness, UK, on 13th July 2023. Operations were commenced at location CPT128 and were completed at location BH112. Demobilisation was completed in the port of Liverpool, England on 22nd October 2023.

15.40 The geotechnical survey consisted of two types of boreholes. The first consisted of Cone Penetrometer Testing (CPTU) boreholes utilising a downhole WISON system with oversampling on client request. The second comprised sampling boreholes.

15.41 The original scope of the survey comprised of 38 CPT and 15 sampling boreholes to a termination depth of 50m or upon the acquisition of 5m of 'competent' bedrock, whichever was achieved first. A wide range of Shelby tubes were available during the site investigation. Shelby tubes were selected to optimise sample quality and recovery depending on soil conditions. Due to presence of soft clays, stiff clays, and sands throughout the boreholes, a mixture of thin and medium wall Shelby tubes of varying lengths were utilised during sampling operations.

15.42 In total 16 CPTU borehole locations (+3 bump over[5]) were completed, along with 11 Sampling Boreholes (+5 Bump overs) during the site investigation on the M.V. Horizon Geodiscovery. Not all of the planned boreholes could be completed due to bad weather.

15.43 Following the acquisition of the data, the logs were provided to Royal HaskoningDHV's geoarchaeologist in accordance with the Archaeological Method Statement (Offshore) – Assessment of Geotechnical Survey Data (Document Reference FLO-MOR-MS-0014; this Method Statement was shared with Historic England prior to the survey on the 28th April 2023).

15.44 Two boreholes were identified which contained sediments of possible archaeological interest. These are summarised in **Table 15.7** below.

Table 15.7 Boreholes containing sediments of possible archaeological interest

ID	Depth (m below seafloor)	Description	Archaeological objective
BH109	6.65-9.65	Sand with rare pockets of organic matter	Confirm presence/absence of organic matter and potentially request sub samples
	16.30-18.51	Silty sand with thin beds of low strength clay	Possible alluvium, potentially request sub samples
BH118	12.50-14.50	Sand with rare pockets of organic matter	Confirm presence/absence of organic matter and potentially request sub samples
	14.50-18.84	Low strength clay with closely spaced lamination of brown sand	Possible alluvium, potentially request sub samples

15.45 Following the review of the logs, Royal HaskoningDHV's geoarchaeologist reviewed the core samples photographs for both of these borehole logs and determined that no subsamples would be required. The reasoning is provided in **Table 15.8**.

Table 15.8 Borehole photograph review

ID	Photograph Review	Sub-sample
BH109	Black staining in core photographs but appears minerogenic and faded boundaries suggest possibly geochemical rather than in-situ or detrital organic matter. Sand described as slightly calcareous, and photographs indicate fine fragments	No

[5] A bump over occurs if recovery is not possible and the borehole needs to be slightly relocated to achieve recovery.

ID	Photograph Review	Sub-sample
	of white, possible shell material. Deposit likely marine sand. Archaeological potential = low.	
	Core photographs show similar colour to underlying glacial clay and whilst it has clear sand/clay beds, considered to be glacial in origin, potentially glaciomarine to deltaic. Archaeological potential = low.	No
BH118	Comprises marine shell visible at depth in the core photographs. Black staining is similar to in BH109 and considered to be minerogenic/geochemical rather than organic. Archaeological potential = low.	No
	Core photograph shows similar colour to underlying glacial clay and beds/laminations are very small. Interpreted to have formed in glaciomarine environment. Archaeological potential = low.	No

15.46 Further geotechnical investigations are planned to be undertaken in 2024 to acquire additional data.

15.4.2.2 Other available sources

15.47 In addition to the survey data, the sources presented in **Table 15.9** have been used to inform the marine archaeology and cultural heritage assessment.

15.48 Given the interconnected nature of the Project and the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, the environmental information for the Transmission Assets PEIR has also been used to inform this chapter (Morgan Offshore Wind Limited and Morecambe Offshore Windfarm Ltd, 2023).

Table 15.9 Existing data sources used in this chapter

Data source	Spatial coverage	Data contents
The UKHO data for charted wrecks and obstructions	UK	Records of wrecks and obstructions data including 'dead' and salvaged wrecks that are no longer charted as navigational hazards.
Maritime records maintained by Historic England, the NHLE and formerly the National Record of the Historic Environment (NRHE) National Historic Environment Record (NHER)	England	Maritime records, including documented losses of vessels, and records of terrestrial monuments and findspots, including the archaeological excavation index.

Data source	Spatial coverage	Data contents
The NHLE maintained by Historic England	England	Official, up to date, register of all nationally protected historic buildings and sites in England - listed buildings (LB), Scheduled Monuments (SM), protected wrecks, Registered Parks and Gardens (RPGs), and battlefields (including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973).
The Coastal and Intertidal Zone Archaeology Network (CITiZAN)	UK	CITiZAN, the Coastal and Intertidal Zone Archaeological Network, highlights the threat of coastal erosion to a wealth of foreshore and intertidal sites. These archaeological features encompass a huge time span, many are of considerable local or national significance.
Relevant mapping including Admiralty Charts, historic maps, and Ordnance Survey (OS)	UK	Information relation to previously charted wrecks, seabed topography and topography.
Existing archaeological studies and published sources	Irish Sea	Background information on the archaeology of the Irish Sea, including the assessment results of nearby offshore windfarm projects including Awel y Môr (AyM), Walney, Barrow, Ormonde, Gwynt y Môr, Burbo Bank, Mona and Morgan, and the Transmission Assets for the Morgan Offshore Wind Project and Morecambe Offshore Windfarm.
West Coast Palaeolandscapes Survey	West Coast of England	Study mapping submerged landscapes contained within an area of the Irish Sea using wide variety of seismic data sources.

15.4.3 Impact assessment methodology

15.49 **Chapter 6 EIA Methodology** provides a summary of the general impact assessment methodology applied to the Project.

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

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

A. Understanding cultural heritage assets

B. Evaluating the consequences of change

15.52 Understanding cultural heritage assets (A) distinguishes between:

- Describing the asset (what it is and what is known about it)
- Ascribing cultural significance (a description of what is valued about it)
- Attributing importance (a scaled measure of the degree to which the cultural significance of that asset should be protected)

15.53 Evaluating the consequences of change (B) also distinguishes between three separate analytical stages:

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

15.54 The relationship between these principles and the general approach to **Chapter 6 EIA Methodology** is described in the following sections.

15.4.3.1 Understanding cultural heritage assets

15.55 A description of the cultural heritage assets, and their cultural significance, relevant to the assessment of marine archaeology and cultural heritage is provided in **Section 15.5**. At this stage of the Project, many of these assets are not yet fully understood. However, as set out in the Principles, as well as in national planning guidance including the NPSs (**Table 15.4**) proportionality is key. Applicants must provide a level of detail that is proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their cultural significance.

15.56 The level of detail provided in **Section 15.5**, therefore, sufficiently characterises these assets so that potential impacts upon their cultural significance can be understood for the purposes of EIA.

15.57 As discussed in consultation with heritage stakeholders (see **Table 15.1**), further investigation and data gathering would be progressed throughout the Project development process (post-consent), including high resolution surveys, alongside additional mitigation requirements as set out in the Outline OWSI.

15.58 This is in line with the Principles which describe how, “an understanding of the cultural heritage asset is likely to be an iterative process which regularly reappraises the consequential impact on cultural significance as a proposal evolves or as more evidence emerges from research and investigations”. **Section 15.5**, therefore, also highlights where there is a need to acquire additional information, and when this would be progressed, as part of an ongoing iterative design process.

15.59 The NPPF (MHCLG, 2021, Annex 2) defines cultural (or heritage) significance as the sum of the heritage values or interests that we, as a society, recognise in a heritage asset and seek to protect or enhance for future generations. A statement of cultural significance should explain why we value a heritage asset. While the NPPF does directly relate to offshore infrastructure projects, this definition of cultural (or heritage) significance is still applicable to offshore cultural heritage.

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

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

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

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

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

15.65 In determining the significance of effect for the purposes of EIA, this last analytical stage (attributing importance) broadly equates to 'sensitivity' as described in **Section 15.4.3.3**.

15.4.3.2 Evaluating the consequences of change

15.66 The Principles describe change as, "both the act and the result of making something different from how it was before, whether directly or indirectly, temporarily or permanently, reversibly or irreversibly". It is also important to note that change may or may not lead to an impact on cultural significance. Before a scaled measure of this change can be determined it is necessary to describe the potential change to a heritage asset or its setting. To this end, a narrative approach describing the nature of potential changes is provided for each impact assessed in **Section 15.6** and **15.7**.

15.67 This is followed by the determination of a scaled measure of the degree to which any change would impact cultural significance, which broadly equates to the 'magnitude of impact' as described in **Section 15.4.3.3**. This change could have a positive (beneficial) or negative (adverse) outcome. It is not a measure of the reach or extent of the proposal but rather the change to 'what matters' about a heritage asset.

15.68 The final stage is weighting the effect (the measure that brings together the magnitude of the impact and the cultural heritage asset's importance). For the Project this is articulated through the significance of effect matrix presented in **Table 15.12**. Following on from the previous stages of the assessment, which draw out the narrative regarding the importance of a cultural heritage asset, its cultural significance, and how the proposal would impact this cultural significance, this measure is indicative of the weight that should be given to

the matter in influencing the design of the proposal or, ultimately, in influencing whether the proposal will be acceptable and permitted.

15.69 Definitions for this weighted measure of significance of effect (in EIA terms) are provided in **Table 15.13**.

15.4.3.3 Definitions of sensitivity, value, and magnitude

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

15.71 For the purposes of this EIA, the criteria for determining the heritage importance of any relevant heritage assets are described in **Table 15.10**.

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

15.73 **Table 15.10** includes heritage assets of uncertain heritage importance i.e., where the importance, existence and/or level of survival of an asset has not been ascertained (or fully understood) from available evidence. Although **Table 15.10** provides a definition for assets of an uncertain heritage importance, where uncertainty occurs, the precautionary approach is to assign the highest likely level of importance. This precautionary approach represents good practice in CHIA and reduces the potential for impacts to be under-estimated.

Table 15.10 Criteria for determining heritage importance

Importance	Definition
High (perceived International/National Importance)	▪ WHS ▪ SMs ▪ Grade I and II* LBs or structures ▪ Protected wrecks ▪ Aviation crash sites ▪ Designated historic landscapes of outstanding interest ▪ Conservation Areas containing buildings or structures with high heritage importance, or high concentrations of LBs ▪ Assets of acknowledged international/national importance ▪ Assets that can contribute significantly to acknowledged international/national research objectives
Medium (perceived Regional Importance)	▪ Grade II LBs or structures ▪ Designated special historic landscapes ▪ Other types and character of Conservation Areas ▪ Assets that contribute to regional research objectives ▪ Assets with regional value, educational interest, or cultural appreciation 'Locally Listed' buildings or structures ▪ Assets that contribute to local research objectives ▪ Assets with local value, educational interest, or cultural appreciation ▪ Assets compromised by poor preservation and/or poor contextual associations
Low (perceived Local importance)	▪ 'Locally Listed' buildings or structures ▪ Assets that contribute to local research objectives ▪ Assets with local value, educational interest, or cultural appreciation ▪ Assets compromised by poor preservation and/or poor contextual associations
Negligible	▪ Assets with no significant value or archaeological/historical interest
Uncertain/Unknown	▪ The importance/existence/level of survival of the asset has not been ascertained (or fully ascertained/understood) from available evidence

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

15.75 Direct impacts, indirect impacts, and impacts resulting from a change in setting on the significance of heritage assets are considered relevant. Impacts may be adverse or beneficial. Depending on the nature of the impact and the

duration of development, impacts can also be temporary and/or reversible or permanent and/or irreversible.

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

15.77 The magnitude of adverse impacts with respect to marine archaeology and cultural heritage directly relates to the extent of harm to, or loss of, key elements of the asset's cultural significance, which may include its setting.

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

15.79 Alternatively, benefits may occur on the basis of data gathering exercises undertaken for the purpose of a project which will enhance public understanding by adding to the archaeological record (e.g., through the accumulation of publicly available information and data). The measure of beneficial impact (high/medium/low) is, therefore, necessarily situational, and specific to a given site, area, or subject. One such example of a positive magnitude of impact could be relevant to, for example, new survey data being acquired, which will ultimately be made publicly accessible. This is further discussed in **Section 15.7.3.2**.

15.80 The criteria used for assessing the magnitude of impact regarding marine archaeology and cultural heritage are presented in **Table 15.11**.

Table 15.11 Magnitude of impact to heritage assets

Magnitude	Definition
High Adverse	Key elements of the asset's fabric and/or setting are lost or fundamentally altered, such that the asset's cultural significance is lost or severely compromised.
Medium Adverse	Elements of the asset's fabric and/or setting which contribute to its cultural significance are affected, but to a more limited extent, resulting in an appreciable but partial loss of the asset's cultural significance.
Low Adverse	Elements of the asset's fabric and/or setting which contribute to its cultural significance are affected, resulting in a slight loss of cultural significance.

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

15.4.3.4 Effect significance

15.81 The potential significance of effect for a given impact, is a function of the sensitivity of the receptor and the magnitude of the impact (see **Chapter 6 EIA Methodology** for further details). As described above, for archaeology and cultural heritage this equates to the importance of a heritage asset weighed against the magnitude of change to its cultural significance. The determination of significance is guided using a significance of effect matrix, as shown in **Table 15.12**. Definitions of each level of significance are provided in **Table 15.13**. Impacts and effects may be deemed as being either positive (beneficial) or negative (adverse).

15.82 It is important that the matrix (and indeed the definitions of importance and magnitude) is seen as a framework to aid understanding of how a judgement has been reached from the narrative of each effect assessment and that it is not a prescriptive formulaic method.

15.83 Potential effects are described followed by a statement of whether the effect is significant in terms of the EIA Regulations. Potential effects identified within the assessment as major or moderate are regarded as significant in terms of the EIA Regulations. Whilst minor effects (or below) are not significant in EIA

terms in their own right, it is important to distinguish these as they may contribute to significant effects cumulatively or through interactions.

15.84 Following initial assessment, if the effect does not require additional mitigation (or none is possible), the residual effect would remain the same. If, however, additional mitigation is proposed, an assessment of the post-mitigation residual effect is provided.

Table 15.12 Significance of effect matrix

		Adverse Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Importance	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

Table 15.13 Definition of effect significance

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

15.4.4 Historic seascape character

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

15.86 The historic character of the seascape is described in terms of ability to accommodate change. A key aspect of this ability is how that character is perceived by the public. For this reason, an approach is required which recognises the dynamic nature of seascape and how all aspects of the

seascape, no matter how modern or fragmentary, can form part of the character of that seascape.

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

15.88 Changes to the historic seascape character and the extent to which these changes can be accommodated are discussed in **Section 15.5.4**.

15.4.5 CEA methodology

15.89 The CEA considers other plans, projects and activities that may impact cumulatively with the Project. As part of this process, the assessment considers which of the residual impacts assessed for the Project on its own, have the potential to contribute to a cumulative effect. **Chapter 6 EIA Methodology** provides further details of the general framework and approach to the CEA.

15.90 For marine archaeology and cultural heritage, cumulative effects may occur where archaeological receptors have the potential to be impacted by other existing, consented and/or proposed developments or activities. This includes consideration of the extent of influence of changes to marine physical processes (see **Chapter 7 Marine Geology, Oceanography and Physical Processes**) and changes to the seascape and landscape (see **Chapter 18 Seascape, Landscape and Visual Impact Assessment**) arising from the Project-alone, and those arising from the Project cumulatively or in combination with other projects, including other offshore windfarm developments.

15.91 As described in **Chapter 1 Introduction**, the Transmission Assets associated with the Project are undergoing a separate consent process as part of the Morgan and Morecambe Offshore Wind Farms: Transmission Assets project. To enable impacts from the Project and the Transmission Assets to be considered together, a 'combined' assessment has been included within the cumulative assessment (**Section 15.7.3.1**) to identify any key interactions and additive effects.

15.92 Cumulative effects are considered in **Section 15.7**.

15.4.6 Setting assessment methodology

15.93 In order to effectively and efficiently understand the potential impact to the setting of coastal onshore heritage assets, it was deemed necessary that a setting assessment be undertaken. A requirement for the assessment of the settings of heritage assets is defined in PPG: Historic Environment (MHCLG, 2019).

15.94 The setting assessment has been undertaken in accordance with the Historic England advice presented in The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition) (Historic England, 2017a). This recommends a staged approach to the assessment of potential impacts on heritage significance, comprising the following five steps:

- **Step 1**: Identify which heritage assets and their settings are affected
- **Step 2**: Assess the degree to which these settings make a contribution to the significance of the heritage asset(s) or allow significance to be appreciated
- **Step 3**: Assess the effects of the proposed development, whether beneficial or harmful, on that significance or on the ability to appreciate it
- **Step 4**: Explore ways to maximise enhancement and avoid or minimise harm
- **Step 5**: Make and document the decision and monitor outcomes

15.95 In consultation with Historic England, a high-level screening assessment was undertaken as a first step (step 1) to inform the PEIR (see Annex 1 of **Appendix 15.3**). The high-level screening assessment aimed to identify designated heritage assets which could be impacted by the Project. This has been followed by a full detailed Setting Assessment (steps 2-5) informing this chapter (see **Appendix 15.3**).

15.96 It was determined through the EPP via an ETG meeting that a 50km study area around the extent of the windfarm site would be suitable to assess impact to the setting of designated heritage assets as the windfarm site would be unlikely to be seen beyond this and would therefore not cause any significant impact.

15.97 Due to the high number of designated assets within the 50km study area (1 WHS, 87 SMs, 2960 LBs and 26 RPGs) it was communicated through the EPP via an ETG meeting that only assets which may have views out to sea, or which have a relationship to the sea that form part of their settings would

require assessing. A total of 73 assets were identified that fell into these criteria and a list of those assets which have been assessed is included in **Appendix 15.3**.

15.98 Following further screening, using SLVIA viewpoints and photomontages it was determined that of the 73 assets identified, 37 would require further (steps 2-5) assessment as discussed through the ETG meetings (see **Table 15.1**). This was confirmed following site visits undertaken in August 2023.

15.4.7 Transboundary impact assessment methodology

15.99 **Chapter 6 EIA Methodology** provides details of the general framework and approach to the assessment of transboundary effects.

15.100 For marine archaeology and cultural heritage, transboundary impacts may be relevant where wrecks of non-British, European nationality are subject to impact from development and may therefore fall within the jurisdiction of another country. Any wreck non-British, European wreck identified within the windfarm site would be subject to the same mitigation (i.e., application of an AEZ) therefore no impact would occur.

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

15.102 Transboundary impacts to heritage assets would not occur due to the localised nature of disturbance which do not cross territorial borders. Similarly, transboundary impacts with respect to changes identified in **Chapter 7 Marine Geology, Oceanography and Physical Processes**, have been scoped out of the assessment as agreed through the Scoping Opinion.

15.4.8 Assumptions and limitations

15.103 The records held by the UKHO, Historic England, the NHLE and formerly the NRHE, NHER and the other sources used in this assessment are not a record of all surviving cultural heritage assets, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these datasets is not complete and does not preclude the subsequent discovery of further elements of the historic

environment that are, at present, unknown. In particular, this relates to buried archaeological features.

15.104 Data limitations regarding geophysical data are outlined in Section 5.3 of **Appendix 15.1**.

15.5 Existing environment

15.5.1 Seabed prehistory

15.5.1.1 Description of identified assets

15.105 There are no known seabed prehistory sites within the windfarm site.

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

15.107 The area of Liverpool Bay was largely above water during the Palaeolithic period and was repeatedly overridden by ice sheets during the peak of glacial periods. However, after the ice sheets retreat, the study area is known to have been characterised by a landscape of open tundra and floodplains cut by numerous watercourses draining from the surrounding highlands into large shallow lakes (Fitch and Gaffney, 2011).

15.108 The post glacial environment was cold and dry, while some areas of ice may still have survived. The large floodplains would have supported grazing animals, such as the prehistoric giant elk *Megaloceros giganteus*. The area would have supported occupation and exploitation by early hominins (Dyfed Archaeological Trust, 2018).

15.109 It has been noted most of the offshore area in the Irish Sea is formed of Devensian glacial till covered in tens of metres of marine deposits (Fleming, 2005). However, the palaeoenvironmental analysis of boreholes undertaken c.30km east of the former proposed Rhiannon Offshore Windfarm (which was not ultimately taken forward as a development project), and in proximity to the windfarm site, recovered pollen sequences relating to the upper Palaeolithic (c. 34,000 Before Present (BP). This suggests that isolated pockets of material from this date could survive in the windfarm site (Wessex Archaeology, 2011).

15.110 Palaeographic research of the Irish Sea and Liverpool Bay area has shown that the windfarm site is associated with shallower bathymetry than further west in the Irish Sea (Fitch and Gaffney, 2011). Additionally, the windfarm site is in proximity to the general position of the Mesolithic coastline dating to c.10,000 BP (Fitch and Gaffney, 2011). This area is more likely to contain submerged and buried coastal peaty sediments of higher archaeological potential. The potential for encountering preserved artefacts and archaeological material in general in the east of the Irish Sea and Liverpool Bay is also significantly higher. Finds of this nature could be of high archaeological importance.

15.111 Evidence of the Mesolithic in the Irish Sea and Liverpool Bay area and coastal regions comes from several sites along the coast including at Greasby, Irby, Holyoake, New Brighton, Heysham Head occupation site and Formby Point where over 145 footprints of humans and animals have been identified (Bailey *et al*., 2020). Similarly, a human skeleton was located beneath peats in the Liverpool Bay area and radiocarbon-dated between 7,500 and 7,000 cal BP (calibrated years BP) (Bailey *et al*., 2020).

15.112 By the Neolithic period, the Irish Sea and Liverpool Bay area had become inundated, with sea-levels around the UK having risen to a level approximate to their current position. As such, evidence from the Neolithic onwards is likely to be of an increasingly maritime nature. Examples of Neolithic log boats have been recorded in the UK and Ireland.

15.113 An archaeological review of the geophysical survey assessments and ground model covering the Project AfL area (including the windfarm site) was conducted by MSDS Marine. This was done to inform the undertaking of the palaeolandscape assessment and potential for previously undiscovered submerged prehistoric sites to be present (**Appendix 15.1**). This included a review of geophysical survey data reports, select seismic profiles and ground model outputs including mapped horizons and grids. These sources were reviewed to establish an understanding of the geological make-up of the site, formations present and their palaeoenvironmental and archaeological potential.

15.114 As part of the MSDS Marine assessment, information about the wider area has also been used to better contextualise the various environments experienced in the area during the Pleistocene and Holocene (namely British Geological Survey (BGS) and West Coast Palaeolandscape Survey (WCPS)) to provide context of a wider area (Figure 7 of **Appendix 15.1**) and to inform the archaeological assessment of the geophysical data.

15.115 A total of one borehole and six cores have been taken within the 2km buffer by the BGS, the data for which was available for review as part of this

assessment. Seismic surveys of the area were also undertaken by the BGS in order to feed into the Offshore Regional Report (ORR) for the area (Jackson *et al*. 1995). The findings of the ORR have been included within the assessment.

15.116 For the assessment of the geophysical data, a 500m buffer was applied as some of the survey data extended beyond the AfL area (MSDS Marine assessment area). This was done to characterise the historic environment within the survey area and to provide a wider area context.

15.117 Full details of MSDS Marine's assessment are presented within **Appendix 15.1**.

15.118 Through the interpretation of the geophysical data A sequence of five geological units were identified within the windfarm site, as described in Section 5.6 of **Appendix 15.1**. The sequence of units have been summarised in **Table 15.14**.

Table 15.14 Quaternary sequence within the windfarm site

Unit	Base	Lithology	Correlated Formation	Correlated Member	Age	Depositional environment	Archaeological potential
1	H17	Marine silty sand	Western Irish Sea (A)	Mud Facies	Devensian to early Holocene	May be deep water glaciomarine to shallow marine, though other interpretations are possible	Some potential identified though further investigation required
2	H40	Sand	Western Irish Sea (A)	Prograded Facies	Devensian	Deltaic to glaciomarine	Limited but potential cannot be ruled out
3	H45	Silty sand	Western Irish Sea (A)	Mud Facies	Devensian	Deep water glaciomarine to shallow marine	Limited due to adverse conditions
			Western Irish Sea (B)	Mud Facies (Upper Tabular Stratified Member)	Devensian	Glaciomarine to marine	
4	H50	Till	Cardigan Bay Formation	Upper Till Member	Devensian	Glacial	Limited due to adverse conditions
				Lower Till Member	Wolstonian	Glacial	
5	N/A	Mudstone and halite	Triassic Bedrock	N/A	Triassic	N/A	N/A

15.119 A full assessment of these Units is provided in Section 10 of **Appendix 15.1**. In summary, there is limited archaeological potential from the Quaternary Units 4 and 3 within the windfarm site due to the adverse subglacial and marine conditions they represent which would be unsuitable for human activity and yield minimal paleoenvironmental material.

15.120 Unit 2 is thought to represent a glaciomarine to deltaic environment, laid down after the Last Glacial Maximum (LGM), while Unit 1 is thought to represent glaciomarine to marine deposits, though the seismic character would not rule out an alluvial or transgressive environment. Unit 2 infills a series of channel features incised into Units 3 and 4. There is some palaeoenvironmental potential within Unit 2 due to its potentially deltaic nature, and uncertainty in the interpretation and date of the unit and its correlated formation between geological sources (Jackson *et al*., 1995; Mellett *et al*., 2015). Archaeological potential is more limited but cannot be ruled out. Unit 2 is also likely to have been affected by marine erosion caused by the Holocene transgression, this will have affected the potential of the unit.

15.121 Unit 1 is thought to be primarily marine in nature, limiting archaeological potential. However, it is possible this unit also represents the Holocene transgression. As such, there may be some potential for archaeological and palaeoenvironmental remains within Unit 1, as some research suggests the windfarm site may have been terrestrial, bordering a floodplain with multiple fluvial channels during this period (Fitch and Gaffney, 2011; Brooks *et al*. 2011). However, there is no evidence of organic material within this deposit and the floodplain is considered to be a glacial feature. As such, the potential for palaeoenvironmental remains is limited. Further investigation of these units, through coring and geoarchaeological analysis is required to address these gaps in understanding.

15.122 As discussed in **Section 15.4.2.1**, further bespoke SBP interpretation of units of archaeological interest was undertaken by MSDS Marine to resolve localised variations and identify deposits of potential archaeological interest to be targeted in the geotechnical survey campaign that was conducted across the windfarm site in July to October 2023. Through the assessment of SBP data, a series of channelised features were identified in the data, along with localised high amplitude reflectors that may be indicative of shallow gas or organic deposits. Although it was noted that reverse polarity, a common signature of organic deposits in seismic data, was not observed.

15.123 Following the review of borehole logs and sample photographs, no sub-samples of archaeological interest were identified as discussed in **Section 15.4.2.1**.

15.5.1.2 Cultural significance of identified assets

15.124 There are no known seabed prehistory sites within the windfarm site for which significance can be described.

15.125 As such, the significance of these palaeolandscapes lies primarily in their archaeological interest or research value, particularly when considered alongside survey data and interpretations produced for other seabed development projects in the Irish Sea. This is discussed further in terms of CEA in **Section 15.7**.

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

15.127 For offshore assets, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer'. With respect to former prehistoric landscapes in the Irish Sea, these are largely experienced conceptually in terms of interpreted data and research. As such, the setting of these assets (in terms of the surroundings in which they are experienced) does not form a key part of their cultural significance. However, changes within the physical setting would occur (i.e., the introduction of the Project into the seascape) and the capacity of these palaeolandscapes to accommodate this change is discussed alongside historic seascape character in **Section 15.5.3**.

15.5.1.3 Importance of identified assets

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

15.129 Although palaeoenvironmental material encountered beyond the context of an in-situ prehistoric site still has evidential value for understanding changes in

the climate and environment with offshore contexts, isolated discoveries should be considered of low importance for the purposes of assessment.

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

15.131 The heritage importance of the potential heritage assets outlined above are presented in **Table 15.15**.

Table 15.15 Heritage importance (seabed prehistory)

Asset type	Definition	Importance
Potential in-situ prehistoric sites	Primary context features and associated artefacts and their physical setting (if/where present).	High
	Known submerged prehistoric sites and landscape features with the demonstrable potential to include artefactual material.	
Potential submerged landscape features	Other known submerged palaeolandscape features and deposits likely to date to periods of prehistoric archaeological interest with the potential to contain in-situ material.	High
Potential derived Prehistoric finds	Isolated discoveries of prehistoric archaeological material discovered within secondary contexts.	Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material.	Low
	Palaeoenvironmental material associated with specific palaeolandscape features or archaeological material.	High

15.5.2 Maritime and aviation archaeology

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

15.5.2.1 Seabed features

15.133 SSS, MBES, and magnetometer data interpreted by MSDS Marine for the geophysical survey area has demonstrated the presence of several seabed

features which have been identified at varying levels of archaeological potential. Seabed features are discriminated by MSDS Marine in accordance with the definitions set out in **Table 15.16** (see Section 4 of **Appendix 15.1**).

Table 15.16 MSDS Marine criteria for discriminating the relevance of identified seabed features

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

15.134 A total of 21 anomalies of potential archaeological interest were identified within the windfarm site, however, none of these were determined to be of high archaeological potential. These are presented in **Table 15.17** and **Figure 15.3**.

Table 15.17 Distribution of archaeological anomalies within the windfarm site by potential

Potential	Total
Low	17
Medium	4
High	0
Total	21

A total of 17 of the anomalies in the windfarm site have been interpreted as low archaeological potential. These anomalies are set out in **Table 15.8**.

Table 15.18 Low potential anomaly categories within the windfarm site

Anomaly category	Anomaly ID	Total
Chain, cable, or rope	MC22_0007, MC22_0031, MC22_0033, MC22_0034, & MC22_0035	5
Likely geological	MC22_0008, MC22_0015, MC22_0022, MC22_0023, & MC22_0041	5
Potential debris	MC22_0009, MC22_0011, & MC22_0016	3

Anomaly category	Anomaly ID	Total
Unidentified debris	MC22_0019, MC22_0029, MC22_0036, & MC22_0038	4
Total	17	17

15.135 The anomalies interpreted as of low archaeological potential (**Table 15.18**) are a mixture of small features, often boulder-like, or likely to represent modern debris such as chain, cable, or rope or small items of debris with no features indicating archaeological potential. Further information regarding the low potential anomalies, including positions and dimensions, can be found in Annex A of **Appendix 15.1**.

15.136 Four anomalies interpreted as of medium archaeological potential were identified within the windfarm site. These anomalies are presented in **Table 15.19** and on **Figure 15.3.**

Table 15.19 Medium potential anomaly within the windfarm site

Anomaly category	Anomaly ID	Total
Potential debris	MC22_0020	1
Unidentified debris	MC22_0013, MC22_0014, & MC22_0039	3
Total	4	4

15.137 The anomalies within the windfarm site interpreted as being of medium archaeological potential have characteristics that indicate a likelihood of representing anthropogenic debris that has the potential to be of archaeological interest.

15.138 MC22_0013 (Figure 11 of **Appendix 15.1**) is only visible in the SSS data with no associated magnetic anomaly. Its position does not correspond with any UKHO or NRHE records. It is visible as a curvilinear feature in association with a small area of seabed disturbance, and two further distinct features, covering an area 12.4m x 7.3m with a maximum height above seabed of 0.2m. The anomaly is largely incoherent, but the form of the features may indicate anthropogenic origin. The assessment of the anomaly as medium potential is precautionary, based primarily on the visible size. The anomaly lies within an area of stretched data caused by movement of the SSS towfish which can alter the form and dimensions, it is also not visible within the other datasets which may cast doubt as to the true interpretation.

15.139 MC22_0014 (Figure 12 of **Appendix 15.1**) is visible within the SSS and MBES data, with no associated magnetic anomaly. The position does not correspond with any UKHO or NRHE records. The anomaly is visible in the SSS data as two prominent, and joined, curvilinear features over an area 6.6m x 1.9m with a measurable height of 0.3m. Within the MBES data the anomaly lies within a

slight depression, likely caused by scour, with a number of irregular features. The overall form of the anomaly indicates anthropogenic debris, although the origin cannot be determined. The form does not indicate the remains of a wrecked vessel; thus, a medium potential rating is considered appropriate.

15.140 MC22_0020 (Figure 13 of **Appendix 15.1**) is visible within the SSS and MBES data, with no associated magnetic anomaly. The position does not correspond with any UKHO or NRHE records. Within the SSS data, the anomaly appears as a boulder-like feature measuring approximately 2.0m x 1.5m with irregular scour extending north-east, south-west. Within the MBES data the anomaly appears irregular with a prominent, roughly linear, feature orientated north-east, south-west measuring 3.9 m x 1.7m. Up to 1.4m to the north-east smaller features are visible. Scour is evident all around the anomaly, but most prominent to the east. The form of the anomaly is indicative of anthropogenic debris, although the origin is not clear. The prominence of the associated scour may suggest a large object, or a number of smaller solid objects. There is no evidence in the immediate vicinity to indicate that the anomaly may be part of a larger, buried feature.

15.141 MC22_0039 (Figure 16 of **Appendix 15.1**) is visible within the SSS and MBES data, with a correlating magnetic anomaly of 437.7nT. The position does not correspond directly with any UKHO or NRHE records, however UKHO record 8299 (a ‘dead’ wreck) lies 280m to the north-east. It is not believed the anomaly and the UKHO record are related, but it is noted for completeness. The anomaly is visible in the SSS data as a small feature within a sandwave, quite boulder like, and measuring 1.5m x 1.4m with a measurable height of 0.1m. Within the MBES data the anomaly is visible as a small break in the sand, with a slight mound and a shallow depression. The anomaly has been identified primarily due to the associated large magnetic anomaly. Whilst the form of the anomaly, and the data in the surrounding area, does not suggest further buried material the magnetic anomaly indicates ferrous, and thus anthropogenic, material. The archaeological significance is not clear, the anomaly could represent modern debris, or potential Unexploded Ordnance (UXO).

15.5.2.2 Magnetic anomalies

15.142 This section sets out anomalies that were identified solely through their magnetic signatures.

15.143 There are 45 magnetic anomalies identified within the windfarm site which do not correlate with known features or infrastructure. One of these correlates directly with an anomaly identified as being of archaeological potential (**MC22_0039**).

15.144 The distribution of magnetic anomalies within the windfarm site that do not correlate with known features or infrastructure is presented in **Table 15.20** and **Figure 15.4**.

Table 15.20 Magnetic anomalies within the windfarm site

Intensity (nT)	Total
5 to 50	42
50 to 100	2
100 to 200	0
200 +	1
Total	45

15.145 One large magnetic anomaly (>100nT) was identified within the magnetometer dataset, MC22_MAG_0254, a complex anomaly of 739.4nT. The anomaly is isolated with no corresponding seabed anomaly identified within the other datasets possibly because it is buried. The anomaly is not visible on the adjacent lines of data, which are approximately 75m each side (see Figure 18 of **Appendix 15.1**).

15.146 Two anomalies within the windfarm site measure between 50 and 100nT. These are MC22_MAG_0266 and MC22_MAG_0105. Neither anomaly are related to any UKHO or NRHE records, however, MC22_MAG_0266 is located c.85m southeast of NRHE record 1027264 (an unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature). As such, the two may be related.

15.147 All the remaining magnetic anomalies measure <50nT so are considered to be of limited archaeological potential and likely represent items of metallic debris.

Historic Environment Records (HER)

15.148 In addition to the geophysical anomalies identified by MSDS Marine, there are additional records charted by the UKHO and the NRHE within the windfarm site. These are presented on **Figure 15.5** and **Figure 15.6**.

UKHO records

15.149 There are two UKHO records (8069 and 8293 within the windfarm site (see **Figure 15.5**)) which are identified as foul ground originating from fisherman's fasteners. Both the records are in the south-east of the windfarm site and are considered dead. No evidence of any anthropogenic material, or geological material, that may have resulted in a net snag is visible in the geophysical data at either location, or within the vicinity.

Historic England maritime records

15.150 Within the windfarm site there are 39 maritime records distributed throughout the windfarm site, all of which derive from fisherman's fasteners, with the following description: '*Unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature*'. All the records were created in 1999. The distribution of records is shown in **Figure 15.6**. With the exception of NRHE record 909448, which correlates with UKHO record 8069 (foul ground derived from a fisherman's fastener), no NRHE records correlate with any archaeological anomalies, or UKHO records, and none relate to reported losses.

Potential for additional remains

15.151 The potential for undetected, buried archaeological material may be considered generally low based on the limited identified anomalies and HERs within the windfarm site. However, there is potential for archaeological remains to be present in areas of mobile sandwaves and where greater depths of finer grained sediment would promote the survival of buried archaeological material. Additionally, given the line spacing of the magnetometer it is possible that further magnetic material is present within the windfarm site which was not detected. Similarly, it is possible that the identified magnetic anomalies and fisherman's fasteners relate to archaeological material that was not visible in the SSS and MBES data.

15.5.2.3 Aviation remains

15.152 There are no known aviation crash sites protected under the Protection of Military Remains Act 1986 within the windfarm site.

15.153 In addition, there are no HERs which relate to any aviation remains. Should aviation remains be located within the windfarm site these would likely be associated with World War I (WWI) and World War II (WWII) and would be afforded protection under the Protection of Military Remains Act 1986. However, as little fighting occurred over the Irish Sea, the chance of finding such remains is limited.

15.154 No anomalies characteristic of aviation remains were identified by MSDS Marine within the windfarm site or the wider geophysical survey area.

15.5.2.4 Cultural significance of identified assets

15.155 The cultural significance of unidentified wrecks and debris, archaeological anomalies and potential wrecks, aircraft, and isolated finds (which are yet to be discovered) is currently unknown. The archaeological interest (or otherwise) of these features would be further examined post-consent as

required (e.g., investigation of individual anomalies (ground truthing) through ROV and/or diver survey).

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

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

15.158 Regarding setting, as for seabed prehistory above, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer'. Although some wreck sites or aircraft crash sites have a setting which can be experienced and appreciated within their seascape (by divers or visitors on boats trips for example), none have been identified within the windfarm site.

15.5.2.5 Heritage importance of identified assets

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

Isolated finds of maritime or aviation origin within secondary contexts will have evidential value for patterns of activities offshore and are assessed as being of medium importance. A summary of heritage importance is presented in **Table 15.21**.

Table 15.21 Heritage importance (maritime and aviation archaeology)

Asset type	Definition	Importance
Known maritime heritage assets	Debris identified as possible wreck sites or associated debris	High
	Un-named wrecks and associated debris fields/debris	
	Seabed disturbance associated with large magnetic anomaly	
	Previously recorded wrecks not seen in geophysical data	

Asset type	Definition	Importance
Additional anomalies	Anomalies identified by geophysical assessment that could be of anthropogenic origin	High
Potential wrecks	Wrecks within the Study Area that are yet to be discovered	High
Potential derived maritime finds	Isolated artefacts lost from a boat or ship or moved from a wreck site	Medium
Potential derived aviation finds	Isolated artefacts lost from an aircraft or moved from a crash site	Medium

15.5.3 Coastal heritage assets

15.160 At its closest point, the windfarm site is located approximately 30km offshore. As such, the WTGs may be visible from coastal heritage assets and therefore the Project has the potential to impact upon the setting of these assets. As such, a setting assessment was required to determine the effect the Project would have on the setting of designated heritage assets.

15.161 In consultation with Historic England and the MMO during the second ETG meeting (31st August 2022) it was agreed that a high-level screening assessment would be undertaken (see Annex 1 of **Appendix 15.3**) as a first step (step 1) (see **Section 15.4.6**) to identify those designated heritage assets which could be impacted by the Project. This information was presented in the PEIR, and it was determined that a 50km buffer around the extent of the windfarm site would be suitable for this screening exercise.

15.162 As outlined in **Section 15.4.6,** due to the high number of designated assets identified within the 50km buffer (see Figure 1.2 of **Appendix 15.3**) only assets with views out to sea or which have a relationship to the sea which forms part of their setting have been assessed.

15.163 Within the 50km Study Area, a total of 73 designated assets were initially identified whose setting may be impacted by the operation of the Project (see Figures 1.7a - g of **Appendix 15.3**). Further details on the methodology used to identify these assets is presented in **Section 15.4.6**. These assets comprise:

- One WHS
- 13 SMs
- Three RPGs
- Seven LBs
- Nine Grade II* LBs

- 27 Grade II LBs
- 13 conservation areas

15.164 This process was informed by consultation with the SLVIA consultants to capture specific heritage viewpoints for the assessment (Figures 1.3a-f – 1.6a-g of **Appendix 15.3** of the ES). Non-heritage specific SLVIA photomontages, viewpoints and wireframes (Figures 18.25 – 18.71 of **Chapter 18 Seascape, Landscape and Visual Impact Assessment** of the ES) were also used to inform the setting assessment.

15.165 With the use of heritage and SLVIA viewpoints, photomontages and wireframes it was determined that of the 73 designated coastal assets initially identified, a total of 37 would require further detailed assessment as their settings would be affected by the Project. These 37 have been taken forward to steps 2-5 of the Setting Assessment presented in **Appendix 15.3**.

15.5.4 Historic seascape character

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

15.167 This was done as a pilot study and represents a 'point in time' study. As such, additional data and project information has been taken into account for the assessment of the Irish Sea HSC (see **Table 15.22**).

15.168 The consolidated national GIS dataset was mapped against the windfarm site and the wider area to identify the primary cultural processes which have shaped the historic seascape of the study area. This includes both the current character types (**Figure 15.7**) overlain with constructed and proposed developments, and the previous (prehistoric and historic) character types for which information is available. The character texts accompanying the GIS datasets were used to identify the primary values and perceptions for each character type summarised in **Table 15.22**.

15.169 A qualification of change since production of the HSC baseline, as well as potential changes to the character should the Project DCO Application be successful, is also included in **Table 15.22**. It should be noted that no previous character types have been identified within the windfarm site by the Irish Sea HSC study (**Figure 15.8**) (Newcastle University, 2011).

Table 15.22 Summary of historic seascape character types

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
Communications	Submarine telecommunications cable	Mapped as a minor character type within the windfarm site, with Vodafone Lanis 1 telecom cable forming the southern edge of the windfarm site boundary and EXA Atlantic (formerly GTT Hibernia Atlantic) telecom cable running NW through its centre. Within the wider Irish Sea region there are several submarine telecommunications cables including: ▪ BT fibre optic telephone line from Silecroft to Isle of Man, laid 1988 ▪ Fibre optic telecommunications cable LANIS was laid between Blackpool and the Port Grenaugh, Isle of Man 1992 ▪ Transatlantic communications cable HIBERNIASEG, from Canada and the United States to Ireland and on to Ainsdale, Southport ▪ Submarine telecommunications cable ESAT2, Ainsdale As well as the active cables, there is also a telegraph cable laid between	No identified change.	As submarine telecommunications cables are mostly undetected in the marine environment it is unlikely that perceptions of this character type would be altered by Project construction activities or by the presence of installed infrastructure.

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
		the mainland and Ramsey on the Isle of Man in 1859, with two more laid in 1875 and 1885. Submarine telecommunications cables are mostly undetected in the marine environment. However, they are a highly reliable form of transferring information and are critical to our present-day life. They can be perceived as obstacles to certain sea users such as fishermen and dredgers.		
Industry	Hydrocarbon pipeline Hydrocarbon field (gas) Renewable energy installation (wind) Submarine power cable	**Hydrocarbon field (gas) and Hydrocarbon pipeline:** The Irish Sea has always been important to the energy industry, most notably for its natural oil and gas resources which have been heavily exploited since the 1960s.There is a series of gas and oil fields offshore in the southern half of England's sector of the Irish Sea. These are: ▪ The Douglas Oil Field the first to be developed in the east Irish Sea Basin, in 1996 (Yaliz, 1997) ▪ The Hamilton and Hamilton North fields discovered in 1990 ▪ The Morecambe Bay Gas Field discovered in 1975	Since the writing of the Irish Sea HSC (2011) a large number of offshore windfarms have been constructed and are operating in the Irish Sea.	Overall, perceptions of the Irish Sea energy industry place greater emphasis upon nuclear power and renewable energy. The HSC states that Britain has the best offshore wind resource in Europe and changing perceptions associated with the construction of the Project are therefore likely to be seen as part of this natural progression for energy generation and as a positive change from fossil fuels to renewable energy.

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
		▪ The South Morecambe field discovered in 1975 with the North Morecambe field. The South Morecambe Gas field is located within the north part of the windfarm site. Within the wider Irish Sea region this character type is not a dominant part of the historic character. The South Morecambe Drilling Platform 3 (DP3), which is now decommissioned, was previously located within the windfarm site and the Calder Accommodation Platform 1 (CA1) is located 0.9km to the west of the windfarm site. More recently nuclear power and renewable energy sources have become viewed as more important as a result of increasing concerns about greenhouse gas emissions from energy generation using fossil fuels.		This is further qualified by UK climate change policies. In recent years further windfarms have been constructed and consented within the Irish Sea within Welsh and English waters. This change and the addition of the Project, other Round 4 projects (Mona and Morgan Offshore Wind Projects). Licencing for carbon capture and storage will extend this focus on renewables character within the Irish Sea.
		Renewable energy installation (wind): The Irish Sea is an important resource for renewable energy, particularly over the last c.20 years. At the time the HSC was written (2011), there were five		

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
		offshore windfarms operating or in development in the Irish Sea: ▪ Burbo Bank ▪ Barrow ▪ Walney I and II ▪ Ormonde ▪ West of Duddon Sands Similarly, two windfarms were operating off the Welsh coast: ▪ North Hoyle Offshore Windfarm ▪ Rhyl Flats Offshore Windfarm In addition to these, Shell Flat a windfarm of 180 proposed turbines was cancelled in 2008 (Newcastle University, 2011).		
Navigation	Maritime debris	Maritime debris refers to an area deemed hazardous due to a predominance of recorded obstructions and 'fouls' not known to be associated with a wreck. There are extensive navigation hazards in the waters off England's Irish Sea coast, which are marked on historic and modern maritime charts and comprise the many shoals and flats which typify this entire coastline.	Survey and evaluation for new plans and projects have extended public understanding of these hazards which have been identified as a direct result of these activities. This ongoing accumulation of publicly available	The primary perceptions which associate hazardous water and wrecks with local heritage and stories relating to dangers of the high seas, to recreational diving and to wrecks as habitats could be enhanced through the provision of publicly available data on seabed features identified during geophysical survey, and in the event of unexpected discoveries

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
			data acquired as part of the consenting process prior to activities is considered to be of public value.	reported, through the PAD during construction activities. During operation, the Project may result in a change to the perception of navigational hazards on the basis that the introduction of wind turbines represents additional navigation hazards. They are, however, equipped with navigational features such as warning lights. On this basis, this character sub-types are considered to have the capacity to accommodate this level of change.
Cultural topography	Fine sediment plains	In the Irish Sea region, the marine cultural topography is characterised by fine sediment plains, with some patches of coarse sediment plains off the coast of Cumbria, at the edge of Morecambe Bay and on the western boundary of the English sector. These types of seabed sediments each provide distinct preservation conditions for wrecks and implications for the potential form and survival of underlying palaeolandscapes.	New plans and projects (as described above for the industry character type) have further restricted access to these deposits and the underlying palaeolandscapes (through the physical presence of cables and foundations, for example) or	The primary perceptions which associate marine cultural topography with high archaeological potential could be further enhanced through the accumulation of publicly available data, including discoveries reported through the PAD during construction activities. As the final design of layouts would take the locations of heritage assets and palaeolandscape features into account, change can

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
			reduced the extent of deposits, through dredging for example. However, a beneficial impact is the ongoing accumulation of publicly available data acquired as part of the consenting process prior to activities which is considered to be of public value.	potentially be offset by professionally executed and published archaeological studies.
Fishing	Shellfish dredging Fishing ground Bottom trawling	Fishing is the dominant character type mapped within the windfarm site and is mapped across several areas. It is one of the more dominant character types within the Irish Sea HSC. The main fishing ports facing the Irish Sea include Fleetwood, Barrow-in-Furness, Ravenglass, Whitehaven, Harrington, Workington, Maryport and Silloth. Primary fishing methods in the region include stern trawling, anchor seine netting, beam trawling, potting and creeling, dredging and gill	No identified change.	Although there would be areas where fishing activities are temporarily displaced as a result of construction works, fishing activities would still be permitted in areas not undergoing construction activities. Similarly, as outlined in **Chapter 13 Commercial Fisheries** (Document Reference 5.1.13), fishing activities would still be possible outside the footprint

Broad character types	Character sub-types	Descriptions, values and perceptions	Qualification of change since HSC baseline	Capacity to accommodate change with the Project
		netting. Shellfish are also of great importance to the region's fishing industry. The offshore fishing industry in this region was much reduced with the decline of fishing in the late 20th century. The fishing fleet at Fleetwood is now much reduced, but the town still has an important fishing industry. Especially around Morecambe Bay, the shell fishing industry is seen as important to the history and culture of the communities who live around it. This largely occurs on the exposed sands and estuaries.		of the installed infrastructure within the windfarm site.

15.5.5 Climate change and future trends

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

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

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

15.6 Assessment of effects

15.6.1 Potential effects during construction

15.6.1.1 Impact 1: Direct impact to known heritage assets

Description of impact

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

15.174 These relationships are crucial to developing a full understanding of an asset. Such impacts may occur if heritage assets are present within the footprint of infrastructure elements of the Project (i.e., foundations and cables) or within the footprint of activities such as seabed clearance or the placement of jack-up vessels.

Magnitude of impact

15.175 With the application of the embedded mitigation (see **Section 15.3.3**), all direct impacts to known heritage assets as a result of the Project can be avoided.

15.176 Based on the characterisation of the existing environment and the identification of known and potential heritage assets a total of four AEZs and one TEZ have been established within the windfarm site (see **Appendix 15.1**). The AEZs and TEZ within the windfarm site are presented on **Figure 15.9** and are summarised in **Table 15.23** and **Table 15.24**.

Table 15.23 AEZs within the windfarm site

Anomaly ID	Description	Potential	WGS84 Z30N		AEZ (m)
			X	Y	
MC22_0013	Unidentified debris	Medium	460388.2	5958939.3	30 radius
MC22_0014	Unidentified debris	Medium	461851.3	5958082.3	15 radius
MC22_0020	Potential debris	Medium	466231.1	5956833.2	15 radius
MC22_0039	Unidentified debris	Medium	460876.8	5962642.2	15 radius

Table 15.24 TEZs within the windfarm site

Anomaly ID	Description	Amplitude (nT)	WGS84 Z30N		AEZ (m)
			X	Y	
MC22_MAG_0254	Magnetic	739.4	458129.8	5957731.9	50 radius

15.177 AEZs are not recommended at this time for features interpreted as being of low archaeological potential. The positions of these features would be avoided by means of micrositing during detailed project design, where possible.

15.178 The archaeological assessment of pre-construction survey data, including high resolution geophysical data undertaken for the purposes of UXO identification, would further clarify the nature and extent of these anomalies and the scheme design would be modified to either avoid heritage assets (i.e., implement new AEZs where appropriate) or undertake additional mitigation. Seabed features identified as being of low archaeological potential are not known heritage assets but have the potential to be, so are considered further as 'potential' heritage assets under Impact 2 (see **Section 15.6.1.2**).

Significance of effect

15.179 With the application of AEZs and the TEZ direct impacts to known heritage assets would be avoided, and there is **no pathway for change** during construction.

15.180 AEZs and the TEZ (part of embedded mitigation) may be reduced, enlarged, or removed in agreement with Historic England if further relevant information becomes available. However, unless modified by agreement, it is important that AEZs are retained throughout the lifetime of the Project and monitoring of AEZs may be required by the regulator and Historic England to ensure adherence both during construction and in the future operation and maintenance of the windfarm. Similarly, the TEZ may be made into an AEZ and new AEZs implemented should culturally significant archaeological remains be identified.

15.181 The approach to the implementation, revision, and monitoring of AEZs is set out in the Outline OWSI.

15.182 Adherence to AEZs, as set out in the Outline OWSI, would ensure **no change** would occur to known heritage assets with respect to Impact 1.

15.6.1.2 Impact 2: Direct impact to potential heritage assets

Description of impact

15.183 It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). Therefore, unavoidable direct impacts may occur if archaeological material is present within the windfarm site associated with the following construction phase activities:

- Seabed preparation (including UXO and boulder clearance, where required)
- Installation of WTG and OSP foundations
- Installation of offshore cabling (inter-array and platform link)
- Seabed contact by legs of jack-up vessels

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

- Potential in-situ prehistoric sites, submerged landscape features, derived/isolated Prehistoric finds and palaeoenvironmental evidence
- Potential wrecks and derived/isolated maritime finds (including both seabed features and any further discoveries of material not seen in the geophysical data)
- Potential aircraft and derived/isolated aviation finds (including both seabed features and any further discoveries of material not seen in the geophysical data)

Magnitude of impact

15.185 Until the final design and layouts are confirmed, there remains uncertainty in the precise nature and extent of any direct impacts. All direct impacts that result in damage to, or disturbance of, in-situ prehistoric, maritime and aviation sites and potential submerged landscape features and palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material) would be adverse, permanent, and irreversible. The 'fabric' of the asset and, hence, its potential to inform our historical understanding, would be removed.

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

15.187 In accordance with the definitions set out in **Table 15.11**, without additional mitigation, there is potential for direct impacts of **high adverse magnitude** upon potential in-situ heritage assets.

15.188 Isolated/derived artefacts, either of prehistoric, maritime or aviation origin within reworked deposits may be considered less sensitive to change than in-situ material, as their relationship with their context or physical setting is less relevant to understanding their significance. Therefore, in accordance with the definitions set out in **Table 15.11**, without mitigation, there is potential for direct impacts of **low adverse magnitude** upon potential isolated finds. Should such finds be encountered during construction activities, although removal from the marine context would still result in the destruction of that contextual relationship, albeit a secondary context (i.e., not in-situ), isolated artefacts have capacity to accommodate physical changes, therefore resulting in only a slight loss of heritage significance.

Significance of effect

15.189 As set out in **Table 15.15** and **Table 15.21**, in-situ prehistoric, maritime and aviation sites are assessed as being of potentially high heritage significance (importance), as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material). In accordance with the significance matrix set out in **Table 15.12**, direct impacts are thereby assessed as having the potential to have **major adverse** effects on these heritage asset types as a worst-case scenario, which is significant in EIA terms.

15.190 Isolated/derived finds in secondary contexts are assessed as being of medium heritage significance (importance). In accordance with **Table 15.12**, should they be encountered during construction activities, direct (physical) impacts to isolated finds are considered to be of potential **minor adverse** significance, which is not significant in EIA terms.

Additional mitigation

15.191 Further detailed archaeological assessment and interpretation of geophysical and geotechnical data would be undertaken post-consent to reduce, as far as possible, the potential for unintended impacts during construction phase activities. Any survey data would be assessed by a qualified archaeological sub-contractor.

15.192 The examination of potential prehistoric deposits through the assessment of pre-construction geotechnical and geophysical data would further contribute to the body of scientific data available for the study of seabed prehistory within the Irish Sea region (see **Section 15.7**).

15.193 Archaeological input would be incorporated into the planning and execution of any future sampling programmes and all available geotechnical data (e.g., samples/geotechnical logs acquired as part of engineering-led ground investigation works) would be subject to staged geoarchaeological assessment in the post-application/post-consent stages of the Project. Historic England would also be consulted on the scope of all further post submission/consent geophysical and geotechnical surveys undertaken for the Project. This would ensure that the data generated are sufficiently robust to enable professional archaeological interpretation and analysis.

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

15.195 Similarly, the archaeological assessment of high-resolution pre-application/pre-construction geophysical data and ground-truthing of identified anomalies of potential archaeological significance would be undertaken, where required. These actions would help to confirm and clarify further the potential for maritime and aviation heritage assets. If features of archaeological interest are identified during these, they would be subject to the same mitigation as described for known heritage assets (see **Section 15.6.1.1**).

15.196 Where features cannot be avoided, then additional work may be required (to be undertaken post-consent) to establish the archaeological interest of the feature (e.g., investigation of individual anomalies (ground truthing) through ROV and/or diver survey). Once the character, nature and extent of selected

features are more fully understood, appropriate mitigation measures (proportionate to the significance of the asset) to avoid, reduce or off-set impacts would be determined on a case-by-case basis. For example, if features of archaeological interest are confirmed during further investigations, which are considered to be of sufficient significance to warrant preservation in-situ, then they would be subject to the same mitigation as described for known heritage assets (AEZs) described in **Section 15.6.1.1**.

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

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

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

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

15.201 The approach to the implementation of the above mitigation measures (as well as embedded mitigation) is set out in the Outline OWSI.

Residual effect

15.202 If further seabed features are identified through future investigations to be undertaken post-application/post-consent, including the archaeological assessment of pre-construction survey data, these would be subject to the same mitigation measures (avoid, reduce, or offset) as set out directly above and in **Section 15.3.3**. Therefore, residual effects are anticipated to be no worse than **minor adverse** significance, which is not significant in EIA terms.

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

15.204 In the event of unforeseen impact to potential sites, the implementation of a formal protocol would allow any finds to be promptly reported, archaeological advice obtained, and any recovered material is stabilised, recorded, and conserved.

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

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

15.206 The Project has the potential to interact with both local and regional hydrodynamic and sedimentary processes which in turn may result in impacts of an indirect (physical) nature occurring upon heritage assets. Changes in coastal processes can lead to re-distribution of erosion and accretion patterns while changes in tidal currents, for example, may affect the stability of nearby morphological and archaeological features. Indirect impacts to heritage assets may occur if buried heritage assets become exposed to marine processes, due to increased wave/tidal action for example, as these would deteriorate faster than those protected by sediment cover. Conversely, if increased sedimentation results in an exposed site becoming buried this may be considered a beneficial impact.

15.207 As set out in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (Section 7.6.2.1 – 7.6.2.6), during the construction phase of the Project, there is the potential for foundations installation and array/platform link cable installation activities to disturb sediment, potentially resulting in changes in seabed levels.

15.208 For Impact 2a in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (changes in seabed level due to seabed preparation for foundation installation), it is predicted that coarser sediment disturbed during seabed preparation would fall rapidly to the seabed (in minutes or tens of minutes) as a highly turbid dynamic plume immediately after it is discharged. Deposition of this sediment would form a ‘mound’ local to the point of release. The resulting mound would be a measurable protrusion above the existing seabed (likely to

be up to tens of centimetres) but would remain local to the release point. The geometry of each of these produced mounds would vary across the windfarm site, depending on the prevailing physical conditions. Given the lack of coarser sediment at the windfarm site, it is considered that the majority of sediment disturbed during seabed preparation would form a passive plume and deposit farther afield within a spring tidal excursion (10km) with light deposition (in the order of millimetres).

15.209 In all cases, the sediment within the mound would be like (but not the same as) both the seabed that it has replaced and the surrounding seabed. The change in seabed elevation is within the natural change to the bed caused by sandwaves and sand ridges and hence the blockage effect on physical processes would be negligible.

15.210 For Impact 2b in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (changes in seabed level due to drill arisings for installation of piled foundations) if the drilling penetrates the diamict unit, the sediment released from the drilling is assumed to be wholly in the form of larger aggregated 'clasts' which would settle rapidly. These clasts would remain on the seabed (at least initially), rather than being disaggregated into individual fine-grained sediment components immediately upon release. Mounds would reside on the seabed near the site of release. These mounds would be composed of sediment with a different particle size and would behave differently (they would be cohesive) to the surrounding sandy seabed.

15.211 Because of their potential size, future transport of the aggregated clasts would be limited, and most would remain static within the mound. However, over time the flow of tidal currents over the mound would gradually winnow the topmost clasts (there would be a gradual disaggregation of the clasts into their constituent particle sizes) and, over time, the mound would lower through erosion. The assessment indicates that changes in seabed level due to drill arisings for installation of piled foundations would be negligible beyond the immediate footprint of the foundation.

15.212 For Impact 4 in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (change in seabed level due to sandwave clearance/levelling and installation of inter-array and platform link cables), any impacts would be similar to those seabed level impacts already considered for the installation of foundations (Impact 2 of this chapter).

15.213 Similarly, with respect to the Impact 6 in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (indentations on the seabed due to installation vessels), as it is only sediments within the immediate vicinity of the leg that would be impacted, it is also only heritage assets within the footprint of the legs (and/or anchors) that would be impacted (with no change in the

near and/or far-field). As this corresponds to the same footprint as the direct impacts discussed above, these indirect impacts are considered to equate to the same conclusions and mitigation as presented above and are not considered further.

15.214 Given these negligible changes in bed level, and those changes would be short-term and limited in extent (i.e., in the vicinity of installed infrastructure), it is concluded that there is **no pathway for change** to the fabric of any heritage asset.

15.6.1.4 Impact 4: Impacts to the setting of marine heritage assets

15.215 Changes in setting due to construction activities would be temporary and of sufficiently short duration that they are not anticipated to give rise to material harm. As such, changes are anticipated to be **negligible adverse** significance (not significant in EIA terms). Long term impacts to the setting of heritage assets are discussed in **Section 15.6.2.4**.

15.6.1.5 Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets

15.216 Changes in setting of terrestrial coastal heritage assets due to construction activities, would be temporary and of sufficiently short duration that they are not anticipated to give rise to material harm. As such, changes are anticipated to be **negligible adverse** significance (not significant in EIA terms).

15.6.2 Potential effects during operation and maintenance

15.6.2.1 Impact 1: Direct impact to known heritage assets

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

15.6.2.2 Impact 2: Direct impact to potential heritage assets

Description of impact

15.218 Direct impacts to potential heritage assets are unlikely to occur resulting from intrusive maintenance activities (as described in **Chapter 5 Project Description**) as any impacts would already have occurred during the installation and construction phase of the Project. These would already have been subject to appropriate and proportionate additional mitigation measures, as and where necessary.

15.219 There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-up vessels deployed during planned or unscheduled maintenance activities, or within the footprint of any replacement

scour protection material or cable protection, if these are located in areas which were not previously subject to disturbance.

Magnitude of impact

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

Significance of effect

15.221 As set out in **Table 15.15** and **Table 15.21**, in-situ prehistoric, maritime and aviation sites are assessed as being of potentially high heritage significance (importance), as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material). In accordance with the significance matrix in **Table 15.12**, direct (physical) impacts to these heritage asset types thereby have the potential to have **major adverse** effects as a worst-case scenario, which is significant in EIA terms.

15.222 Isolated/derived finds in secondary contexts are assessed as being of medium heritage significance (importance). Should they be encountered during operation and maintenance activities, direct (physical) impacts to isolated finds are considered to be of potential **minor adverse** significance and therefore not significant in EIA terms.

Additional mitigation

15.223 The archaeological assessment of post-construction monitoring data would further reduce, as far as possible, the potential for unintended impacts during operation and maintenance. If further features of archaeological interest are identified these would be subject to the same mitigation as described for known heritage assets described in **Section 15.6.1.1**, with the primary approach being avoidance.

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

15.225 The approach to the implementation of these mitigation measures is set out in the Outline OWSI.

Residual effect

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

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

15.227 As set out in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (Section 7.6.3), during the operation and maintenance phase of the Project, there is the potential for the presence of foundations and cable protection to cause changes to the tidal and wave regimes due to physical blockage effects and maintenance activities disturbing sediment, potentially resulting in changes in seabed levels (operation and maintenance impacts 1 to 6 in **Chapter 7 Marine Geology, Oceanography and Physical Processes**). These changes could potentially affect the sediment regime and/or seabed morphology and therefore effect marine heritage assets.

15.228 For Impact 1 in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (changes to the tidal regime due to the presence of structures on the seabed (WTG and OSP foundations) this has the potential to alter the baseline tidal regime, particularly tidal currents. Any change in the tidal regime has the potential to contribute to changes in seabed morphology due to alteration of sediment transport patterns. The conceptual evidence-based assessment suggests that each foundation would present an obstacle to the passage of currents locally, causing a small modification to the height and/or phase of the water levels and a wake in the current flow. However, **Chapter 7 Marine Geology, Oceanography and Physical Processes** concluded there would be no significant effect resulting from Impact 1, as changes in the tidal regime would be limited and are anticipated to be spatially confined to a narrow wake downstream of each individual WTG/OSP. Away from the immediate vicinity of the installed foundations, therefore, there would be **no pathway for change** for indirect impact to heritage assets.

15.229 For Impact 2 in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (changes to the wave regime due to the presence of structures on the seabed (WTG and OSP foundations)), the presence of the foundation structures has the potential to alter the baseline wave regime, particularly in respect of wave heights and directions. Any changes in the wave regime may contribute to changes in seabed morphology due to alteration of sediment transport patterns. However, **Chapter 7 Marine Geology, Oceanography**

and Physical Processes concluded there would be no significant effect resulting from Impact 2 as the presence of the WTGs/OSP would represent small changes on the wave regime. Away from the immediate vicinity of the installed foundations, therefore, there would be **no pathway for change** for indirect impact to heritage assets.

15.230 For Impact 3 in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (changes to the sediment transport regime due to the presence of structures on the seabed (WTG and OSP foundations)), modifications to the tidal regime and/or the wave regime due to the presence of the foundation structures may affect the sediment regime. However, these changes to the marine geology, sediment regime and physical processes would be both low in magnitude and largely confined to local wake or wave shadow effects attributable to individual foundations. Therefore, these would be small in geographical extent. Away from the immediate vicinity of the installed foundations there would be **no pathway** for indirect impacts to heritage assets.

15.231 For Impact 4 (loss of seabed area due to due to the footprint WTG and OSP foundations) in **Chapter 7 Marine Geology, Oceanography and Physical Processes**, it was concluded that effects would be confined to the footprint of each foundation structure (loss of seabed) and within a few metres of the scour protection material (secondary scour). For Impact 5 (morphological and sediment transport effects due to cable protection measures) in **Chapter 7 Marine Geology, Oceanography and Physical Processes**, it was concluded that effects would not extend far beyond the direct footprint and gross patterns of bedload transport would therefore not be affected significantly. Any impacts to heritage assets within the footprint of the WTG/OSP foundations and scour protection, and cable protection have already been addressed through consideration of the direct (physical) impacts associated with construction Impacts 1 and 2 in **Sections 15.6.1.1** and **15.6.1.2**.

15.232 Considering the above context, there would be **no pathway for change** for indirect effects to heritage assets.

15.233 Similarly, for Impact 6 in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (cable repairs and reburial, and scour protection/cable protection replacement material during the operation and maintenance phase), the disturbance areas would be extremely small in comparison to construction (and there are no identified effects to wider sediments transport processes) given the anticipated frequency and length of repair/reburial activities. As such, there would be **no pathway for change** for indirect effects to heritage assets.

15.6.2.4 Impact 4: Impacts to the setting of marine heritage assets

Description of impact

15.234 During the operational life of the Project the presence of the WTGs and OSP(s) would introduce a clear change to the setting of offshore assets. However, as assessed in **Section 15.5.1.2** and **15.5.2.4**, the setting of individual offshore heritage assets corresponds more broadly to their location (and collective research value) within wider palaeolandscapes and maritime and aviation networks. Therefore, this is considered in more detail as part of their cumulative research value as discussed in **Section 15.7**.

15.235 Maintenance activities, through vessel movements, would introduce a temporary change to the setting of offshore heritage assets.

Magnitude of impact

15.236 In terms of maintenance activities, individually, the baseline setting of individual heritage assets is already influenced by passing vessels in this area associated with industry, fishing, and recreation, thereby reducing the potential magnitude of impact from the presence of vessels, personnel and infrastructure associated with maintenance activities. As such, the magnitude of impact is assessed as **negligible**.

Significance of effect

15.237 As set out in **Table 15.15** and **Table 15.21**, in-situ prehistoric, maritime and aviation sites are assessed as being of potentially high heritage significance (importance), as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material). In accordance with the significance matrix in **Table 15.12** impacts to their setting are thereby assessed as having the potential to have a **minor adverse** effect on these heritage asset types as a worst-case scenario, which is not significant in EIA terms.

15.6.2.5 Impact 5: Changes to the setting of coastal (terrestrial) designated heritage assets

Description of Impact

15.238 The presence of permanent visible infrastructure (i.e., WTGs/OSP(s)) could have an ongoing impact on the setting of coastal heritage assets for the duration of the operation and maintenance phase.

15.239 The following designated heritage assets were identified as potentially subject to change in setting due to the presence of the offshore infrastructure in the seascape. As a result, this may affect their heritage significance. As a result, a more detailed assessment has been undertaken (in accordance with the

methodology set out in **Section 15.4.6**) of the following designated heritage assets (**Appendix 15.3**):

- Morecambe Conservation Area:
  - Grade II* LB - Midland Hotel, Marine Road Central (List Entry: 1208988)
- Heysham Conservation and associated assets:
  - SM - St Patrick's early Christian chapel and associated cemetery, Lower Heysham (List Entry: 1020535)
  - Grade I LB - Rock Cut Tombs Approximately 10 Metres West of Chapel of St Patrick (List Entry: 1292902)
  - Grade I LB - Rock Cut Tombs Approximately 4 Metres Southeast of Chapel of St Patrick (List Entry: 1207215)
  - Grade I LB - Chapel of St Patrick (List Entry: 1208949)
- LBs associated with Middleton Tower Holiday Camp:
  - Grade II LB - Ye Olde Farmhouse, Middleton Tower Holiday Camp (List Entry: 1071770)
  - Grade II LB - Tower Approx. 10 Metres West of Ye Old Farmhouse, Middleton Tower Holiday Camp (List Entry: 1164309)
- Sunderland Point Conservation Area
- Cockersand Premonstratensian Abbey:
  - SM – Cockersand Premonstratensian Abbey (List Entry: 1018919)
  - Grade I LB – The Chapter House, Cockersand Abbey (List Entry: 1362525)
- LBs associated with Rossall School:
  - Grade II LB – West Range of Quadrangle at Rossall School (List Entry: 1072425)
  - Grade II LB – The Gazebo at Rossall School (List Entry: 1072421)
- North Promenade, Blackpool Conservation Area:
  - Grade II LB – Imperial Hotel (List Entry: 1072011)
- Town Centre, Blackpool Conservation Area
  - Grade I LB - Tower Buildings (Blackpool Tower) (List Entry: 1205810)
  - Grade II LB – North Pier (List Entry: 1205766)
  - Grade II LB - Clifton Hotel (List Entry: 1362393)
  - Grade II LB - Promenade Shelters (List Entry: 1205804, 1072012, 1072013)

- Porritt Houses/Ashton Gardens Conservation Area
- Grade II LB – St Anne's Pier (List Entry: 1196341)
- RPG - Promenade Gardens, Lytham St Anne's (List Entry: 1001491)
    - Grade II LB - Bandstand Approximately 70 Metres Southeast of St Anne's Pier (List Entry: 1196339)
    - Grade II LB - Lifeboat Monument Approximately 100 Metres Southeast of St Anne's Pier (List Entry: 1196340)
    - Grade II LB - Octagonal Pavilion Approximately 130 Metres Southeast St Anne's Pier (List Entry: 1219352)
    - Grade II LB - Promenade Shelter Opposite West End of Boating Pool (List Entry: 1297673)
    - Grade II LB - Promenade Shelter Opposite West End of Open-Air Baths (List Entry: 1219362)
- Grade II LB - Grand Hotel with Front Garden Wall (List Entry: 1219349)
- Lytham Avenues Conservation Area
- Grade II* LB - Fairhaven United Reformed Church (List Entry: 1196364)
- Grade II LB - Southport Pier (List Entry: 1379746)
- Grade II* LB - Fort Perch Rock (List Entry: 1258164)
- Grade II* LB - Perch Rock Lighthouse (List Entry: 1258288)

15.240 In general, while the Project would be visible from the designated heritage assets along the coastline, its presence would not detract from their archaeological, historic, and architectural interest. The WTG/OSP(s) would only be visible on a clear day and would enter a seascape already dominated by the offshore wind industry. Therefore, **no change** to the significance of the designated heritage assets would occur to due to changes in their setting. This is supported by the detailed setting assessment presented in **Appendix 15.3**.

15.6.3 Potential effects during decommissioning

15.241 Given the lack of information regarding timing and methodology used for decommissioning, it is not possible to undertake a detailed assessment at this time. A further assessment would be undertaken at the time of decommissioning. At this current stage, decommissioning impacts are only covered at a high level.

15.6.3.1 Impact 1: Direct (physical) impact to known heritage assets

15.242 As all known heritage assets would be avoided through the retention of AEZs as required throughout the lifetime of the Project, there is **no pathway for change** to known heritage assets during decommissioning.

15.6.3.2 Impact 2: Direct (physical) impact to potential heritage assets

Description of impact

15.243 Direct impacts to potential heritage assets are unlikely to occur as a result of decommissioning as any impacts would already have occurred during installation of the windfarm infrastructure during the construction phase and would already have been subject to appropriate and proportionate additional mitigation measures, as and where necessary. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-up vessels deployed during decommissioning activities, if these are located in areas which were not previously subject to disturbance. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred.

Magnitude

15.244 As for construction activities, and as a worst-case, there is potential for direct impacts of **high adverse** magnitude upon potential in-situ heritage assets and **low adverse** magnitude upon potential isolated finds.

Significance of effect

15.245 As set out in **Table 15.15** and **Table 15.21**, in-situ prehistoric, maritime and aviation sites are assessed as being of potentially high heritage significance (importance), as are potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material). In accordance with the significance matrix in **Table 15.12**, direct (physical) impacts to these heritage asset types thereby have the potential to have **major adverse** effects as a worst-case scenario, which is significant in EIA terms.

15.246 Isolated/derived finds in secondary contexts are assessed as being of medium heritage significance (importance). Should they be encountered during decommissioning activities, direct (physical) impacts to isolated finds are considered to be of potential **minor adverse** significance, which is not significant in EIA terms.

Additional mitigation

15.247 The archaeological assessment of any future geophysical data would further reduce, as far as possible, the potential for unintended impacts during decommissioning. If further features of archaeological interest are identified these would be subject to the same mitigation as described for known heritage assets described in **Section 15.6.1.1**, with the primary approach being avoidance.

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

15.249 The approach to the implementation of these mitigation measures is set out in the Outline OWSI.

Residual effect

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

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

15.251 As concluded in **Chapter 7 Marine Geology, Oceanography and Physical Processes** (Section 7.6.4), changes associated with decommissioning would be comparable to or less than those identified for the construction phase. Therefore, there would be no pathway for indirect effects to heritage assets. As such, **no change** is anticipated.

15.6.3.4 Impact 4: Impacts to the setting of marine heritage assets

15.252 Decommissioning may result in a further change to the setting of marine heritage assets with the removal of the WTGs, OSP(s) and associated infrastructure. The presence of vessels, personnel and infrastructure associated with decommissioning activities would also temporarily affect the setting. However, as for construction, these impacts are temporary and reversible and the significance of this effect would, therefore, be **negligible adverse** as the setting would change in a way which does not materially affect its cultural significance.

15.6.3.5 Impact 5: Changes to the setting of coastal (terrestrial) designated heritage assets

15.253 Decommissioning may result in a further change to the setting of coastal heritage assets with the removal of the WTGs, OSP(s) and associated infrastructure. The presence of vessels, personnel and infrastructure associated with decommissioning activities would also temporarily affect the setting. However, as for construction these impacts are temporary and

reversible and the significance of this effect would, therefore, be negligible adverse as the setting would change in a way which does not materially affect its cultural significance.

15.7 Cumulative effects

15.254 In order to undertake the CEA, and as per the PINS advice note (PINS, 2019), the potential for cumulative effects has been established considering each Project-alone effect (and the Zone of Influence (ZoI) of each impact) alongside the list of other plans, projects and activities that could potentially interact. These stages are detailed below.

15.7.1 Identification of potential cumulative effects

15.255 Part of the cumulative assessment process was the identification of which individual impacts assessed for the Project have the potential for a cumulative effect on receptors (impact screening). This information is set out in **Table 15.25**. Screening considered the ZoI of the impacts and the plans and projects identified in **Table 15.26** (presented in **Figure 15.10**). Impacts for which the significance of effect was assessed in the Project-alone assessment as 'negligible', or above, were considered in the CEA screening (i.e. only those assessed as 'no change' were not taken forward as there is no potential for them to contribute to a cumulative effect[6]).

[6] The following impacts concluded 'No change': Construction Impacts 1 and 3; Operation and maintenance Impact: 1 and 3; Decommissioning: Impacts 1 and 3.

Table 15.25 Potential cumulative effects (impact screening)

Impact	'Project-alone' residual effect significance	Potential for cumulative effect	Rationale
Construction phase			
Impact 2: Direct (physical) impact to potential heritage assets	Minor adverse	Yes	Although the effect would be mitigated by agreed measures as part of the consenting process for each of the constructed and planned projects, the impacts would still have occurred, and permanent damage or destruction would have taken place. The assessment of cumulative impacts, therefore, needs to consider the effect of multiple unavoidable impacts from multiple projects upon the archaeological resource.
Impact 4: Impacts to the setting of marine heritage assets	Negligible adverse	No	As assessed in **Section 15.6.1.4**, impacts to the setting of individual assets are not anticipated to give rise to material harm. Considering the baseline information and the location of other projects in their region, there is no potential for significant cumulative effects.
Impact 5: Changes to the setting of coastal (terrestrial) designated heritage assets	Negligible adverse	No	As assessed in **Section 15.6.1.5**, impacts to the setting of individual assets are not anticipated to give rise to material harm. Considering the baseline information and the location of other projects in their region, there is no potential for significant cumulative effects.
Operation and maintenance phase			
Impact 2: Direct (physical) impact to potential heritage assets	Minor adverse	Yes	There is potential for multiple unavoidable impacts associated with operation and maintenance activities

Impact	'Project-alone' residual effect significance	Potential for cumulative effect	Rationale
			of other projects (e.g., cable repairs and jack-up leg footprints).
Impact 4: Impacts to the setting of marine heritage assets	Minor adverse	No	As assessed in **Section 15.6.2.4**, impacts to the setting of individual assets are not anticipated to give rise to material harm. Considering the baseline information and the location of other projects in their region, there is no potential for significant cumulative effects.
Impact 5: Changes to the setting of coastal (terrestrial) designated heritage assets	Negligible adverse	No	As assessed in **Section 15.6.2.5**, impacts to the setting of individual assets are not anticipated to give rise to material harm. Considering the baseline information and the location of other projects in the region, there is no potential for significant cumulative effects.
Decommissioning phase			
Impact 2: Direct (physical) impact to potential heritage assets	Minor adverse	Yes	There is potential for multiple unavoidable impacts associated with decommissioning considered cumulatively with activities associated with other projects.
Impact 4: Impacts to the setting of marine heritage assets	Negligible adverse	No	As assessed in **Section 15.6.3.4**, impacts to the setting of individual assets are not anticipated to give rise to material harm. As such, there can be no cumulative effect.
Impact 5: Changes to the setting of coastal (terrestrial) designated heritage assets	Negligible adverse	No	As assessed in **Section 15.6.3.5**, impacts to the setting of individual assets are not anticipated to give

Impact	'Project-alone' residual effect significance	Potential for cumulative effect	Rationale
			rise to material harm. As such, there can be no cumulative effect.

15.7.2 Identification of other plans, projects, and activities

15.256 The identification and review of the other plans, projects and activities that may result in cumulative effects (described as 'project screening') is undertaken alongside an understanding of Project-alone effects. For this chapter, a 30km distance was used to identify possible projects for inclusion in the CEA, as this distance encompasses the ZoI for all relevant impacts, as well as incremental changes over the wider area. Other windfarm projects that interact with heritage setting have been considered within the 50km study area. This information is set out in **Table 15.26**. This includes consideration of the relevant details of each project, including current status (e.g., under construction), planned construction period, distance to the Project, status of available data and rationale for including or excluding from the CEA.

15.257 All projects considered for CEA across all topics have been identified within **Appendix 6.1 CEA Project Long List** (Document Reference 5.2.6.1), which forms an exhaustive list of plans, projects, and activities relevant to the Project.

15.258 While UXO clearance for the Project[7] (which would be considered as part of a separate licence application) and for other projects in the region can cause seabed disturbance and increased suspended sediment concentrations (SSCs) which can result in disturbance of heritage assets, effects would be highly localised and temporary and recoverable and as such not considered to cause cumulative effects.

[7] UXO clearance activities for the Project would be considered as part of a separate licence application.

Table 15.26 Summary of projects considered for the CEA in relation to marine archaeology and cultural heritage

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
Morgan and Morecambe Offshore Wind Farms: Transmission Assets	Pre-application stage. PEIR published in October 2023.	2026 - 2029	0 (adjacent)	Y	Potential for multiple direct (physical) impacts to potential heritage assets which traverse the boundaries of the Project windfarm site such as palaeolandscapes, and maritime and aviation networks relating to conflicts, migration, and trade routes.
Vodafone Lanis 1 telecom cable	Operational	N/A	0 (bisects the windfarm site)	Y	Cables with a footprint which overlap/adjoin with the Project have the potential for cumulative direct (physical) impact to potential heritage assets due to maintenance activities.
EXA Atlantic (formerly GTT Hibernia Atlantic) telecom cable	Operational	N/A	0 (along the southern boundary of the windfarm site)	Y	
Carbon Capture Storage Area (EIS Area 1)	Licences awarded in 2023 (see Morecambe Net Zero Cluster Project below)	Unknown	0	Y	Licence area noted and awarded to Spirit Energy (the project considers repurposing the North and South Morecambe natural gas fields to create a carbon storage cluster). Exploration surveys are being undertaken (2024), however, project timescales are unknown and there are no specific details of associated offshore works. It is possible existing infrastructure would be used.
Morecambe Net Zero Cluster Project (carbon storage cluster)	Early planning				

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
South Morecambe DP3 (gas platform)	Decommissioned	N/A	0	N	Gas platform and jacket decommissioning activities completed in 2023 with no above ground infrastructure remaining.
Calder CA1 platform (and associated cables and pipelines)	Operational	N/A	0 (associated cables and pipelines bisect the windfarm site, whilst the platform itself is located 0.9km to the west of the windfarm site)	N	Limited activities at the platform anticipated to interact with marine physical processes. Possible interaction with maintenance activities. Other existing oil and gas infrastructure located at a greater distance from the Project windfarm site is not considered cumulatively given the small scale and low frequency of any maintenance activities and uncertainty around potential decommissioning timeframes.
South Morecambe CPP1 (and surrounding South Morecambe platforms)	Operational	N/A	1.6	N	
Gateway Gas Storage Project	On hold	N/A	4.1	Y	Project noted, however there is insufficient information available as the project has been on hold since 2010.

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
Isle of Man Interconnector	Operational	N/A	4.6	N	The interconnector sits outside of the windfarm site. Maintenance activities are minimal.
South Morecambe DP4 (gas platform)	Decommissioned	N/A	5.1	N	As per South Morecambe DP3.
Carbon Capture Storage Licence (CS004)	Licensed in 2020	Unknown	7.5	Y	Licence area linked to the HyNet North West project. Applications for the HyNet Carbon Dioxide pipeline and HyNet North West Hydrogen Pipeline projects encompass onshore works only and there are no specific details of associated offshore works, however it is possible existing infrastructure would be used.
Liverpool Bay aggregate production area (Area 457)	Open	N/A	9.7	N	These aggregate production areas dredge sand (The Crown Estate, 2020) and (The Crown Estate & The British Marine Aggregate Producers Association (BMAPA), 2022) which is not considered to be of archaeological potential.
Mona Offshore Wind Project	Pre-application stage. PEIR submitted 2023.	2026 - 2029	10.0	Y	Potential for temporal overlap, therefore, should be considered to have the potential to result in multiple direct impact to potential heritage assets which traverse the boundaries of the offshore windfarms such as palaeolandscapes, and maritime and aviation networks relating to conflicts, migration, and trade routes, for example.

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
					For indirect impacts, there is potential for these offshore windfarms to cumulatively affect the setting of designated coastal heritage assets. The results of surveys and evaluations, and the distribution of reported discoveries cumulatively form part of a collective body of information regarding the marine historic environment within the Irish Sea.
West of Duddon Sands Offshore Windfarm	Operational	N/A	12.9	Y	Fully commissioned, operational offshore windfarm. There is potential for this offshore windfarm to cumulatively affect the setting of designated coastal heritage assets.
Morgan Offshore Wind Project Generation Assets	Pre-application stage. PEIR submitted 2023.	2026 - 2029	16.7	Y	Potential for temporal overlap, therefore, should be considered to have the potential to result in multiple direct impact to potential heritage assets which traverse the boundaries of the offshore windfarms such as palaeolandscapes, and maritime and aviation networks relating to conflicts, migration, and trade routes, for example. For indirect impacts, there is potential for these offshore windfarms to cumulatively affect the setting of designated coastal heritage assets. The results of surveys and evaluations, and the distribution of reported discoveries

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
					cumulatively form part of a collective body of information regarding the marine historic environment within the Irish Sea.
Site Y Disposal Area	Open	N/A	16.8	N	Ongoing activity, any impacts would likely be minimal and localised within the footprints of the projects.
Walney Extensions Offshore Windfarm	Operational	N/A	18.8	Y	As per West of Duddon Sands Offshore Windfarm.
Walney 1 Offshore Windfarm	Operational	N/A	20.3	Y	
Barrow Offshore Windfarm	Operational	N/A	21.0	Y	
Walney 2 Offshore Windfarm	Operational	N/A	22.7	Y	
IS205 Barrow D Disposal Area	Open	N/A	22.7	N	As per Site Y Disposal Area.
Size Z Disposal Area	Open	N/A	23.9	N	
Liverpool Bay aggregate exploration and option area (Area 1808)	Open	N/A	25.7	N	As per Liverpool Bay aggregate production area (Area 457).

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
Ormonde Offshore Windfarm	Operational	N/A	27.0	Y	As per West of Duddon Sands Offshore Windfarm.
AyM Offshore Wind Farm	Consent granted 2023	2027 – 2030	28.9	Y	Potential for temporal overlap, therefore, should be considered to have the potential to result in multiple direct impact to potential heritage assets which traverse the boundaries of the offshore windfarms such as palaeolandscapes, and maritime and aviation networks relating to conflicts, migration, and trade routes, for example. For indirect impacts, there is potential for these offshore windfarms to cumulatively affect the setting of designated coastal heritage assets. The results of surveys and evaluations, and the distribution of reported discoveries cumulatively form part of a collective body of information regarding the marine historic environment within the Irish Sea.
Gwynt y Môr Offshore Windfarm	Operational	N/A	28.9	Y	As per West of Duddon Sands Offshore Windfarm.
Hilbre Swash aggregate production area	Open	N/A	29.0	N	As per Liverpool Bay aggregate exploration and option area (Area 1808).
Burbo Bank Extension	Operational	N/A	29.1	Y	As per West of Duddon Sands Offshore Windfarm.

Project	Status (at the time of assessment)	Construction period	Closest distance to the Project (km)	Screened into the CEA (Y/N)	Rationale
Morecambe Bay: Lune Deep Disposal Area	Open	N/A	30.1	N	As per Site Y Disposal Area.
Burbo Bank Offshore Windfarm	Operational	N/A	33.4	Y	As per West of Duddon Sands Offshore Windfarm.
North Hoyle Offshore Windfarm	Operational	N/A	36.3	Y	
Rhyl Flats Offshore Windfarm	Operational	N/A	40.0	Y	
Mooir Vannin Offshore Wind Farm	Pre-application stage. Scoping submitted 2023.	2030-2032	43.7	Y	As per AyM Offshore Wind Farm.

15.7.3 Assessment of cumulative effects

15.259 Having established the residual effects from the Project with the potential for a cumulative effect, along with the other relevant plans, projects and activities, the following sections provide an assessment of the level of cumulative effect that may arise. These are assessed per impact where the potential for cumulative effects have been identified (in line with **Table 15.26**).

15.260 Given the interconnected nature of the Project and the Morgan and Morecambe Offshore Wind Farms: Transmission Assets, a separate 'combined' assessment of these has been provided within the CEA (**Section 15.7.3.1**). Thereafter, the cumulative assessment considered all plans, projects and activities screened into the CEA (**Section 15.7.3.2**).

15.7.3.1 Cumulative assessment – the Project and Transmission Assets (combined assessment)

15.261 While the Transmission Assets[8] are being considered in a separate ES as part of a separate DCO application (combined with the Morgan Offshore Wind Project transmission assets), given the functional link, a 'combined' assessment has been made considering both the Project and the Transmission Assets for the purposes of cumulative assessment. This provides an assessment including impact interactions and additive effects and thus any change in the significance of effects as assessed separately.

15.262 The Transmission Assets PEIR (Morgan Offshore Wind Limited and Morecambe Offshore Windfarm Ltd, 2023) informed the assessment. The assessment was also undertaken in reference to the baseline presented in **Section 15.5**.

15.263 Only the marine elements of the Transmission Assets would interact with the Project in relation to marine archaeology and cultural heritage, including:

- Export cables adjoining the Morgan Offshore Wind Project and the Project and making landfall south of Blackpool
- Booster station for the Morgan Offshore Wind Project
- OSP(s) (for the Project and Morgan Offshore Wind Project)

[8] As the Transmission Assets includes infrastructure associated with both the Project and the Morgan Offshore Wind Project Generation Assets, it should be noted that the combined assessment considers the transmission infrastructure for both the Project and the Morgan Offshore Wind Project Generation Assets.

Construction phase

15.264 The following (project-alone) impacts were concluded in the Transmission Assets PEIR (Morgan Offshore Wind Limited and Morecambe Offshore Windfarm Ltd, 2023) during the construction phase:

- Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors - minor adverse effect (not significant in EIA terms)
- Direct damage to marine archaeology receptors (e.g., wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)) - minor adverse effect (not significant in EIA terms)
- Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g., palaeolandscapes and associated archaeological receptors) - minor adverse effect (not significant in EIA terms)

15.265 During the construction phase of the Project there is the potential for cumulative impacts with the Transmission Assets. This involves the potential for sediment plume and deposition overlap during construction activities, however as discussed in **Section 15.6.1.3**, the magnitude of effects identified for the Project would not result in indirect change to any heritage assets. This also applies to similar effects during the operation and maintenance and decommissioning phases of the Project. In terms of direct effects, both the Project and the Transmission Assets project have committed to undertaking archaeological assessments in advance of construction, and at varying scales of resolution, which are relevant to the wider understanding of the Irish Sea. Both projects have implemented a number of measures to limit significance effects to marine archaeology receptors. These include:

- The implementation of AEZs around wrecks site or anomalies that have potential to be wreck related
- Avoidance of unknown marine archaeology receptors through micrositing or the implementation of AEZs following the assessment of detailed pre-construction geophysical survey data
- Preservation by record of submerged prehistory through the archaeological assessment of geotechnical data

15.266 As such, the significance of direct effects to marine archaeology receptors is not anticipated to be greater than the effects assessed for each project separately (**minor adverse** and not significant in EIA terms).

15.267 Cumulative effects to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g., palaeolandscapes and associated archaeological receptors) were scoped out of the Morgan and Morecambe Offshore Windfarm: Transmission Assets CEA as such deposits are anticipated to be deeper than the cable would be installed. Accordingly, there would be no cumulative effects to these receptors.

15.268 No other effects were identified in connection with the Transmission Assets where cumulative effects could arise.

Operation and maintenance

15.269 During operation and maintenance, the following impacts (project-alone) were concluded in the Transmission Assets PEIR (Morgan Offshore Wind Limited and Morecambe Offshore Windfarm Ltd, 2023):

- Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors - **minor adverse** effect (not significant in EIA terms)
- Direct damage to marine archaeology receptors (e.g., wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)) - **minor adverse** effect (not significant in EIA terms)
- Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g., palaeolandscapes and associated archaeological receptors) - **minor adverse** effect (not significant in EIA terms)

15.270 In terms of direct damage to marine archaeology receptors (e.g., wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors) cumulative effects to marine heritage assets may occur if maintenance activities occur across the two projects. As discussed above, (**Paragraph 15.273**) both projects have implemented a number of measures to limit significance effects to marine archaeology receptors. As such, the significance of effect is not anticipated to be greater than the effects assessed for each project separately (**minor adverse** and not significant in EIA terms).

15.271 Cumulative effects to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g., palaeolandscapes and associated archaeological receptors) were scoped out of the Morgan and Morecambe Offshore Windfarm: Transmission Assets CEA as such deposits are anticipated to be deeper than the cable would be installed. Accordingly, there would be no cumulative effects to these receptors.

15.272 No other effects were identified in connection with the Transmission Assets where cumulative effects could arise.

Decommissioning

15.273 Decommissioning activities would be similar to those of construction and are therefore not considered to be above the Project-alone effects (**no change** to **minor adverse** and not significant in EIA terms).

Summary

15.274 Key interactions and additive effects between the Project and the Transmission Assets have been considered with no identification of effects that would result in impacts of greater significance than assessed for either the Project or the Transmission Assets. A summary is provided in **Table 15.27** considering all residual impacts from the Project and Transmission Assets.

Table 15.27 Summary of impacts from the Project and Transmission Assets alone and combined (note: wording of impacts has been summarised to encompass both project)

Impact	Transmission Assets significance of effect	Project-alone significance of effect	Combined assessment
Construction/decommissioning phases			
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	Minor adverse	No pathway of change	Not considered to be above as individually assessed.
Direct damage to marine archaeology receptors (e.g., wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors))	Minor adverse	Minor adverse	Not considered to be above as individually assessed.
Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g., palaeolandscapes and associated archaeological receptors	Minor adverse	Minor adverse	Not considered to be above as individually assessed.
Operation and maintenance phase			
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	Minor adverse	No pathway of change	Not considered to be above as individually assessed.

Impact	Transmission Assets significance of effect	Project-alone significance of effect	Combined assessment
Direct damage to marine archaeology receptors (e.g., wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors))	Minor adverse	Minor adverse	Not considered to be above as individually assessed.
Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g., palaeolandscapes and associated archaeological receptors	Minor adverse	Minor adverse	Not considered to be above as individually assessed.

15.7.3.2 Cumulative assessment – All plans and projects

15.275 Based on both the impacts (**Table 15.25**) and other plans and projects (**Table 15.26**) identified, where required, a detailed cumulative assessment has been undertaken considering all relevant information from the Project and other plans and projects (including the Transmission Assets).

Cumulative Impact 1: Direct (physical) impact to potential heritage assets during all phases of the Project

15.276 It is recognised that each of the projects included in the CEA as set out in **Table 15.26** may result in unavoidable direct (physical impacts) to potential heritage assets. When projects summarised in **Table 15.26** are considered in isolation and, assuming the application of appropriate mitigation, physical impacts might only be determined to be of **negligible** or **minor adverse** significance at worst. For example, Mona and Morgan Offshore Wind Projects predict (within PEIRs) that with the application of appropriate mitigation measures (set out in an Outline WSI) the significance of effect would be no greater than **minor adverse** significance, which is not significant in EIA terms (Morgan Offshore Wind Limited, 2023 and Mona Offshore Wind Limited, 2023).

15.277 However, when considered collectively on a regional scale, these multiple unavoidable impacts may be considered of greater adverse significance. For example, it is possible that unique aspects of former landscapes, or of the in-situ maritime and aviation archaeological resource, may be lost as a result. In addition, if a site is damaged or destroyed, comparable sites elsewhere may

increase in importance due to greater rarity and any future direct impacts would be of greater significance.

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

15.279 However, each of the projects in **Table 15.26** would also have completed/undertaken archaeological assessments in advance of construction, and at varying scales of resolution, which would be relevant to the wider understanding of the Irish Sea. This would likely include the assessment of any pre-construction geotechnical and geophysical data that is acquired. This has been included by both the Mona and Morgan Offshore Wind Projects, Morgan and Morecambe Offshore Wind Farms: Transmission Assets, and AyM as adopted measures. As sites are decommissioned, they may also yield additional information.

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

15.281 Despite the significant data that is being gathered and produced through the consenting process, the wider extent of these networks and seascapes/landscapes from various periods remain largely unmapped on a regional scale and the extent to which these seascapes/landscapes may either be confined within a project area, or may extend beyond the bounds of a project, is not currently mapped.

15.282 Whilst a regional, strategic assessment is considered to be beyond the scope of the Project as an individual project, the potential for providing this mapped data would be explored in consultation with stakeholders and projects owners/developers. This contribution to wider analysis in relation to the cumulative impact of multiple constructed and planned projects would facilitate greater understanding of the cumulative effect of offshore wind development within the West Coast region.

15.283 As such, on a regional level, the cumulative impacts from the Project with other projects can be offset through the mapping of accessible data and provision of publicly accessible data post-consent with results from the Project and results from other offshore wind developments within the Irish Sea if available. In this way contribution could be made to regional research initiatives and

provide 'joined-up' objectives for post-consent investigation and mitigation. This approach is set out in the Outline OWSI.

15.8 Transboundary effect assessment

15.284 Transboundary effects have been scoped out of the EIA (as outlined in **Section 15.4.7**).

15.9 Inter-relationships

15.285 There are clear inter-relationships between marine archaeology and cultural heritage topic and other topics that have been considered within this ES. **Table 15.28** provides a summary of the principal inter-relationships and sign-posts to where those issues have been addressed in the relevant chapters.

Table 15.28 Marine archaeology and cultural heritage inter-relationships

Topic and description	Related chapter	Where addressed in this chapter	Rationale
Construction phase			
Indirect impact to heritage assets from changes to physical processes	**Chapter 7 Marine Geology, Oceanography and Physical Processes**	**Sections 15.6.1.3** and **Section 15.7** informed by **Chapter 7 Marine Geology, Oceanography and Physical Processes**	Significant changes to physical processes may impact the preservation/survival of buried/exposed heritage assets.
Indirect (non-physical) impacts upon the setting of heritage assets (designated and non-designated)	**Chapter 18 Seascape, Landscape and Visual Impact Assessment**	**Section 15.6.1, Section 15.7** and **Appendix 15.3** informed by **Chapter 18 Seascape, Landscape and Visual Impact Assessment**	There could be potential impacts with respect to visual receptors along the coast which could also represent potential impacts to the setting of heritage assets. Wireframes, viewpoints and photomontages associated with SLVIA have been used to inform **Section 15.6.1** and **Appendix 15.3**.
Operation and maintenance phase			
Indirect impact to heritage assets from changes to physical processes	**Chapter 7 Marine Geology, Oceanography and Physical Processes**	**Section 15.6.2.3** and **Section 15.7** informed by **Chapter 7 Marine Geology, Oceanography and Physical Processes**	Significant changes to physical processes may impact the preservation/survival of buried/exposed heritage assets.

Topic and description	Related chapter	Where addressed in this chapter	Rationale
Indirect (non-physical) impacts upon the setting of heritage assets (designated and non-designated)	**Chapter 18 Seascape, Landscape and Visual Impact Assessment**	**Section 15.6.2** and **Appendix 15.3** informed by **Chapter 18 Seascape, Landscape and Visual Impact Assessment**	There could be potential impacts with respect to visual receptors along the coast which could also represent potential impacts to the setting of heritage assets. Wireframes, viewpoints, and photomontages associated with SLVIA have been used to inform initial setting consideration outlined in **Section 15.6.2** and **Appendix 15.3.**
Decommissioning phase			
Inter-relationships for impacts during the decommissioning phase would be the same as those outlined above for the construction phase.			

15.10 Interactions

15.286 The impacts identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between impacts are presented in **Table 15.29**, **Table 15.30** and **Table 15.32**. This provides a screening tool for which impacts have the potential to interact. The impacts have been assessed relative to each development phase (i.e., construction, operation and maintenance or decommissioning) to see if (for example) multiple construction impacts affecting the same receptor could increase the level of impact upon that receptor.

15.287 Following this, a lifetime assessment was undertaken which considers the impact interactions identified and the potential for impacts to effect receptors relevant to this chapter across all development phases (**Table 15.33**).

Table 15.29 Interaction between impacts – screening (construction phase)

	Potential interaction between construction phase impacts				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of marine heritage assets and historic seascape character	Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets
Impact 1: Direct impact to known heritage assets		No	No	No	No
Impact 2: Direct impact to potential heritage assets	No		Yes	Yes	No
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes		Yes	No
Impact 4: Impacts to the setting of marine heritage assets and historic seascape character	No	Yes	Yes		Yes
Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets	No	Yes	Yes	Yes	

Table 15.30 Interaction between impacts – screening (operation and maintenance phase)

	Potential interaction between operation and maintenance phase impacts				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of marine heritage assets and historic seascape character	Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets
Impact 1: Direct impact to known heritage assets		No	No	No	No
Impact 2: Direct impact to potential heritage assets	No		Yes	Yes	No
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes		Yes	No
Impact 4: Impacts to the setting of marine heritage assets and historic seascape character	No	Yes	Yes		Yes
Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets	No	Yes	Yes	Yes	

Table 15.31 Interaction between impacts – screening (decommissioning phase)

	Potential interaction between decommissioning phase impacts				
	Impact 1: Direct impact to known heritage assets	Impact 2: Direct impact to potential heritage assets	Impact 3: Indirect impact to heritage assets from changes to physical processes	Impact 4: Impacts to the setting of marine heritage assets and historic seascape character	Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets
Impact 1: Direct impact to known heritage assets		No	No	No	No
Impact 2: Direct impact to potential heritage assets	No		Yes	Yes	No
Impact 3: Indirect impact to heritage assets from changes to physical processes	No	Yes		Yes	No
Impact 4: Impacts to the setting of marine heritage assets and historic seascape character	No	Yes	Yes		Yes
Impact 5: Impacts to the setting of coastal (terrestrial) heritage assets	No	Yes	Yes	Yes	

Table 15.32 Interaction between impacts – phase and lifetime assessment

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

15.11 Potential monitoring requirements

15.288 Monitoring requirements are described in the In Principle Monitoring Plan (IPMP) (Document Reference 6.4) submitted alongside the DCO Application and would be further developed and agreed with stakeholders prior to construction, based on the IPMP and taking account of the final detailed design of the Project.

15.289 Anticipated monitoring requirements for marine archaeology and cultural heritage is described in the Outline OWSI. It is anticipated that monitoring requirements would consist of archaeological analysis of any pre- and post-construction geophysical and geotechnical survey data to identify known and potentially unknown heritage assets, seabed/palaeolandscape features and to monitor construction and post-construction effects. These would be further developed and agreed with stakeholders prior to construction, taking account of the final detailed design of the Project.

15.290 It is recognised that monitoring would form an important element in the management and verification of the impacts of the Project. AEZs would be retained throughout the Project lifetimes and monitoring of AEZs may be required by the regulator to ensure adherence both during construction and in the future operation and maintenance of the Project (as relevant to Impact 1).

15.291 Post-construction monitoring may also be required to assess any changes to sediment cover across the windfarm site which may result in the exposure or burial of heritage assets, which may affect their long-term preservation (see Impact 3). This requirement may be triggered should monitoring during the Projects lifetime show greater than anticipated changes in marine physical processes.

15.12 Assessment summary

15.292 This chapter has provided a characterisation of the existing environment for marine archaeology and cultural heritage based on both existing public data and site-specific survey data, which has established that there would be at worst minor adverse residual effects with archaeological mitigation for heritage assets during the construction, operation and maintenance, and decommissioning phases of the Project.

15.293 There are no known seabed prehistory sites within the windfarm site. A sequence of five quaternary Units have been identified within the windfarm site. The interpreted sedimentary units are largely of limited/very limited archaeological potential although there is some potential for in-situ archaeological remains within Units 1 and 2. However, recent sea-level curves indicate the area experienced a period of marine flooding and then sea-level

fall before the final Holocene transgression (Shennan *et al*. 2018). This could limit the survival of archaeological remains.

15.294 A total of 21 seabed features have been identified within the windfarm site. Of these 17 have been interpreted as low archaeological potential, while the remaining four have been interpreted as being of medium archaeological potential (MC22_0013, MC22_0014, MC22_0020, and MC22_0039).

15.295 Within the windfarm site there are 45 magnetic anomalies that do not correlate with identified seabed features or pre-existing infrastructure. One large magnetic anomaly (>100nT) was identified MC22_MAG_0254 in the windfarm site, a complex anomaly of 739.4nT. The anomaly does not correspond to any seabed anomalies identified within the other datasets.

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

15.297 There are two UKHO records (8069 and 8293) within the windfarm site which are identified as foul ground originating from fisherman's fasteners. Similarly, within the windfarm site there are 39 maritime records maintained by Historic England. All these records derive from fisherman's fasteners, with the following description: '*Unidentified seabed obstruction reported by fishermen. Possibly indicative of wreckage or a submerged feature*'. All the records were created in 1999. Based on the interpretation of geophysical data undertaken by MSDS Marine, these are likely to be natural in origin.

15.298 With the application of mitigation measures, it is anticipated that all direct impacts to known heritage assets resulting from the Project would be avoided. The approach to the implementation of these mitigation measures is set out in the Outline OWSI, prepared in accordance with industry standards and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

15.299 Subject to approval from Historic England, AEZs would be implemented around the medium potential anomalies, with a TEZ applied to the high amplitude magnetic anomaly. The AEZs would be retained for the lifetime of project while the TEZ may be removed with the approval of Historic England once more detailed geophysical data has been acquired and assessed. AEZs are not recommended at this time for features of low archaeological potential or low amplitude magnetic anomalies. The positions of these features would be avoided by means of micro-siting during detailed project design, where possible.

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

15.301 It is not possible to avoid heritage assets that have not yet been discovered (potential heritage assets). To minimise this potential impact, further archaeological assessment of high-resolution geophysical data and geoarchaeological assessment of geotechnical data would be undertaken post-application/ post-consent, prior to any construction works commencing. This would reduce, as far as possible, the potential for unintended impacts during construction. In the event of an unexpected discovery, this would be reported using a formal PAD which would establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures where necessary. Through the protocol, any possible in-situ heritage assets encountered on the seabed would be immediately provided with a temporary exclusion zone to prevent further impacts from taking place until advice had been received. Following confirmation of the presence of archaeological material, additional mitigation measures to record or conserve the site would be agreed in consultation with Historic England.

15.302 Potentially beneficial effects have also been identified through the contribution of data to academic and scientific research. The approach would be considered post-consent in consultation with key stakeholders, including Historic England, and is set out in the Outline OWSI.

15.303 In terms of impacts to the setting of coastal heritage assets, no change to the significance of designated heritage assets through changes to their setting would occur as assessed in **Appendix 15.3**.

Table 15.33 Summary of potential impacts on marine archaeology and cultural heritage

Potential impact	Receptor	Cultural heritage importance	Magnitude	Significance of effect	Additional mitigation measures proposed	Residual effect	Cumulative residual effect
Construction phase							
Impact 1: Direct impact to known heritage assets	Wrecks and anomalies of archaeological interest (seabed features identified as medium archaeological potential)	High	No change due to application of AEZs			No Change	As per Project-alone
	Historic wrecks for which remains have yet been to be identified	High	No change due to application of AEZs			No Change	
Impact 2: Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	High	High	Significant (Major adverse)	Further assessment and investigation and additional mitigation to avoid, reduce or offset impacts.	Not Significant (Minor adverse)	Potential beneficial effect through regional mapping of accessible data and provision of publicly accessible data post-

Potential impact	Receptor	Cultural heritage importance	Magnitude	Significance of effect	Additional mitigation measures proposed	Residual effect	Cumulative residual effect
	Isolated finds	Medium	Low	Not Significant (Minor adverse)	PAD	Not Significant (Minor adverse)	consent (described but currently not quantifiable)
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No pathway of change. **Chapter 7 Marine Geology, Oceanography and Physical Processes** concludes there would be no significant effect resulting from the Project.			No Change	As per Project-alone
Impact 4: Impacts to the setting of marine heritage assets	Known and potential heritage assets	Medium to High	Negligible	Not Significant (Negligible adverse)	N/A	Not Significant (Negligible adverse)	As per Project-alone
Operation and maintenance phase							
Impact 1: Direct impact to known heritage assets	Known heritage assets	Medium to High	No Change due to application of AEZs			No Change	As per Project-alone
Impact 2: Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	High	High	Significant (Major adverse)	Further assessment of geophysical and geotechnical data.	Not Significant (Minor adverse)	Potential beneficial effect through regional mapping of accessible data and

Potential impact	Receptor	Cultural heritage importance	Magnitude	Significance of effect	Additional mitigation measures proposed	Residual effect	Cumulative residual effect
	Isolated finds	Medium	Low	Not Significant (Minor adverse)	N/A	Not Significant (Minor adverse)	provision of publicly accessible data post-consent (described but currently not quantifiable)
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No pathway of change. **Chapter 7 Marine Geology, Oceanography and Physical Processes** concludes there would be no significant effect resulting from the Project.			No Change	As per Project-alone
Impact 4: Impacts to the setting of marine heritage assets	Known and potential heritage assets	Medium to High	Negligible	Not Significant (Minor adverse)	N/A	Not Significant (Minor adverse)	As per Project-alone
Impact 5: Changes to the setting of coastal designated heritage assets	Coastal designated heritage assets	High	No Change (see **Appendix 15.3**)		N/A	No Change	As per Project-alone

Potential impact	Receptor	Cultural heritage importance	Magnitude	Significance of effect	Additional mitigation measures proposed	Residual effect	Cumulative residual effect
Decommissioning phase							
Impact 1: Direct impact to known heritage assets	Known heritage assets	Medium to High	No Change due to application of AEZs			No Change	As per Project-alone
Impact 2: Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	High	High	Significant (Major adverse)	Further assessment of geophysical and geotechnical data.	Not Significant (Minor adverse)	Potential beneficial effect through regional mapping of accessible data and provision of publicly accessible data post-consent (described but currently not quantifiable)
	Isolated finds	Medium	Low	Not Significant (Minor adverse)	N/A	Not Significant (Minor adverse)	
Impact 3: Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to High	No Change. Effects comparable to those assessed for Construction Impact 1.			No Change	As per Project-alone

Potential impact	Receptor	Cultural heritage importance	Magnitude	Significance of effect	Additional mitigation measures proposed	Residual effect	Cumulative residual effect
Impact 4: Impacts to the setting of marine heritage assets	Known and potential heritage assets	Medium to High	Negligible	Not Significant (Negligible adverse)	N/A	Not Significant (Negligible adverse)	As per Project-alone

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