Partners in UK offshore wind

MONA OFFSHORE WIND PROJECT

Preliminary Environmental Information Report

Volume 2, chapter 13: Marine archaeology

Image of an offshore wind farm

April 2023
Final

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Rev01	Draft for Client review	RPS	bpEnBW		16/09/2022
Rev02	Addressing client comments	RPS	bpEnBW		19/01/2033
Rev03	Final	RPS	bpEnBW	bpEnBW	17/02/2023

Prepared by:	Prepared for:
RPS	**Mona Offshore Wind Ltd.**

Contents

Tables

Figures

Glossary

Term	Meaning
Gazetteer	A geographical index or dictionary.
Palaeochannel	A geological term describing a remnant of an inactive river or stream channel that has been filled or buried by younger sediment.
Palaeoenvironmental	An environment of a past geological age.

Acronyms

Acronym	Description
AEZ	Archaeological Exclusion Zone
AHEF	Archaeology and Heritage Engagement Forum
AMAPs	Areas of Maritime Archaeological Potential
BEIS	Department for Business, Energy and Industrial Strategy
BULSI	Burial, use, loss, survival and investigation
CEA	Cumulative effects assessment
HE	Historic England
HSC	Historic Seascape Character
JNAPC	Joint Nautical Archaeology Policy Committee
MBES	Multibeam Bathymetry
MLWS	Mean Low Water Springs
MPS	Marine Policy Statement
NMRW	National Monuments Record Wales
NPS	National Policy Statement
NSIPs	Nationally Significant Infrastructure Projects
PAD	Protocol for Archaeological Discoveries
PEIR	Preliminary Environmental Information Report
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
SBP	Sub-bottom Profiler
SSS	Sidescan Sonar
SLVIA	Seascape, Landscape and Visual Impact Assessment
TAEZ	Temporary Archaeological Exclusion Zone
WSI	Written Scheme of Investigation

Units

Unit	Description
%	Percentage
km	Kilometres
km^2	Square kilometres
m	Metres
nm	Nautical miles (distance; 1nm = 1.852km)

13. Marine archaeology

13.1. Introduction

13.1.1 Overview

13.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the assessment of the potential impact of the Mona Offshore Wind Project on marine archaeology. Specifically, this chapter considers the potential impact of the Mona Offshore Wind Project seaward of Mean Low Water Springs (MLWS) during the construction, operations and maintenance, and decommissioning phases. Those impacts of the Mona Offshore Wind Project landward of MLWS are addressed in volume 3, Chapter 19: Historic environment chapter of the PEIR.

13.1.1.2 This chapter also draws upon information contained within volume 6, annex 13.1: Marine archaeology technical report of the PEIR.

13.1.2 Purpose of chapter

13.1.2.1 The primary purpose of the PEIR is outlined in volume 1, chapter 1: Introduction of the PEIR. In summary, the primary purpose of an Environmental Statement is to support the Development Consent Order (DCO) application for the Mona Offshore Wind Project under the Planning Act 2008 (the 2008 Act). The PEIR constitutes the Preliminary Environmental Information Report for the Mona Offshore Wind Project and sets out the findings of the EIA to date to support the pre-application consultation activities required under the 2008 Act. The EIA will be finalised following completion of pre-application consultation and the Environmental Statement will accompany the application to the Secretary of State for Development Consent.

13.1.2.2 The PEIR forms the basis for statutory consultation which will last for 47 days and conclude on 4 June 2023, as outlined in volume 1, chapter 2: Policy and legislation of the PEIR. At this point, comments received on the PEIR will be reviewed and incorporated (where appropriate) into the Environmental Statement, which will be submitted in support of the application for Development Consent scheduled for quarter one of 2024.

13.1.2.3 In particular, this PEIR chapter:

- Presents the existing environmental baseline established from desk studies, site-specific surveys and consultation
- Identifies any assumptions and limitations encountered in compiling the environmental information
- Presents the potential environmental effects on marine archaeology arising from the Mona Offshore Wind Project, based on the information gathered and the analysis and assessments undertaken
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Mona Offshore Wind Project on marine archaeology.

13.1.3 Study area

13.1.3.1 The Mona marine archaeology study area consists of the Mona Array Area and the Mona Offshore Cable Corridor up to Mean Low Water Springs (MLWS) with an additional 2km buffer. This is shown in Figure 13.1. This study area was used as the search area for obtaining records from relevant archive databases. This wider Mona marine archaeology study area allows for a greater understanding of the wider archaeological baseline environment, with the dual purpose of enabling any archaeological trends within the region to be recognised and to allow any archaeological sites identified to be represented in a broader archaeological context. Physical processes modelling carried out for the Mona Array Area (volume 2, chapter 6: Physical processes of the PEIR) has shown that changes to the tidal regime are limited to the immediate Mona Offshore Array Area. Therefore, changes in marine physical process beyond the 2km Mona marine archaeology study area are so minimal as to be negligible and thus a 2km buffer is considered adequate in which to assess potential impacts upon marine archaeology.

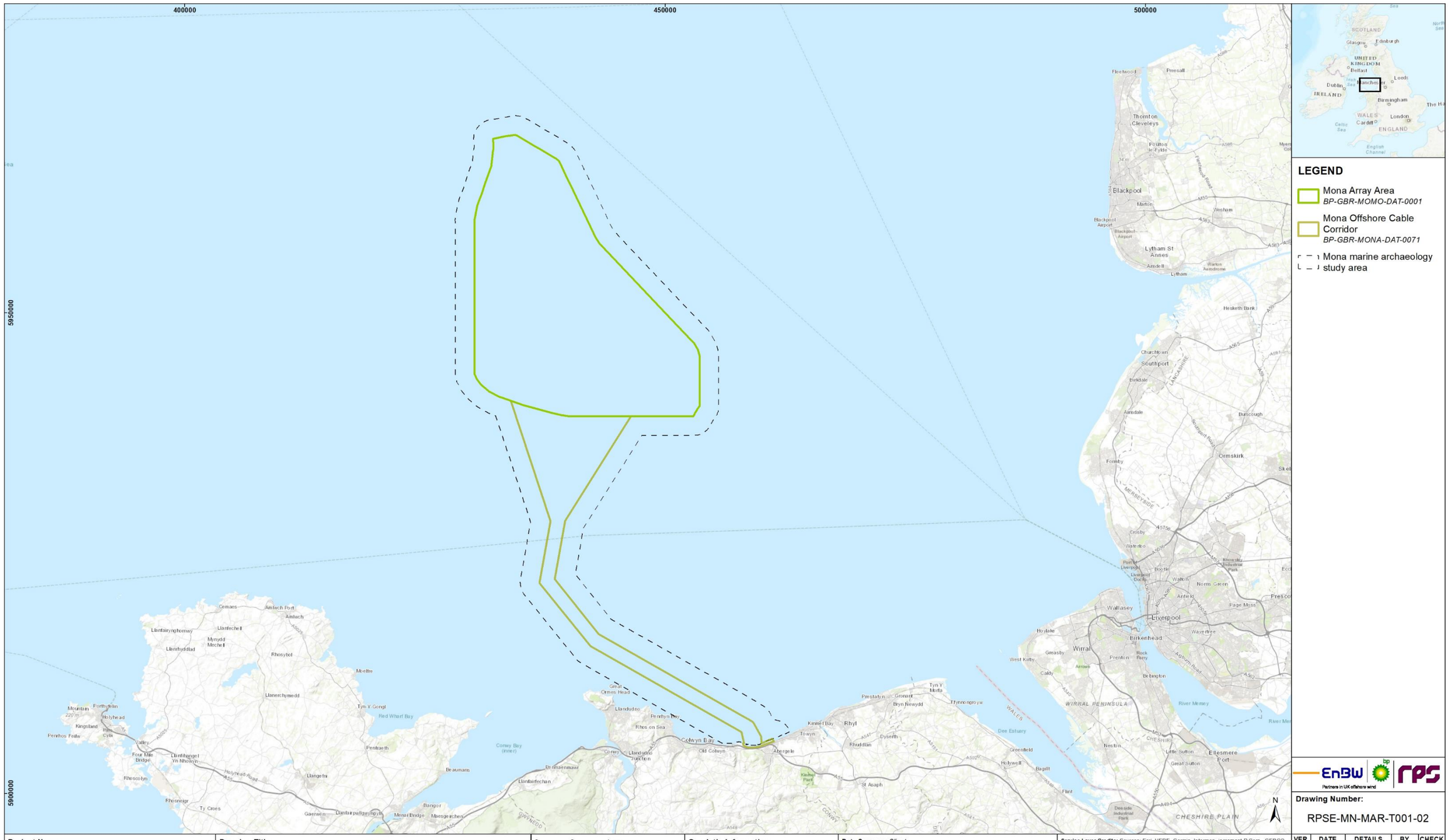


Figure 13.1: Mona marine archaeology study area.

13.2. Policy context

13.2.1 National Policy Statements

13.2.1.1 Planning policy on renewable energy infrastructure is presented in volume 1, chapter 2: Policy and legislation of the PEIR. Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to marine archaeology, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, DECC, 2011b), the UK Marine Policy Statement (MPS; HM Government, 2011) and the Welsh National Marine Plan (WNMP, Welsh Government 2019).

13.2.1.2 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment. These are summarised in Table 13.1 below. NPS EN-1 and NPS EN-3 also highlight a number of factors relating to the determination of an application and in relation to mitigation.

13.2.1.3 In addition to NPS EN-3, the Marine Policy Statement (MPS), in paragraph 2.6.6.3, states that heritage assets in the marine environment "should be conserved through marine planning in a manner appropriate and proportionate to their significance", adding that, "opportunities should be taken to contribute to our knowledge and understanding of our past by capturing evidence from the historic environment and making this publicly available, particularly if a heritage asset is to be lost".

13.2.1.4 With reference to non-designated heritage assets in the UK marine environment the MPS states, in paragraph 2.6.6.5, that the "Many heritage assets with archaeological interest in these areas are not currently designated as scheduled monuments or protected wreck sites but are demonstrably of equivalent significance. The absence of designation…does not necessarily indicate lower significance and the marine plan authority should consider them subject to the same policy principles as designated heritage assets…based on information and advice from the relevant regulator and advisors".

13.2.1.5 When considering possible damage to or destruction of heritage assets by development proposals, the MPS states in paragraph 2.6.6.9 that "the marine plan authority should identify and require suitable mitigating actions to record and advance understanding of the significance of the heritage asset before it is lost".

13.2.1.6 The WNMP (Table 13.3) includes Policy SOC_05 relating to Heritage Assets which recognises the importance of protecting the underwater historic environment and as such proposals should demonstrate appropriate consideration of the potential impacts of developments in order to prevent substantial loss or harm. It also highlights that development proposals should consider opportunities to better understand and promote the historic environment.

13.2.1.7 The WNMP Implementation Guidance (Welsh Government 2020) highlights that the absence of designated historic assets should not suggest that non designated heritage assets are of less importance and points out that given the difficulties with investigating underwater heritage, the significance of many marine historic assets has not as yet been established and so all such assets should be considered by proposals.

13.2.1.8 The guidance advises that all proposals should demonstrate compliance with relevant national and regional legislation and guidance. The relevant regional Welsh archaeological trust should be consulted for the historic environment records and the RCAHMW for their extensive database of marine historic assets. Any assessment should also be undertaken in accordance with guidelines set out by the Chartered Institute for Archaeologists and best practise guidance notes for the marine historic environment.

13.2.1.9 The guidance highlights that proposals should demonstrate the potential impact on relevant historic assets and that there should be a general presumption in favour of preservation or enhancement of historic assets.

13.2.1.10 Further advice in relation specifically to the Mona Offshore Wind Project has been sought through consultation with the statutory authorities and from The Planning Inspectorate's Scoping Opinion (The Planning Inspectorate, 2022) (section 13.2.3 and Table 13.4).

13.2.1.11 Table 13.1 refers to the current NPSs, specifically NPS EN-1 (DECC, 2011a) and NPS EN-3 (DECC, 2011b). If the NPSs are updated prior to the application for Development Consent, the revised NPSs will be fully considered in relation to marine archaeology within the Environmental Statement.

Table 13.1: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to marine archaeology.

Summary of NPS EN-3 and EN-1 guidance	How and where considered in the PEIR
Consultation with all relevant statutory consultees is to be carried out at an early stage (paragraph 2.6.140 of NPS EN-3).	Consultation with relevant statutory and non-statutory stakeholders has been carried out from the early stages of the Mona Offshore Wind Project. See section 13.2.3 and Table 13.4 for further details.
Assessments should include a desk-based assessment that should take into account any geotechnical or geophysical surveys that have been undertaken to inform the wind farm design (paragraph 2.6.141 of NPS EN-3).	A marine archaeology desk-based assessment and technical report has been produced which informs the archaeological assessment (see volume 6, annex 13.1: Marine archaeology technical report of the PEIR). The archaeological review of geophysical data is included in section 13.4 below and in volume 6, annex 13.1: Marine archaeology technical report of the PEIR.
Assessment should include any beneficial effects on the historic environment, for example through improved access or new knowledge (paragraph 2.6.142 of NPS EN-3).	The EIA has considered the potential adverse and beneficial impacts on the historic environment during each phase of the Mona Offshore Wind Project (see section 13.7.3). The mitigation measures adopted as part of Mona Offshore Wind Project including any future geophysical and geotechnical surveys undertaken will produce new archaeological data and understandings of the historic marine environment of the area. This is a beneficial outcome of the Mona Offshore Wind Project. This is discussed further in section 13.8 below.
Decision-making is based on being satisfied that the proposed development has been designed sensitively, taking into account known heritage assets and their status. Any negative effects will be weighed against the public interests of the Mona Offshore Wind Project (paragraph 2.6.144 of NPS EN-3).	Measures adopted as part of the Mona Offshore Wind Project has been designed sensitively. Mitigation is primarily by avoidance and the Mona Offshore Wind Project has been designed to avoid known sensitive receptors through provision of Archaeological Exclusion Zone's (AEZs) and Temporary Archaeological Exclusion Zones (TAEZs) (section 13.7). Any potential adverse effects have been assessed in this chapter in section 13.8.

Summary of NPS EN-3 and EN-1 guidance	How and where considered in the PEIR
The most effective form of protection for important heritage assets can be achieved through implementing exclusion zones around the heritage assets which stop development activities within their area (paragraph 2.6.145 of NPS EN-3).	Mona Offshore Wind Project will incorporate AEZs, where appropriate, as stated in the measures adopted as part of Mona Offshore Wind Project (see section 13.7). AEZs are discussed further in the Outline WSI and Protocol for Archaeological Discoveries (PAD) to be submitted with the ES.

Table 13.2: Summary of the MPS and WNMP

Summary of key points in MPS and WNMP relevant to marine archaeology	How and where considered in the PEIR
Heritage assets in the marine environment "should be conserved through marine planning in a manner appropriate and proportionate to their significance" and "opportunities should be taken to contribute to our knowledge and understanding of our past by capturing evidence from the historic environment and making this publicly available, particularly if a heritage asset is to be lost" (paragraph 2.6.6.3 of MPS)	The PEIR has considered the significance of all known and potential heritage assets within the MASA. This is discussed further in section 13.8 below. The mitigation measures adopted as part of Mona Offshore Wind Project including any future geophysical and geotechnical surveys undertaken will produce new archaeological data and understandings of the historic marine environment of the area. The results of these investigations will ultimately be made publicly available. This is discussed further in section 13.7 below.
The absence of designation…does not necessarily indicate lower significance and the marine plan authority should consider them [non designated heritage assets] subject to the same policy principles as designated heritage assets…based on information and advice from the relevant regulator and advisors (paragraph 2.6.6.5, of MPS)	The PEIR has considered the significance of all known and potential heritage assets within the MASA. This is discussed further in section 13.8 below. Consultation to date with the relevant regulator and advisors is set out in Table 13.4 and will be ongoing.
The marine plan authority should identify and require suitable mitigating actions to record and advance understanding of the significance of the heritage asset before it is lost (paragraph 2.6.6.9 of MPS)	The mitigation measures adopted as part of Mona Offshore Wind Project including any future geophysical and geotechnical surveys undertaken will produce new archaeological data and understandings of the historic marine environment of the area. The results of these investigations will ultimately be made publicly available. This is discussed further in section 13.7 below. An outline Written Scheme of Investigation (WSI) will also be prepared to support the EIA which will set out the high level mitigation strategy for approval by the regulator and advisors.

Summary of key points in MPS and WNMP relevant to marine archaeology	How and where considered in the PEIR
WNMP SOC_05: Historic Assets Proposals should demonstrate how potential impacts on historic assets and their settings have been taken into consideration and should, in order of preference: a. avoid adverse impacts on historic assets and their settings; and/or b. minimise impacts where they cannot be avoided; and/or c. mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Opportunities to enhance historic assets are encouraged	The PEIR has considered the significance of all known and potential heritage assets within the MASA. This is discussed further in section 13.8 below. The mitigation measures adopted as part of Mona Offshore Wind Project including any future geophysical and geotechnical surveys undertaken will produce new archaeological data and understandings of the historic marine environment of the area. The results of these investigations will ultimately be made publicly available. This is discussed further in section 13.7 below. An outline Written Scheme of Investigation (WSI) will also be prepared to support the EIA which will set out the high level mitigation strategy for approval by the regulator and advisors.
The absence of designated historic assets should not suggest that non designated heritage assets are of less importance and so all such assets should be considered by proposals (paragraph 95 of WNMP Implementation Guidance)	The PEIR has considered the significance of all known and potential heritage assets within the MASA. This is discussed further in section Table 13.8 below.
Proposals should demonstrate compliance with relevant national and regional legislation and guidance. The relevant regional Welsh archaeological trust should be consulted for the historic environment records and the RCAHMW for their extensive database of marine historic assets. Any assessment should also be undertaken in accordance with guidelines set out by the Chartered Institute for Archaeologists and best practise guidance notes for the marine historic environment (paragraph 96 of WNMP Implementation Guidance)	Table 13.1, Table 13.2 and Table 13.3 demonstrate how the PEIR has complied with National and Regional Policy Statements. Section 13.4 confirms the baseline methodology and section 13.5.1 that the baseline assessment was undertaken in accordance with relevant professional and legal legislation and guidance.
Proposals should demonstrate the potential impact on relevant historic assets and that there should be a general presumption in favour of preservation or enhancement of historic assets (paragraph 98 and 100)	

13.2.2 Regional Policy Statements - North West Inshore and North West Offshore Coast Marine Plans

13.2.2.1 The assessment of potential changes to marine archaeology has also been made with consideration to the specific policies set out in the North West Inshore and North West Offshore Coast Marine Plans (MMO, 2021). Key provisions are set out in Table 13.3 along with details as to how these have been addressed within the assessment.

Table 13.3 North West Inshore and North West Offshore Marine Plan policies relevant to marine archaeology.

Policy	Key provisions	How and where considered in the PEIR
NW-HER-1	This policy aims to conserve and enhance marine and coastal heritage assets by considering the potential for harm to their significance. This consideration will not be limited to designated assets and extends to those non-designated assets that are, or have the potential to become, significant. The policy will ensure that assets are considered in the decision-making process and will make provisions for those assets that are discovered during developments.	The potential for harm to the significance of marine heritage assets by the Mona Offshore Wind Project has been assessed in section 13.7.3, which includes the assessment of non-designated marine heritage assets identified within the Mona marine archaeology study area. Mitigation measures have been adopted as part of the Mona Offshore Wind Project to protect the known archaeology assets and make provisions for those assets that are discovered during the Mona Offshore Wind Project in the form of the production of an Outline Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) to be submitted with the ES.

13.2.3 Legislation

13.2.3.1 This chapter of the PEIR has considered the legislative framework as defined by:

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

13.2.3.2 Full details of the legislation, policy and guidance considered in the development of this marine archaeology chapter are presented in volume 6, annex 13.1: Marine archaeology technical report of the PEIR.

13.2.4 Guidance

13.2.4.1 This chapter of the PEIR has been developed in accordance with the following guidelines:

- Planning Policy Wales Technical Advice Note 24: The Historic Environment
- Managing the Marine Historic Environment of Wales Cadw/Welsh Government 2020
- Historic England's (HE) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage (now Historic England), 2008)
- Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Cadw, 2011)
- Code of Conduct (Chartered Institute for Archaeologists, 2014)
- Standard and Guidance for Historic Environment Desk Based Assessment (Chartered Institute for Archaeologists, 2014 (updated 2020))
- COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007a)
- Offshore Renewables protocol for Archaeological Discoveries (The Crown Estate, 2010)
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2010)
- Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

13.3. Consultation

13.3.1.1 A summary of the key issues raised during consultation activities undertaken to date specific to marine archaeology is presented in Table 13.4 below, together with how these issues have been considered in the production of this PEIR chapter.

Table 13.4: Summary of key consultation issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to marine archaeology.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or were considered in this chapter
May 2022	Cadw. Scoping response.	Cadw has not identified any issues with the contents of this chapter but recommend that the Senior Investigator (Maritime) at the Royal Commission on the Ancient and Historic Monuments in Wales should be consulted on this chapter	Noted. RCAHMW have been invited to attend the Archaeology and Heritage Engagement Forum (AHEF) has been set up to cover both on shore and offshore heritage matters in relation to Mona.
May 2022	Historic England. Scoping response.	It is our advice that in consideration of the risk of encountering presently unknown cultural 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, so as to best deliver UK policy objectives for the protection of underwater cultural heritage.	Mitigation measures have been adopted as part of the Mona Offshore Wind Project and are detailed in section 13.7. These include further geotechnical and geophysical survey and the provision of an Outline WSI and PAD in order to account for the possibility of encountering presently unknown cultural heritage.
May 2022	Historic England. Scoping response.	It is important to factor-in seabed sedimentary conditions whereby wrecked vessels of considerable antiquity may have become entombed and therefore the state of preservation is very high. Furthermore, such heritage assets may be very difficult to identify with geophysical survey data which was gathered to generally characterise the area within which the development could occur for EIA purposes. The risk that a presently identified anomaly with minimal 'signature' may actual represent buried archaeological material of considerable importance should always be factored in.	Seabed sedimentary conditions have been assessed in the impact assessment in section 13.8. Mitigation measures have been adopted as part of the Mona Offshore Wind Project and are detailed in section 13.7. These include further geotechnical and geophysical survey and the provision of an Outline WSI and PAD in order to account for the possibility of encountering buried archaeological material.
May 2022	Historic England. Scoping response.	We noted the statement about the identification of "…marine archaeology receptors of relevance to the Mona Offshore Wind Project" A crucial aspect of any such identification is the appreciation of risk that this project will discover presently unknown elements of the historic environment. We therefore appreciated the detail provided about accessing desk-top data and site-specific surveys (conducted in 2021).	Mitigation measures have been adopted as part of the Mona Offshore Wind Project and are detailed in section 13.7. These include the provision of an Outline WSI and PAD in order to account for the possibility of encountering presently unknown cultural heritage.
May 2022	Historic England. Scoping response.	We noted the attention given to the Evidence plan process and the establishment of Expert Working Groups (EWG). Unfortunately, it appears that marine archaeology has not been included and we must direct the Applicant to contact our colleagues in the Welsh national curatorial body to ensure such an EWG is convened without delay.	An Archaeology and Heritage Engagement Forum (AHEF) has been set up to cover both onshore and offshore heritage matters in relation to Mona. The Marine Management Organisation, Historic England, RCAHMW and Cadw *et al*. will be invited to attend.
June 2022	The Planning Inspectorate. Scoping response.	Where possible, the Applicant should seek to agree the magnitude of impact or sensitivity of receptors with relevant consultees through the PEIR and pre-application process. Where differences in opinion remain, these should be identified within the Environmental Statement with justification given for the Applicant's choice.	The magnitude of each impact and sensitivity of each receptor or each receptor group is detailed in section 13.8 of this chapter. We will seek to agree magnitude of impact with relevant consultees through PEIR and pre-application process. This will include the AHEF discussed above.
June 2022	The Planning Inspectorate. Scoping response.	The Environmental Statement should define what a 'reasonable timescale' or 'short time period' would be within which recovery could occur so that an impact would be reversible/not permanent.	Reversibility of impact is not considered within marine archaeology, as impacts upon marine archaeological receptors are not reversible. Mitigations measures have been adopted as part of Mona Offshore Wind Project in order to avoid direct impact on known marine archaeology receptors, details of which are in section 13.7. These include establishing AEZs around identified marine archaeological receptors.
June 2022	The Planning Inspectorate. Scoping response.	A number of mitigation plans have been referred to in aspect chapters. Where plans are relied upon to avoid significant environmental effects, outline or in-principle plans should be submitted as part of the DCO application.	An Outline WSI and PAD will be submitted as part of the DCO application and separate Marine Licence application.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or were considered in this chapter
June 2022	The Planning Inspectorate. Scoping response.	Alteration of sediment transport regimes – construction and decommissioning. This matter is proposed to be scoped out. In the absence of a justification in relation to impacts on marine archaeology, the Inspectorate does not agree that this matter should be scoped out. The Environmental Statement should assess any impacts on marine archaeological assets, where significant effects are likely to occur.	Alteration of sediment transport regimes during construction and decommissioning has been covered in the sediment disturbance and deposition impact section 13.8. The presence of the Mona Offshore Wind Project infrastructure, however, may have a different effect on the alteration of transport regimes during the operational and maintenance phase and is therefore considered separately under this impact.
June 2022	The Planning Inspectorate. Scoping response.	Some of the potential impacts to be assessed result from changes to marine physical processes. The study area to be used for the marine archaeological assessment is different to that proposed for the assessments of physical processes. The Environmental Statement should provide a justification for the extent of the study area used in the marine archaeological assessment, in light of the potential for impacts from physical processes over a wider extent.	Justification for the Mona marine archaeology study area is detailed in section 13.1.3.

13.4. Baseline environment

13.4.1 Methodology to inform baseline

13.4.1.1 Data used to compile this report consists of primary geophysical survey data (Table 13.6) and secondary information derived from a variety of sources (Table 13.5).

13.4.2 Desktop study

13.4.2.1 Information on marine archaeology within the Mona marine archaeology study area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 13.5 below.

13.4.2.2 The principal archaeological archives relating to the Mona marine archaeology study area are the National Record of the Historic Environment (NRHE) as held by Historic England (HE) and the National Monuments Record Wales (NMRW) as held by RCAHMS. Data from the United Kingdom Hydrographic Office (UKHO) is a further resource, of which RPS holds in house and is utilised to corroborate positional information of known wrecks and obstructions on the seabed. Additional sources consulted include historic Ordnance Survey maps and Admiralty Charts. Manx National Heritage were also contacted and confirmed that they hold no records within the Mona marine archaeology study area.

Table 13.5: Summary of key desktop data.

Title	Source	Year	Author
UKHO Wreck and Obstructions Data	UKHO	2022	United Kingdom Hydrographic Office (UKHO)
Historic Environment Record Data	National Record of the Historic Environment (NRHE)	2021	Historic England
Historic Environment Record Data	National Monuments Record Wales (NMRW)	2021	Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW)
Historic Environment Record Data	Gwynedd Archaeological Trust	2021	Gwynedd Archaeological Trust
Historic Seascape Characterisation: The Irish Sea (English Sector)	Archaeology Data Service (ADS)	2011	Historic England
Submerged Landscapes Data	EMODnet Geology	2022	British Geological Survey

13.4.3 Site specific surveys

13.4.3.1 In order to inform the PEIR, site-specific surveys were undertaken. A summary of the surveys undertaken to inform the marine archaeology impact assessment is outlined in Table 13.6 below.

13.4.3.2 A comprehensive marine geophysical survey was carried out for the Mona Array Area. The survey comprised multi-beam bathymetry; side-scan sonar and sub-bottom profile surveys, to inform a detailed understanding of the topography and underlying geological formations of the seabed. An archaeological review of the geophysical data has been carried out and is presented in volume 6, annex 13.1: Marine archaeology technical report of the PEIR. Further geophysical survey of the Mona Offshore Cable Corridor has been undertaken between April to September 2022 and the results will be incorporated in the Environmental Statement. Further details are provided in section 13.14.

Table 13.6: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Sidescan Sonar (SSS)	Mona Array Area	Geophysical survey to characterise the marine archaeology of the Mona Array Area	Gardline	July 2021 to September 2021	volume 6, annex 13.1: Marine archaeology technical report of the PEIR.
Multibeam Bathymetry (MBES)	Mona Array Area	Geophysical survey to characterise the marine archaeology of the Mona Array Area	XOCEAN	June 2021 to March 2022	volume 6, annex 13.1: Marine archaeology technical report of the PEIR.
Sub-bottom Profiler (SBP)	Mona Array Area	Geophysical survey to characterise the marine archaeology of the Mona Array Area	Gardline	July 2021 to September 2021	volume 6, annex 13.1: Marine archaeology technical report of the PEIR.

13.4.4 Baseline environment

13.4.4.1 Marine archaeology is considered within the following categories:

- Submerged prehistoric archaeology: This includes paleochannels and other inundated terrestrial landforms that may preserve sequences of sediment of paleoenvironmental interest, Palaeolithic and Mesolithic sites and artefacts
- Maritime archaeology: relates generally to craft or vessels and any of their associated structures and/or cargo
- Aviation archaeology: this comprises all military and civilian aircraft crash sites and related wreckage.

13.4.4.2 Archaeology is considered in terms of periods that represent timeframes which are defined and categorised by the culture of the people of the time. Notable changes in culture and activities are indicated by changes in chronological periods. Dates are referred to as BC (Before Christ), or AD (anno domini). The chronological periods and their corresponding date ranges that are considered within the report are provided in Table 13.7.

Table 13.7: Overview of British archaeological chronology.

Period	Date Range
Palaeolithic	c. 900,000 to 12,000 BC
Mesolithic	12,000 to 4000 BC
Neolithic	4000 to 2500 BC
Bronze Age	2500 to 800 BC
Iron Age	800 BC to AD 43
Romano-British	AD 43 to 410
Early Medieval	AD 410 to 1066
Medieval	AD 1066 to 1500
Post-medieval	AD 1500 to 1800
19th century	AD 1800 to 1899
Modern	AD 1900 to present day

Submerged prehistoric archaeology

13.4.4.3 The prehistoric archaeological record of the British Isles covers the period from the earliest hominin occupation more than 780,000 BP to the Roman invasion of Britain in 43 AD. During this long span of time, sea level fluctuations caused by three major glaciations (the Anglian, Wolstonian and the Devensian) have shaped the submerged prehistoric landscape within the Mona marine archaeology study area. The changes in sea level have at times exposed the seabed floor creating a terrestrial and potentially habitable environment, suitable for hominin occupation and exploitation. The submerged prehistoric archaeological potential of the Mona marine archaeology study area is summarised below and further information is presented in volume 6, annex 13.1: Marine archaeology technical report of the PEIR.

13.4.4.4 Geological periods referred to in this section are defined by the date ranges presented in Table 13.8. Dates are referred to as BP (Before Present).

Table 13.8: Geological periods.

Period	Date Range	Notes
Holocene	10,000 BP to Present Day	Mesolithic, Neolithic, Bronze Age, Iron Age, Roman, Medieval, Post Medieval and Modern periods. The Holocene is the current time period within the larger geological time scale known as the Quaternary Period.
Devensian from Post Late Glacial Maximum to Late Glacial Interstadial	18,000 to 10,000 BP	Coincides with the Late Upper Palaeolithic and the early Mesolithic.
Devensian up to Late Glacial Maximum	c. 73,000 to 18,000 BP	Arrival in the UK of Late Middle Palaeolithic Neanderthals, who were followed approximately 31,000 BP by Early Upper Palaeolithic, anatomically modern humans (Homo sapiens).
Ipswichian (interglacial)	c. 130,000 to c. 115,000 BP	Last interglacial period in the UK. Overlaps with the Late Middle Palaeolithic.
Wolstonian	c. 374,000 to c. 130,000 BP	Predominantly Pleistocene glaciation. Incorporates the earliest period of the Late Middle Palaeolithic.

Late Middle Palaeolithic (186,000- 45,000 BP, 184,000–43,000 BC)

13.4.4.5 Evidence in the form of the presence of deposits representing the Wolstonian Glaciation indicate that the marine archaeology study area would have been subglacial during the Late Middle Palaeolithic. The analysis of seismic data from within the Mona Array Area and evidence from the wider area suggests that deposits representing environments favourable for human occupation dating to this period are not likely to be present within the Mona marine archaeology study area (Jackson *et al*., 1995; Mellett *et al*., 2015; Wood, 2022).

Upper Palaeolithic (45,000-10,000 BP, 43,000 – 8,000 BC)

13.4.4.6 The site-specific geophysical survey conducted in the Mona Array Area indicates the presence of a glacial lake in the south of the Mona Array Area and therefore supports academic theories (Brooks *et al*., 2011; Jackson *et al*., 1995; Mellett *et al*., 2015; Fitch *et al*., 2011) that the southwest of the Mona Array Area would have been a partially terrestrial environment during the Upper Palaeolithic, with final submergence of the area occurring c.13,000 BP. Although the results of the geophysical survey for the Mona Offshore Cable Corridor are not available at this time, desktop sources indicate

that final submergence of the Mona Offshore Cable Corridor would have occurred c.6000 BP.

13.4.4.7 Despite the partially terrestrial environment within the marine archaeology study area, it may not have been a favourable environment for human exploitation. Permafrost would have been present in the area, limiting the growth of vegetation and therefore the availability of resources for human exploitation. Therefore, the potential for the presence of submerged prehistoric archaeological material within the marine archaeology study area is low.

Mesolithic (10,000 – 6000 BP, 12,000 – 4000 BC)

13.4.4.8 Evidence from the site-specific geophysical survey conducted in the Mona Array Area and modelling conducted as part of the West Coast Palaeolandscape Study (Fitch *et al*. 2011) suggest that the southeast part of the Mona Array Area and along the Mona Offshore Cable Corridor was intertidal during the Mesolithic. The intertidal zone represents an environment that is rich in available resources for human exploitation, access to the sea would provide humans a food source in the form of fish and shellfish. The intertidal zone is also an environment which encourages the growth of vegetation that could be utilised for food and resources. Therefore there is potential for the survival of archaeological material dating to this period within the Mona marine archaeology study area, and in particular within the Mona Offshore Cable Corridor as there will be a greater potential for peat closer to shore. The presence of peat suggests a good palaeoenvironmental potential and also the potential for organic material to be preserved in waterlogged deposits such as fish traps. Future geotechnical surveys will be analysed to confirm presence or absence of peat along the Mona Offshore cable Corridor and the results presented in the Environmental Statement.

Maritime and aviation archaeology

Maritime archaeology potential

Early Prehistoric (Palaeolithic and Mesolithic)

13.4.4.9 There is currently no evidence in the UK for maritime archaeological remains pre-dating the start of the Holocene.

13.4.4.10 Watercraft may have been used in the rivers and estuaries during the Mesolithic for coastal journeys, fishing expeditions, and possibly longer journeys in favourable weather. However due to the paucity of evidence within the archaeological record and the extent of fluvial activity across the Mona marine archaeology study area, the potential for the survival of any archaeology associated with the maritime environment from the Palaeolithic and Mesolithic periods is considered low.

Neolithic and Bronze Age

13.4.4.11 The potential for evidence of watercraft of vessels dating to the Neolithic period within the Mona marine archaeology study area is considered to be low.

13.4.4.12 Evidence of Bronze Age maritime activity has been recorded throughout England with the discovery of a number of inland watercraft and sea faring vessels. No such examples have been recorded within or close to the Mona marine archaeology study area, however it is possible that similar crafts may have been utilised to traverse the area. Generally, based on the available evidence the potential for the discovery of maritime archaeology dating to the Bronze Age is considered to be low.

Iron Age and Romano-British

13.4.4.13 Evidence of Iron Age maritime activity has been discovered in Britain in the form of Romano-Celtic boats which are examples of a new form of ship construction that was emerging in north western Europe at the time. No evidence has been found within the Mona marine archaeology study area and based on the available evidence the archaeological potential is considered to be low. The Roman occupation of Britain was by necessity a maritime endeavour, which would have required continuous transportation of resources and people to the military and civilian sites established by the Romans. Sites such as these can be found along Liverpool Bay and therefore it is likely that there would have been substantial Roman maritime traffic in this area. No evidence has been found within the Mona marine archaeology study area and based on the available evidence the archaeological potential is considered to be low to moderate.

Early Medieval and Medieval

13.4.4.14 The Early Medieval period marked a change in ship construction techniques coinciding with the end of the Roman occupation of Britain in the 5th century AD and an increasing Anglo-Saxon presence in the form of Norse and Danish Vikings. Several examples have been recorded in Britain.

13.4.4.15 With the Medieval period came a boom in maritime trade across Europe and trade expanded across the Irish Sea at this time also, with Dublin becoming an increasingly important commercial port, contributing to the maritime transportation of goods through the Irish Sea. The rapid technological advances in ship construction during the medieval period can also be attributed to increased military campaigns.

13.4.4.16 Due to the large increase of maritime traffic that would have occurred in the Irish Sea during the early medieval and medieval period, the potential for the discovery of archaeological remains dating from this period is considered to be moderate.

Post Medieval and Modern

13.4.4.17 Records of known wreck sites and losses in UK waters are biased towards the Post-Medieval and Modern periods and therefore the precise locations of most wrecks pre-dating these periods in UK waters are not known. The majority of known and recorded wreck sites lie relatively close to the coast.

13.4.4.18 A total of 121 recorded losses have been identified within the desktop data (UKHO, NRHE, NMRW and HER) that are attributed to coordinates within the Mona marine archaeology study area. The high volume of recorded losses in the area is consistent with the increase of trade to and from Liverpool from the 16th century and the increase of military activity from the 18th century. From the 18th century onwards there was also rapid developments in shipbuilding technology including the advent of the steam engine and the use of iron hulls. These advances in shipbuilding mean that the incorporation of metal into ship design made shipwrecks more likely to survive on the seafloor and be identifiable in geophysical surveys.

13.4.4.19 Further advances in technology occurred during both World Wars and the east Irish Sea saw extensive activity associated with these periods, therefore the potential for the presence of modern military remains within the Mona marine archaeology study area is high.

Aviation archaeology

13.4.4.20 Since World War II, despite the volume of both military and civilian air traffic, there have been few aviation losses off the west coast of England and north Wales, in the vicinity of the Mona Offshore Wind Project. The potential for post-war aircraft remains to be discovered within the Mona marine archaeology study area for the transmission assets is therefore considered to be low. Civilian aircraft wrecks are not subject to protection under the terms of the Protection of Military Remains Act 1986.

Known and recorded maritime archaeology

13.4.4.21 Geophysical data was collected for the Mona Array Area only. 49 anomalies of potential archaeological interest were identified within the Mona Array Area. Of these, five are considered to be high potential anomalies, nine are of medium potential and 35 have been classed as low potential anomalies. The distribution of these anomalies are shown in Figure 13.2.

13.4.4.22 The 35 low potential anomalies have been assessed against all available evidence and consequently are considered unlikely to have any archaeological significance and so will not be discussed further in this report.

13.4.4.23 The nine medium potential anomalies could represent marine archaeology sites from potential debris to wreck. These are shown in Figure 13.2 and presented in Table 13.9. Full details of the medium potential anomalies and potential wrecks identified within the desktop data can be found in volume 6, annex 13.1: Marine archaeology technical report of the PEIR.

Table 13.9: Medium potential anomalies.

ID	Category
Mona_0057	Anchor
Mona_0080	Unidentified debris
Mona_0081	Potential debris
Mona_0092	Potential wreck
Mona_0102	Potential debris
Mona_0109	Mound
Mona_0111	Potential debris
Mona_0112	Mound
Mona_0113	Potential wreck

13.4.4.24 Five high potential anomalies were identified within the Mona Array Area (Figure 13.2), three of which have also been recorded within the UKHO.

13.4.4.25 Mona_0076 (Figure 13.2) has been interpreted as a wreck and coincides with the recorded location of UKHO record 7452, the Tijl Uilenspiegel, a late 20th century Belgian fishing trawler that was lost in 1989 and subsequently identified in 2000. The Tijl Uilenspiegel now lies on its port side with some associated debris, namely the vessel's trawl gear.

13.4.4.26 Mona_0084 (Figure 13.2) has been interpreted as a wreck that coincides with UKHO record 8162, NMRW record 518452 and NRHE record 909485. Diver investigations in 1991 recorded the wreck as the remains of a small lightship with a double ended hull. The survey data appears to show evidence of collapse of one end of the lightship. It is likely that this wreck dates from the post medieval or modern period.

13.4.4.27 Mona_0091 (Figure 13.2) has been interpreted as a wreck corresponding to the UKHO record 7969, NMRW record 240670 and NRHE record 909482 of an unidentified steam ship. The wreck measures 37.1m x 5.1m and has a height of 5.8m and shows evidence of degradation. The wreck site was dived in 2000 and reported to be intact. A small bell and pottery dating to 1906 were recovered, indicating that the date of loss must be post 1906 and potentially associated with World War I.

13.4.4.28 Mona_0108 (Figure 13.2) has been interpreted as an area of anthropogenic debris. No UKHO, NRHE, or NMRW records are associated with its position. The area of debris may represent a wreck site and consists of three distinct features. There is a high potential for Mona_0108 to be of archaeological interest due to the size, form and distribution of the material.

13.4.4.29 Mona_0110 (Figure 13.2) has been interpreted as an area of anthropogenic debris. No UKHO, NRHE, or NMRW records are associated with its position, however NRHE records 102663 and 1027034 are located <300m south of this position and are recorded as seabed obstructions. Mona_0110 may represent a wreck site as the overall form, and distribution of features is consistent with that of a wrecked vessel.

13.4.4.30 An additional potential wreck has been identified through the desktop study but is located outside of the Mona Array Area and therefore not within the geophysical study area. The site of the *Linda Blanche* has been identified through UKHO data and attributed an AEZ as a precautionary measure (section 13.7.2).

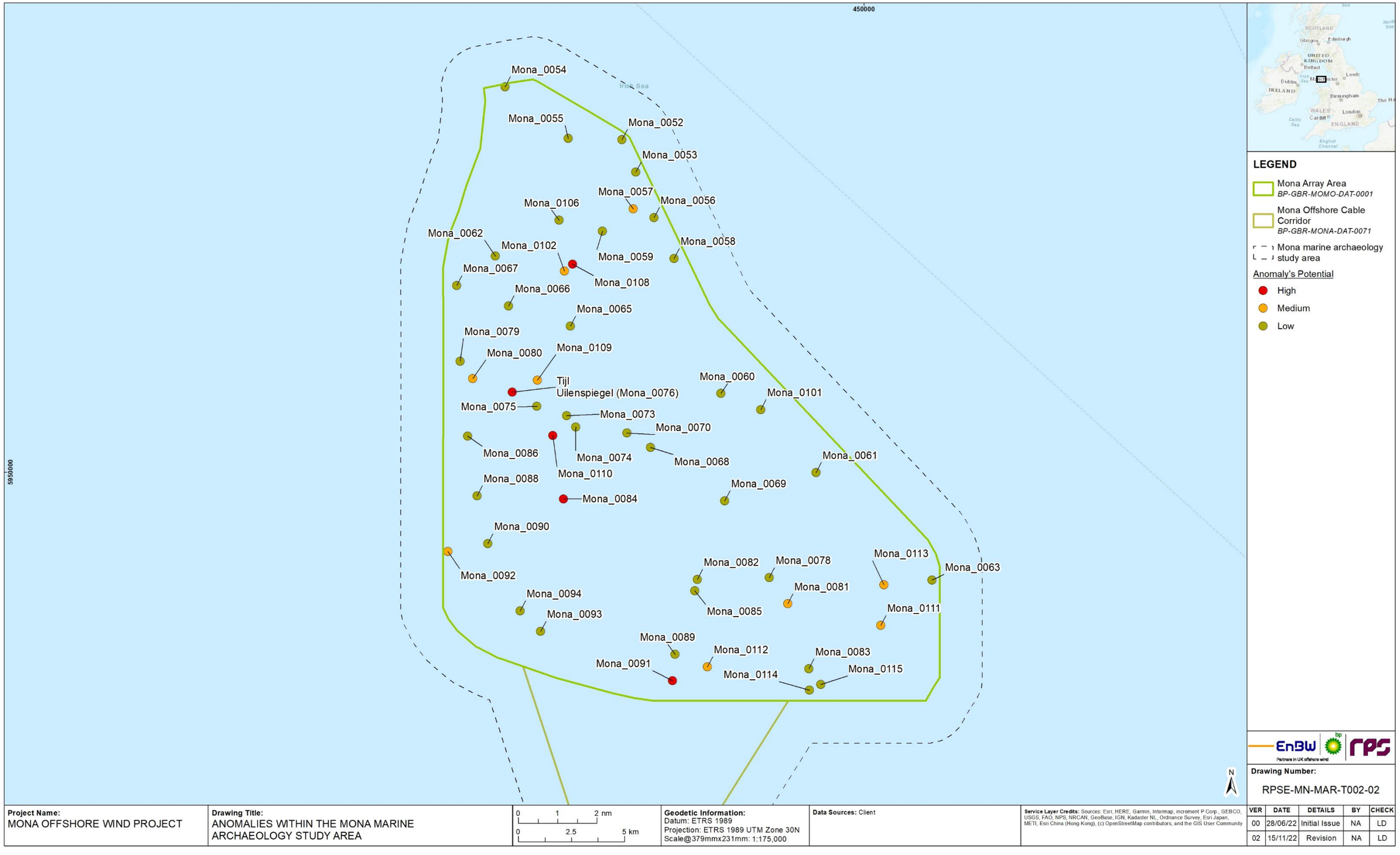


Figure 13.2: Geophysical Anomalies within the Mona marine archaeology study area.

Mona Offshore Cable Corridor

13.4.4.31 The desktop study has identified two entries within the datasets that correlate with potential wreck sites that have positions verified by the UKHO. The *Albanian* was an iron-hulled steam ship built in Liverpool in 1870 used for Mediterranean trade during the 1870s until it collided with the *Nydia* whilst on route from Liverpool to Genoa on the 18 November 1877. The collision off of Great Orme resulted in the loss of both vessels and the *Nydia*, built 1863 in Quebec, is now also a wreck site within the Mona marine archaeology study area. The *Nydia* is now almost entirely buried by sand and it is believed that some damage has been caused though trawling. The *Albanian* was the subject of salvage operations in 1992 and is now reported to lie in three parts and to be very broken up. The geophysical surveys will help to establish the extent of the surviving archaeological remains at the locations shown in Figure 13.3 with the results being incorporated in the Environmental Statement.

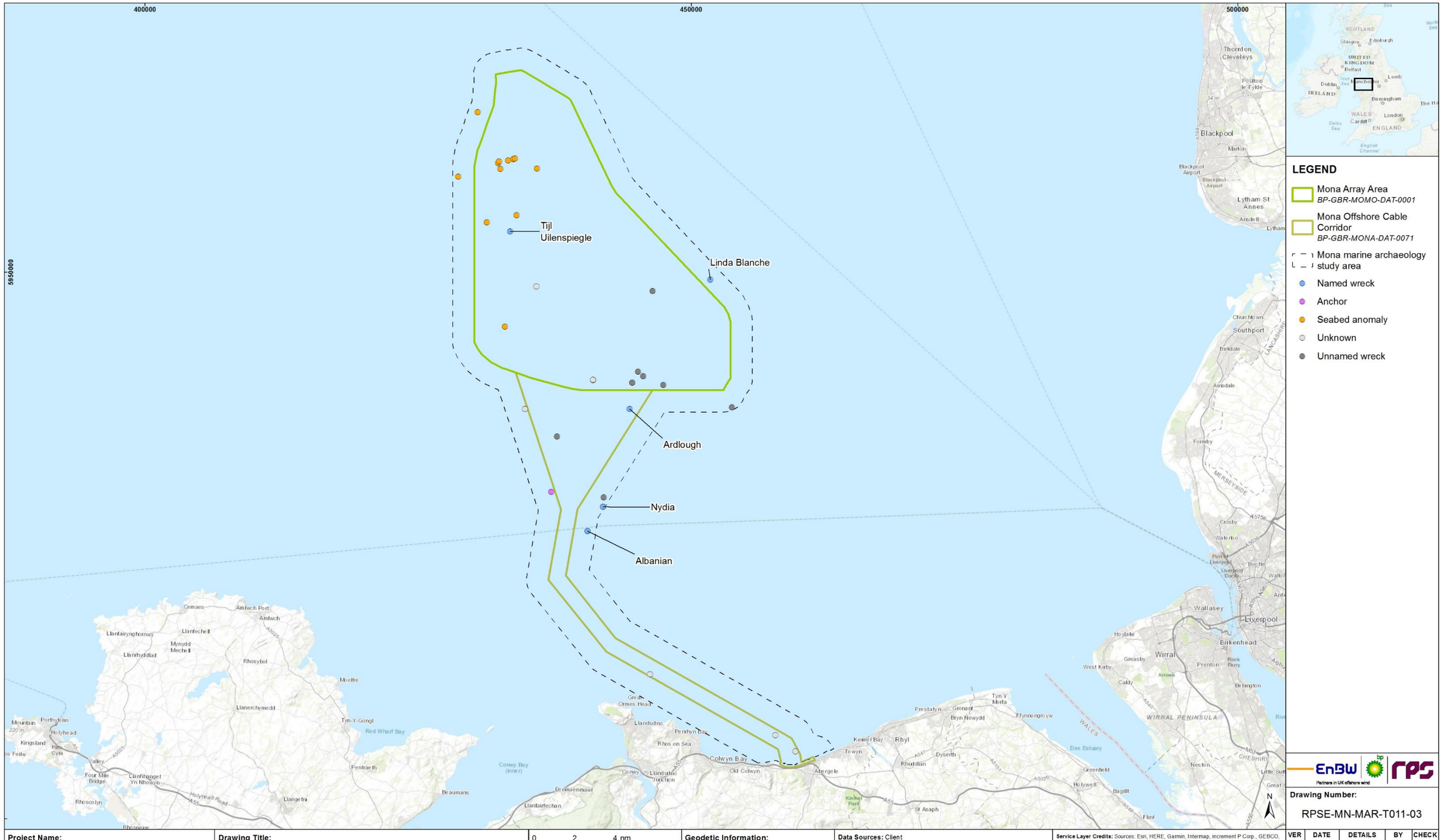


Figure 13.3: Maritime archaeology identified within the desktop data.

13.4.5 Future baseline scenario

1.1.1.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 require that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the Environmental Statement. In the event that Mona Offshore Wind Project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

1.1.1.2 It is unlikely that significant change will occur to the marine archaeology of the Mona marine archaeology study area over the next few decades. It is likely that sediment mobility will continue, and this natural process retains the potential to expose and re-bury marine archaeology, leading to their deterioration over time. It is also possible that new marine archaeology sites and wrecks will be exposed.

13.4.6 Data limitations

13.4.6.1 The records held by the United Kingdom Hydrographic Office (UKHO), NRHE and NMRW 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.

13.4.6.2 The interpretation of geophysical and hydrographic data is by its very nature, subjective. However, by using an experienced specialist who can analyse the form, size and characteristics of an anomaly, a reasonable degree of certainty can be achieved. Measurements can be taken in most data processing software, and whilst largely accurate, discrepancies can occur. Where there is uncertainty as to the potential of an anomaly or its origin, a precautionary approach is always taken to ensure the most appropriate mitigation for the historic environment is recommended. There may be instances where a contact may exist on the seabed but not be visible in the geophysical data. This may be due to the anomaly being covered by sediment or being obscured from the line of sight of the sonar, or due to poor quality data. The desk-based sources and the site-specific survey data examined represent a comprehensive and robust sequence of datasets and observations that allow for a detailed assessment of the archaeological constraints associated with the Mona Array Area. A further geophysical survey of the Mona Offshore Cable Corridor and geotechnical survey for the Mona Offshore Wind Project have been conducted with the results to be incorporated in the Environmental Statement.

13.5. Impact assessment methodology

13.5.1 Overview

13.5.1.1 The marine archaeology impact assessment has followed the methodology set out in volume 1, chapter 5: EIA methodology of the PEIR.

13.5.2 Impact assessment criteria

13.5.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in volume 1, chapter 5: EIA methodology of the PEIR.

13.5.2.2 The criteria for defining magnitude in this chapter are outlined in Table 13.10 below.

Table 13.10: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
High	Total loss of, or major alteration to, key elements/features of the baseline (pre-development) conditions such that post development character/composition/attributes will be fundamentally changed and may be lost from the site altogether.
Medium	Loss of, or alteration to, more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns.
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the ‘no change’ situation.
No change	No change from baseline conditions.

13.5.2.3 The capability of a receptor to accommodate change and its ability to recover if affected is a function of its sensitivity. Receptor sensitivity is typically assessed via the following factors:

- Adaptability - the degree to which a receptor can avoid or adapt to an effect
- Tolerance - the ability of a receptor to accommodate temporary or permanent change without significant adverse impact
- Recoverability - the temporal scale over and extent to which a receptor will recover following an effect
- Value - a measure of the receptor's importance, rarity and worth.

13.5.2.4 Marine archaeology receptors cannot adapt, tolerate or recover from impacts resulting in damage or loss caused by development. As a result, the sensitivity of a receptor can only be determined through its value.

13.5.2.5 Based on HE's Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage, 2008) and Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Cadw 2011) the significance of a historic asset 'embraces all the diverse cultural and

natural heritage values that people associate with it, or which prompt them to respond to it'. Significance is determined by the following value criteria:

- Evidential value - deriving from the potential of a place to yield evidence about past human activity
- Historical value - deriving from the ways in which past people, events and aspects of life can be connected through a place to the present. It tends to be illustrative or associative
- Aesthetic value - deriving from the ways in which people draw sensory and intellectual stimulation from a place
- Communal value - deriving from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values but tend to have additional and specific aspects.

13.5.2.6 Historic England's Ships and Boats: Prehistory to Present - Selection Guide (Historic England, 2017) sets a criteria of value to shipwrecks specifically that is defined as:

- Period
- Rarity
- Documentation
- Group value
- Survival/ condition
- Potential.

13.5.2.7 The criteria for defining value, and therefore sensitivity, in this chapter are outlined in Table 13.11 below.

Table 13.11: Definition of terms relating to the value (and therefore sensitivity) of the receptor.

Value	Definition
Very High	Singular or excellent example and/or significant or high potential to contribute to knowledge and understanding. Receptors with a demonstrable international or national dimension to their importance are likely to fall within this category. Wrecked ships and aircraft that are protected under the Protection of Wrecks Act 1973, Ancient Monuments and Archaeological Areas Act 1979 or Protection of Military Remains Act 1986 with an international dimension or their importance as well as as-yet undesignated sites that are demonstrably of very high archaeological value. Known submerged prehistoric sites and landscapes with a confirmed presence of largely in situ artefactual material or palaeogeographic features with demonstrable potential to include artefactual and/or palaeoenvironmental material, possibly as part of a prehistoric site or landscape.
High	Good example and/or high potential to contribute to knowledge and understanding. Includes shipwrecks and aircraft that are protected under the Protection of Wrecks Act 1973, Ancient Monuments and Archaeological Areas Act 1979 or Protection of Military Remains Act 1986 as well as as-yet undesignated sites that do not have statutory protection or equivalent significance, but have high potential based on an assessment of their importance in terms of build, use, loss, survival and investigation (BULSI). Prehistoric deposits with high potential to contribute to an understanding of the palaeoenvironment.
Medium	Average example and/or moderate potential to contribute to knowledge and understanding and/or outreach. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance, but have moderate potential based on an assessment of their importance in terms of BULSI. Prehistoric deposits with moderate potential to contribute to an understanding of the palaeoenvironment.
Low	Below average example and/or low potential to contribute to knowledge and understanding and/or outreach. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance, but have low potential based on an assessment of their importance in terms of BULSI. Prehistoric deposits with low potential to contribute to an understanding of the palaeoenvironment.
Negligible	Poor example and/or little or no potential to contribute to knowledge and understanding and/or outreach. Assets with little or no surviving archaeological interest.

13.5.2.8 The significance of the effect upon marine archaeology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 13.12. Where a range of significance of effect is presented the final assessment for each effect is based upon expert judgement.

13.5.2.9 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

Table 13.12: Matrix used for the assessment of the significance of the effect.

Sensitivity of Receptor	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major
Very High	No change	Minor	Moderate or Major	Major	Major

13.6. Key parameters for assessment

13.6.1 Maximum design scenario

13.6.1.1 The maximum design scenarios identified in Table 13.14 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor

group. These scenarios have been selected from the Project Design Envelope provided in volume 1, chapter 3: Project description of the PEIR. Effects of greater adverse significance are not predicted to arise should any other design scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

13.6.1.2 In assessing the effects of the Mona Offshore Wind Project on marine archaeology the assessment has been undertaken on the basis of i) the greatest area of near-surface sediments disturbed and ii) the greatest penetration depth of foundations. These two assessments are undertaken as they have very different effects on the marine historic environment, making it difficult to identify which option can best be said to represent the greatest effect.

13.6.1.3 Impacts on the settings of terrestrial heritage assets (landward of MLWS) are considered in the onshore Historic Environment chapter (volume 3, chapter 19 of the PEIR). Impacts on Historic Seascape Character (HSC) are considered in the Seascape, Landscape and Visual Impact Assessment (SLVIA) chapter (volume 4, chapter 25 of the PEIR).

Table 13.13: MDS considered for assessment of potential impacts on marine archaeology.

*C=construction, Operations and maintenance, D=decommissioning

Potential Impact	Phase			Maximum Design Scenario	Justification
	C	O	D		
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors. (the exposure or burial of receptors).	✓	✓	✓	**Construction phase** <u>Site preparation:</u> Sandwave clearance: Sandwave clearance activities undertaken over an approximate 12 month duration within the wider four year construction programme • Wind turbines and Offshore Substation Platform (OSP) foundations: sandwave clearance has been calculated on the basis of wind turbine foundations and an assumption of clearance at up to 50% of locations. Spoil volume per location has been calculated on the basis of 34 locations supporting the largest suction bucket four-legged jacket foundation with an associated base diameter of 205m to an average depth of 7.5m. This equates to a total spoil volume of 8,416,621m^3 and a volume of 247,548m^3 per location. • Inter-array cables: sandwave clearance along 500km of cable length, with a width of 104m, to an average depth of 5.1m. Total spoil volume of 9,542,806m^3 • Interconnector cables: sandwave clearance along 30km of cable length, with a width of 104m, to an average depth of 5.1m. Total spoil volume of 3,060,814m^3 • Offshore export cables: sandwave clearance along 252km of export cable, with a width of 104m, to an average depth of 5.1m. Total spoil volume of 12,051,955m^3. Removal of up to 46km of disused cables. <u>Foundation installation:</u> • Undertaken over a 12 month duration • Wind turbines: installation of up to 68 monopiles of 16m diameter, drilled to a depth of 60m at a rate of 0.89m/h. Two monopiles installed concurrently. Spoil volume of 13,460m^3 per pile • OSPs: installation of one OSP with foundations consisting of two 16m monopiles, drilled to a depth of 60m at a rate of 0.89m/h. Two monopiles installed concurrently. Spoil volume of 13,460m^3 per pile <u>Cable installation:</u> • Inter-array cables: installation via trenching of up to 500km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 2,250,000m^3 Installed over a period of 12 months • Interconnector cables: installation via trenching of up to 50km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 225,000m^3. Installed over a period of four months • Offshore export cables: installation via trenching of up to 360km of cable, with a trench width of up to 3m and a depth of up to 3m. Total spoil volume of 1,620,000m^3. Installed over a period of 15 months • Intertidal export cable: installation via open trenching of up to 6km of cable, with a trench width of 1m and a depth of up to 3m. Total spoil volume of 18,000m^3. Installed over a period of approximately nine months. **Operations and maintenance phase** • Project lifetime of 35 years • Inter-array cables: repair of up 10km of cable in one event every three years. Reburial of up to 20km of cable in one event every five years • Interconnector cables: repair of up to 16km of cable in each of three events every 10 years. Reburial of up to 2km of cable in one event every five years ((assuming 20m width seabed disturbance for repair and remedial burial). • Offshore export cables: repair of up to 32km of cable in eight events every five years. Reburial of up to 15km of cable in one event every five years • Intertidal export cables: Repair of up to 1.6km of intertidal cable every five years. **Decommissioning phase** If scour/cable protection removed the suspended sediment concentration increases temporarily. Similarly, if suction caissons are removed using the overpressure to release them then suspended sediment concentration will be temporarily increased.	<u>Site preparation:</u> The volume of material to be cleared from individual sandwaves will vary according to the local dimensions of the sandwave (height, length and shape) and the level to which the sandwave must be reduced. These details are not fully known at this stage, however based on the available data, it is anticipated that the sandwaves requiring clearance in the array area are likely to be in the range of 15m in height. Site clearance activities may be undertaken using a range of techniques. The suction hopper dredger will result in the greatest increase in suspended sediment and largest plume extent as material is released near the water surface during the disposal of material. Boulder clearance activities will result in minimal increases in suspended sediment concentrations and have therefore not been considered in the assessment. <u>Foundation installation:</u> Installation of foundations via augured (drilled) operations results in the release of the largest volume of sediment. The greatest volume of sediment disturbance by drilling at individual foundation locations and across the site as a whole is associated with the largest diameter monopile for wind turbines. The selected OSP scenario represents the greatest volume of sediment to be released for a drilling event. The greatest drilling rate represents the maximum level of increase in suspended sediment concentration. <u>Cable installation:</u> Cable routes inevitably include a variety of seabed material and in some areas 3m depth may not be achieved or may be of a coarser nature which settles in the vicinity of the cable route. The assessment therefore considers the upper bound in terms of suspended sediment and dispersion potential. Cables may be buried by ploughing, trenching or jetting with jetting mobilising the greatest volume of material to increase suspended sediment concentrations. <u>Operations and maintenance phase</u>

Potential Impact	Phase			Maximum Design Scenario	Justification
					The greatest foreseeable number of cable reburial and repair events is considered to be the maximum design scenario for sediment dispersion.
Direct damage to marine archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)	✓	✓	✓	**Construction phase** Up to 96,536,122,068,7m^2 of seabed loss/disturbance due to: • Presence of foundations and scour protection: up to 760,452m^2 of seabed loss comprising: – Wind turbines: up to 735,488m^2 from the presence of up to 68 wind turbine foundations on suction bucket 4-legged jacket foundations with associated scour protection – OSPs: up to 24,964m^2 from four OSPs on suction bucket jacket foundations with associated scour protection • Jack-up events: up to 908,400m^2 of disturbance from the use of jack-up vessels during foundation installation, with up to four jack-up events at each of 107 wind turbines (two jack-up events for wind turbines and two jack-up events for the foundations), two jack-up events at each of four OSPs. • Cable installation: up to 28,507,840m^2 of disturbance comprising: – Inter-array cables: up to 31,000,000m^2 disturbance from installation of up to 500km of inter-array cables – Interconnector cables: up to 3,520,000m^2 disturbance from installation of up to 50km of interconnector cables – Export cables: up to 28,368,000m^2 disturbance from installation of up to 360km of buried offshore export cables (assumed 100% of all cables are buried) – Seabed disturbance width of up to 104m for sandwave clearance, up to 20m for boulder clearance along inter-array, interconnector and export cables, and up to 3m for cable burial – Sandwave clearance: sandwave clearance required for up to 50% of inter-array, 60% of interconnector cables and 70% of export cables – Pre-lay preparation (boulder and debris clearance): is likely to be required across all inter-array, interconnector and export cables. Although, for the purposes of the MDS boulder clearance only has been assumed across, up to 50% of inter-array, 40% of interconnector, and 30% of export cables (see justification) – Cable protection for cable crossings for inter-array cables: 128,640m2 from 67 cable crossings (each up to 60m in length and 32m in width). Cable protection for cable crossings for interconnector cables: 10,000m^2 from 10 cable crossings (each up to 50m in length and 20m in width). Cable protection for cable crossings for offshore export cables: 144,000m2 from, and 24 crossings (each up to 50m in length and 30m in width) • Sandwave material deposition: up to 66,144,392m^2 of seabed disturbance associated with the deposition of: – 21,020,241m^3 of sandwave clearance material within the Mona Array Area – 12,051,955m3 of sandwave clearance material within the Mona Offshore Cable Corridor affecting up to 24,103,910m2 • Anchor placement: up to 208,000m2 of seabed disturbance from a 100m2 anchor placement event every 500m during offshore export cable installation within the nearshore area (10km for each of the four export cables) only and two 100m2 anchor placements per inter-array cable link • Cable removal: up to 920,000m^2 from the removal of 46km of disused cables • Offshore construction: maximum duration of the offshore construction phase is up to 4 years. **Operations and maintenance phase** Up to 17,606,500m^2 of seabed loss/disturbance due to: • Up to 2,026,500m^2 of seabed loss/disturbance due to jack-ups at wind turbines and OSPs over the lifetime of the Mona Offshore Wind Project for the following: – Up to 937 major component replacements (one every four years for each location) for wind turbines – 12 major component replacements (three over the lifetime per OSP) for OSPs – Four access ladder replacements and four modifications to/replacement of J-tubes for wind turbines – Four access ladder replacements and four modifications to/replacement of J-tubes for OSPs • Up to 15,580,000m^2 of seabed loss/disturbance due to inter-array, interconnector and subtidal/intertidal export cables – Inter-array cables: up to 20,000m for reburial events every five years and up to 10,000m for cable repair events every three years (assuming 20m width seabed disturbance for repair and remedial burial)	Maximum impact on seabed surface resulting in greatest extent of potential direct impact on archaeological receptors during the construction, operations and maintenance and decommissioning phases. Based on the assumption that the width of disturbance for sandwave and pre-lay preparation (boulder and debris clearance) also includes subsequent burial. Pre-lay preparation (boulder and debris clearance) is likely to be required across all inter-array, interconnector and export cables. For the purposes of the MDS, and to avoid double counting of the total footprint with sandwave clearance activities, the MDS assumes up to 50% of inter-array, 40% of interconnector, and 30% of export cables will be subject to pre-lay preparation (boulder and debris clearance) only. It is anticipated that the sandwaves requiring clearance in the Mona Array Area are likely to be in the range 15m in height. The area of seabed affected by the placement of sandwave clearance material has been calculated based on the maximum volume of sediment to be placed on the seabed, assuming all this sediment is coarse material (i.e. is not dispersed through tidal currents; see "Increased suspended sediment concentrations" impact assessment below). The total footprint of seabed affected has been calculated, for the purposes of the maximum design scenario, assuming a mound of uniform thickness of 0.5m height. Parameters for decommissioning will be significantly lower than for the construction phase as cables, cable protection and scour protection are assumed to be left in situ. Maximum design scenario for seabed disturbance associated with export cable maintenance includes repairs/reburial of subtidal cables. Maximum design scenario assumes complete removal of all wind turbine and OSP foundations and cables.

Potential Impact	Phase			Maximum Design Scenario	Justification
				– Interconnector cables: up to 2,000m for reburial events with one event every five years and up to 16,000m of cable in each of three events every 10 years for repair events (assuming 20m width seabed disturbance for repair and remedial burial) • Offshore export cable repair and reburial: repair of up to 8km of cable in two events every five years. Reburial of up to 15km of cable in one event every five years (assuming 20m width seabed disturbance for repair and remedial burial) • Project lifetime: operation phase up to 35 years. **Decommissioning Phase** Up to 18,874,400m^2 of seabed loss/disturbance due to: • Jack-up events: up to 908,400m^2 of disturbance from the use of jack-up vessels during foundation decommissioning with up to two jack-up events per wind turbine, two jack-up events per OSP. • Cable decommissioning: up to 10,000,000m^2 of disturbance from decommissioning of up 500,000 m of inter-array cables, up to 1,000,000m^2 disturbance from decommissioning of up to 50km of interconnector cables and up to 7,200,000m^2 disturbance from decommissioning of up to 360km of buried offshore export cables with seabed disturbance width of 20m for cable reburial • Anchor placements: Up to 208,000m^2 of seabed disturbance from a 100m^2 anchor placed event every 500m within the nearshore area (10km for each of the four export cables) only and two 100m^2 anchor placements per inter-array cable link.	
Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g. Palaeolandscapes and associated archaeological receptors)	✓			**Construction phase** As above for “Direct damage to archaeological receptors”. Foundation installation: 74 jacket foundations reaching pile penetration depth of 75m and seabed disturbance footprint of 378,681m^2.	Maximum depth of seabed disturbance of foundation installation represents the maximum impact to submerged prehistoric archaeological receptors.
Alteration of sediment transport regimes.		✓		**Operations and maintenance phase** • Wind turbines: 68 installations with four-legged suction bucket foundations, each jacket leg with a diameter of 5m, spaced 48m apart, and each bucket with a diameter of 16m. Scour protection to a height of 2.5m. Total footprint of 10,816 m^2 per wind turbine • OSPs: four installations with four-legged suction bucket foundations, each jacket leg with a diameter of 3m, spaced 30m apart, and each bucket with a diameter of 14m. Scour protection to a height of 2.5m. Total footprint of 6241m^2 footprint per OSP • Inter-array cables: cable protection along 50km of the cable, with a height of up to 3m and up to 10m width. Up to 67 cable crossings, each crossing has a height of up to 4m, a width of up to 32m and a length of up to 60m • Interconnector cables: cable protection along 10km of the cable, with a height of up to 3m and up to 10m width. Up to ten cable crossings, each crossing has a height of up to 3m, a width of up to 20m and a length of up to 50m • Export cables: cable protection along 72km of the cable, with a height of up to 3m and up to 10m width. Up to 24 cable crossings, each crossing has a height of up to 3m, a width of up to 30m and a length of up to 50m.	This provides the largest obstruction to flow in the water column. See also volume 2 chapter 6: Physical processes of the PEIR.

13.6.2 Impacts scoped out of the assessment

13.6.2.1 On the basis of the baseline environment and the description of development outlined in volume 1, chapter 3: Project description of the PEIR, no impacts are proposed to be scoped out of the assessment for marine archaeology.

13.7. Measures adopted as part of the Mona Offshore Wind Project

13.7.1 Overview

13.7.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from IEMA, 2016):

- Measures included as part of the project design. These include modifications to the location or design envelope of the Mona Offshore Wind Project which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in IEMA, 2016)
- Measures required to meet legislative requirements, or actions that are standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in IEMA, 2016).

13.7.1.2 A number of measures (primary and tertiary) have been adopted as part of the Mona Offshore Wind Project to reduce the potential for impacts on marine archaeology. These are outlined in Table 13.4 below. As there is a secured commitment to implementing these measures for the Mona Offshore Wind Project, they have been considered in the assessment presented in section 13.8 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). The measures adopted as part of the Mona Offshore Wind Project are captured in the Outline WSI and PAD to be submitted with the DCO application.

Table 13.14: Measures adopted as part of the Mona Offshore Wind Project.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Primary measures: Measures included as part of the project design		
The identification and implementation of AEZs around those sites identified as having high and medium archaeological potential (Table 13.16). Further details of which to be provided in the Outline WSI submitted at application. Final wind turbine locations to avoid any known archaeological constraints identified in pre-construction site investigation surveys through micrositing.	To avoid direct impacts on sites of identified archaeological significance.	Proposed to be secured through a condition in the marine licence(s).
The identification and implementation of Temporary Archaeological Exclusion Zones (TAEZs) based on all available information including the stated positional accuracy, the recorded size of the target and the potential archaeological significance around those records for wrecks and obstructions outside of the survey data coverage but within the Mona Offshore Wind Project boundary. Further details of which to be provided in the Outline WSI submitted at application.	To avoid impacts on sites of archaeological importance.	Proposed to be secured through a condition in the marine licence(s).
Archaeological input into specifications for, and archaeological analysis of, any further pre-construction geophysical and geotechnical surveys. Further details of which to be provided in the Outline WSI submitted at application.	To identify any sites of archaeological importance that may require further investigation, avoidance or engagement with the Statutory Historic Body. To offset the impacts of the Mona Offshore Wind Project on sediments of geoarchaeological/palaeoenvironmental importance and enhance knowledge of the offshore marine archaeological resource.	Proposed to be secured through a condition in the marine licence(s).
Mona Offshore Wind Project archaeologists to be consulted in the preparation of any pre-construction ROV/diver surveys and, if appropriate, in monitoring/checking of data. Further details of which to be provided in the Outline WSI submitted at application.	To identify any sites of archaeological importance that may require further investigation, avoidance or engagement with the Statutory Historic Body.	Proposed to be secured through a condition in the marine licence(s).
Operational awareness of the location of those archaeological anomalies identified as having a low potential. Reporting through the agreed protocol (PAD) will be undertaken should material of potential archaeological interest be encountered. Further details of which to be provided in the Outline WSI submitted at application.	To identify any sites of archaeological importance that may require further investigation, avoidance or engagement with the Statutory Historic Body.	Proposed to be secured through a condition in the marine licence(s).
Archaeologists to be consulted in the preparation of pre-construction cable route clearance or other pre-construction clearance operation and, if appropriate, to carry out archaeological monitoring of such work. Further details of which to be provided in the Outline WSI submitted at application.	To record archaeological remains that may be affected by pre-construction clearance operation.	Proposed to be secured through a condition in the marine licence(s).
Mitigation of unavoidable direct impacts on known sites of archaeological significance: Options include i) preservation by record; ii) stabilisation; iii) detailed analysis and safeguarding of otherwise comparable sites elsewhere. Further details of which to be provided in the Outline WSI submitted at application.	To offset the effects of disturbance/destruction of irreplaceable archaeological remains.	Proposed to be secured through a condition in the marine licence(s).
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
Commitment to preparation, agreement and implementation of an Offshore WSI prior to any post-consent works within the Mona Array Area or Offshore Cable Corridor.	The Outline WSI will be submitted alongside the application and will contain a method statement for pre-construction surveys and details of monitoring requirements. The PAD will ensure the protection and, if necessary, recording of previously unknown sites/objects of archaeological significance affected by the development.	Proposed to be secured through a condition in the marine licence(s).

13.7.2 Archaeological exclusion zones (AEZs)

13.7.2.1 Best practice favours the preservation in situ of archaeological remains, therefore the ideal preferred mitigation for archaeological remains is avoidance (COWRIE, 2011). For the Mona Offshore Wind Project, AEZs have been proposed that prohibit development-related activities within their extents, which vary depending upon the nature of the site. The final development layout will take into account these preliminary zones, which may evolve or be removed (with the agreement of Cadw and HE) as the Mona Offshore Wind Project progresses, subject to layout designs and additional subsequent surveys that may be required.

13.7.2.2 All AEZs agreed with the statutory historic body, through the Offshore WSI, will be marked on the Design Plan. If impacts cannot be avoided, measures to reduce, remedy or offset disturbance will be agreed.

13.7.2.3 In view of their potential archaeological significance, AEZs (either in the form of individual AEZs or clusters) will be placed around the five anomalies classified as being of high archaeological potential and the nine anomalies classed as being of medium potential that have been identified within the Mona Array Area. These anomalies have been recommended AEZs based on the size of the anomaly, the extents of any debris, the potential significance of the anomaly, the potential impact of the development and the seabed dynamics within the area.

13.7.2.4 Dependant of the form of the anomaly, AEZs have either been recommended as a radius' from the centre point of the anomaly or as a distance from the extents. Particularly in the case of shipwrecks, which tend to be longer in length than width, the use of a circle provides unequal protection around the extents. This not only impacts the protection afforded but does not present proportional mitigation.

13.7.2.5 Further AEZs are likely to be proposed following the assessment of geophysical data within the Mona Offshore Cable Corridor.

13.7.2.6 The proposed AEZs are listed in Table 13.15 and shown in Figure 13.4. Scope is allowed for their amendment in light of further evidence and with the involvement of consultees. Further details of AEZs and archaeological monitoring will be provided in the forthcoming Outline WSI and PAD.

13.7.2.7 AEZs are presented as either extents or radius, with extents indicating the distance proposed from the furthest extents of the archaeological anomaly whereas a radius AEZ is one that is measured as a circumference from the central point of the anomaly.

Table 13.15: Proposed AEZs within the Mona marine archaeology study area.

ID	Description	Potential	Eastings	Northings	AEZ (m)
Mona_0076	Wreck	High	433419.2	5953767.8	50 extents
Mona_0084	Wreck	High	435824.4	5948735.6	50 extents
Mona_0091	Wreck	High	440973.4	5940170.0	50 extents
Mona_0108	Potential wreck	High	436254.1	5959800.1	50 extents
Mona_0110	Potential wreck	High	435333.1	5951723.8	50 extents
Mona_0057	Potential anchor	Medium	439115.4	5962417.7	25 radius
Mona_0080	Unidentified debris	Medium	431545.5	5954410.7	15 radius
Mona_0081	Potential debris	Medium	446410.7	5943791.7	15 radius
Mona_0092	Potential wreck	Medium	430376.0	5946260.9	25 radius
Mona_0102	Potential debris	Medium	435869.6	5959476.0	15 radius
Mona_0109	Mound	Medium	434606.8	5954333.8	30 radius
Mona_0111	Potential debris	Medium	450799.2	5942774.0	25 radius
Mona_0112	Mound	Medium	442619.1	5940823.2	15 radius
Mona_0113	Potential wreck	Medium	450956.5	5944683.9	50 extents
Linda Blanche	Potential wreck identified in UKHO data	Medium	451724	5949341	100 radius

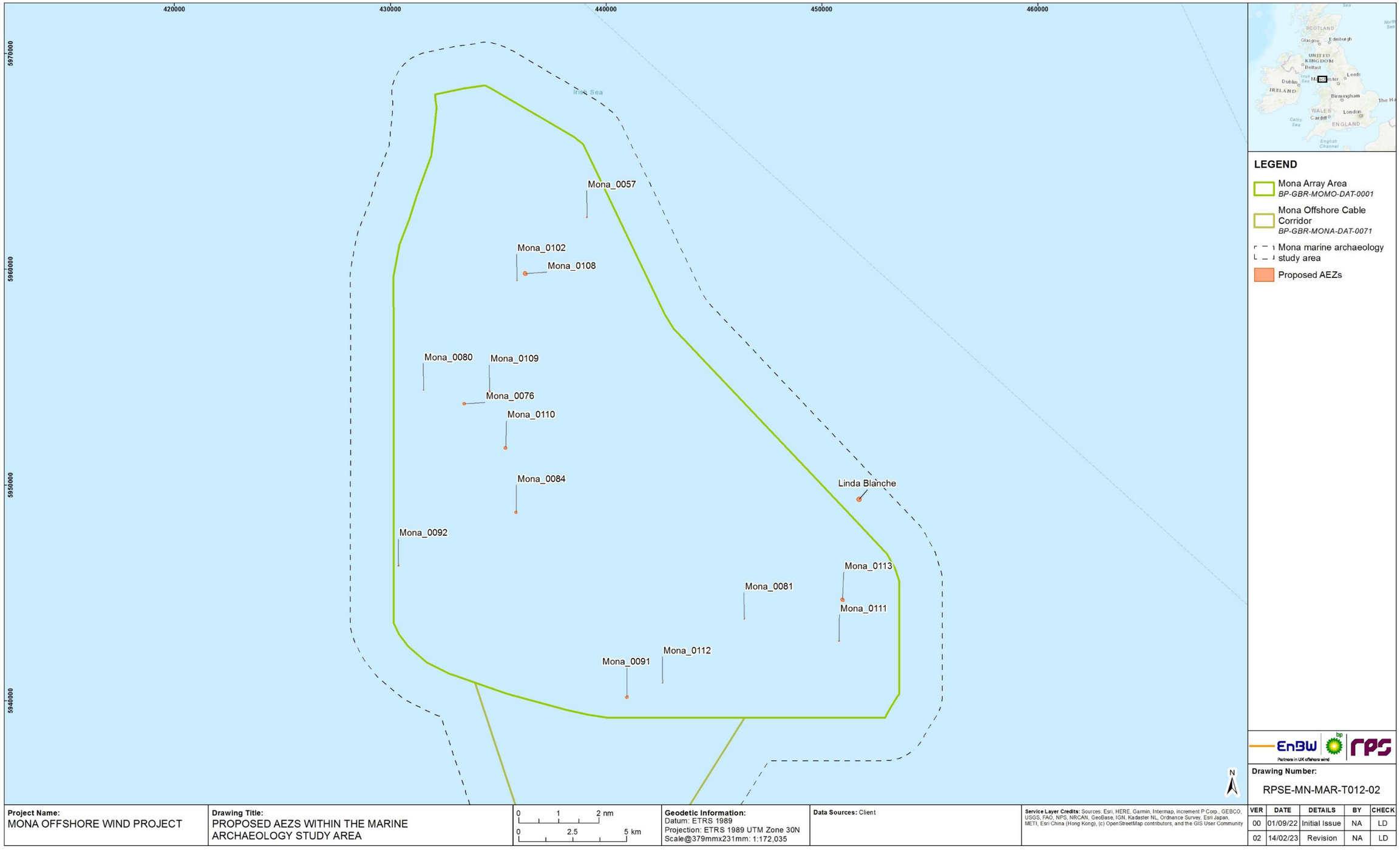


Figure 13.4: Proposed AEZs within the Mona marine archaeology study area.

13.7.3 Preservation by record

13.7.3.1 Where preservation in situ is not practicable, disturbance of archaeological sites or material will be offset by appropriate and satisfactory measures, also known as 'preservation by record'. In these circumstances, the effects of the Mona Offshore Wind Project will be offset by carrying out excavation and recording prior to the impact occurring (COWRIE, 2011).

13.7.3.2 It is likely that previously unknown wrecks, archaeological sites or material may only be encountered during the course of the construction, maintenance and/or decommissioning of Mona Offshore Wind Project. Procedures will therefore be put in place to allow for such eventualities.

13.7.3.3 The Offshore Renewables Protocol for Archaeological Discoveries (The Crown Estate, 2014) will be followed, which will involve the reporting of archaeological discoveries made during the lifetime of the Mona Offshore Wind Project. This protocol covers the reporting and investigating of unexpected archaeological discoveries encountered during construction, operations and maintenance and decommissioning activities, informed by the guidance of a marine archaeologist specialised in working with PADs for offshore wind farm projects. This protocol further makes provision for the implementation of TAEZs around areas of possible archaeological interest, for prompt archaeological advice and, if necessary, for archaeological inspection of important features prior to further construction, maintenance or decommissioning activities in the vicinity. It complies with the Merchant Shipping Act 1995, including notification to the Receiver of Wrecks, in accordance with the Code of Practice for Seabed Developers (Joint Nautical Archaeology Policy Committee (JNAPC) 2006).

13.7.3.4 In view of the potential for the presence of palaeolandscapes, associated prehistoric sites and unidentified wrecks, archaeological monitoring is deemed as appropriate where seabed material is brought to the surface. These proposals may be refined on the basis of the results of any further marine geophysical, geotechnical or diver/ROV+ surveys.

13.8. Assessment of significant effects

13.8.1 Overview

13.8.1.1 The impacts of the construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed on marine archaeology. The potential impacts arising from the construction, operations and maintenance and decommissioning phases of the Mona Offshore Wind Project are listed in Table 13.13 along with the maximum design scenario against which each impact has been assessed.

13.8.1.2 A description of the potential effect on marine archaeology receptors caused by each identified impact is given below.

13.8.2 Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors.

1.1.1.3 The construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project may lead to sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors. The maximum design scenario is represented by sandwave clearance, foundation installation and cable installation and is summarised in Table 13.13.

13.8.2.1 The disturbance of sediment/seabed deposits can result in the exposure of known marine archaeology receptors (i.e. wreck sites) and the exposure of as yet unknown wreck sites and associated materials. Such activities can also result in the burial of known receptors.

Construction, operations and maintenance and decommissioning phases

Magnitude of impact

13.8.2.2 The maximum design scenario for the construction phase is comprised of seabed preparation activities for foundations and cables, installation of wind turbines and OSP monopile foundations via drilling, installation of inter-array, interconnector via prelay plough, trenching, jetting and offshore export cables and any associated jack-up vessel and vessel anchoring activities. Full details of the construction activities which will result in sediment disturbance and deposition are provided in Table 13.13.

13.8.2.3 These construction activities will disturb the seabed, resulting in sediment being released into the water column and subsequently redeposited. Impacts of sediment disturbance and deposition have the potential to expose previously unrecorded marine archaeology receptors, and also to bury or partially bury known marine archaeology receptors, resulting in the potential for direct, temporary impacts on marine archaeology assets located on the seabed.

13.8.2.4 The results of the modelling of suspended sediments and associated deposition arising from this activity as presented in Chapter 6: Physical processes has shown that residual current flow into the east Irish Sea from the north of the Isle of Man and west around Anglesey correlates with this region being a sediment sink. In the Mona Array Area, sediment transport rates are highest during springs, peak flood tide with total sediment loads of up to 0.001m3/s/m and 0.0005 m3/s/m on the peak of the ebb tide. Net sediment transport rates are circa 0.2-1.0m3/d/m within the Mona Array Area.

13.8.2.5 During foundation installation, the maximum design scenario is for the drilled installation of up to 16m diameter monopiles to up to 60m depth. The results of the modelling of suspended sediments and associated deposition arising from this activity as presented in Chapter 6: Physical Processes has shown that the drilled pile installations are anticipated to generate plumes with a suspended sediment level of <50mg/l. These levels would be localised and only persist for a short period. Concentrations within the plume envelope are much lower, typically <1mg/l a short distance from the discharge locations. Following the cessation of drilling the turbidity levels reduce within a few hours as tidal currents reduce. Some of the finer material associated with the drilling process is re-suspended during successive tides as it is redistributed but turbidity levels remain low. The sedimentation beyond the immediate drilling location is indiscernible at less than 1mm. This is due to the relatively slow drilling rate (0.89m/hour), allowing the fine sediment to be widely dispersed while the larger material settles at the release point due to the limited current speed.

13.8.2.6 For inter-array and interconnector cable installation, the maximum design scenario is for a trench of up to 20m width and up to 3m depth. The results of the modelling of suspended sediments and associated deposition arising from this activity as

presented in Chapter 6: Physical processes has shown the sediment plumes are much larger than those for the pile installation

13.8.2.7 The reason for this is twofold, firstly there is a large amount of sediment mobilised (220,500m^3 of material was mobilised during the 4 day simulation along the 49km modelled route) and secondly there was elevated tidal currents on successive tides which remobilised material over the extended period of installation. Peak plume concentrations are highest at around 500mg/l (at the release site) with the sediment settling during slack water becoming resuspended in the form of an amalgamated plume. Sedimentation of 30mm depth occurs at the trench site, with sediment depths reducing moving away from the trench but remaining in the sediment cell and retained in the sediment transport system.

13.8.2.8 Following the completion of the works the turbidity levels return to baseline within a couple of tidal cycles. It would however be anticipated that spring tides following the works may mobilise and redistribute unconsolidated seabed material deposited at the end of the construction phase; this material will therefore be incorporated into the existing transport regime. Export cable installation shows a higher variability in suspended sediment concentrations than inter-array and interconnector cable installation due to the change in hydrography along the export cable corridor and, as anticipated, SSC increased in limited water depth. Average levels of suspended sediment concentrations of <300mg/l are noted along the cable path, with the level dropping to background levels on the slack tide.

13.8.2.9 The maximum design scenario for the operational and maintenance phase is comprised of inter-array, interconnector and offshore export cable repair and reburial activities and any associated jack-up vessel and vessel anchoring activities. Any suspended sediments and associated deposition will be of the same magnitude as, or lower than, the construction phase. For the purposes of this assessment, the impacts of the operational and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction, as set out above.

13.8.2.10 The maximum design scenario for the decommissioning phase is represented by the cutting and removal of foundations to just below seabed level and any associated jack-up vessel and vessel anchoring activities; scour protection and associated cable protection will be left in situ. Decommissioning of the foundations is assumed to result in increases in suspended sediments and associated deposition that are no greater than those predicted for the construction phase. For the purposes of this assessment, the impacts of decommissioning activities are therefore predicted to be no greater than those for construction, as set out above.

13.8.2.11 Therefore, sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors during the construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project is predicted to be of local spatial extent, short term duration, intermittent and medium reversibility. It is predicted that the impact will affect marine archaeology indirectly. The magnitude is therefore considered to be low.

Sensitivity of the receptor

13.8.2.12 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.8.2.13 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptors are therefore considered to be high.

Significance of the effect

13.8.2.14 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded.

13.8.2.15 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. Based on professional judgement, the effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

13.8.3 Direct damage to maritime archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)

13.8.3.1 The seabed activities to facilitate the construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project have the potential to impact both maritime archaeology receptors and submerged prehistoric receptors within the Mona marine archaeology study area.

Construction, operations and maintenance and decommissioning phases

Magnitude of impact

13.8.3.2 The maximum design scenario for the construction phase is comprised of seabed preparation activities for foundations and cables; geotechnical survey activities in the intertidal zone; installation of up to 107 wind turbines and four OSPs, with associated scour protection; the installation of inter-array, interconnector and offshore export cables and associated cable protection; and any associated jack-up vessel and vessel anchoring activities.

13.8.3.3 The maximum design scenario for the operational and maintenance phase is comprised of component replacement activities using jack-up vessels, inter-array, interconnector and offshore export cable repair or reburial activities, and any associated vessel anchor deployments.

13.8.3.4 Decommissioning of the Mona Offshore Wind Project infrastructure will involve cable decommissioning and any associated jack-up vessel and vessel anchoring activities. For the purposes of this assessment, the impacts of operations and maintenance and decommissioning activities are predicted to be no greater than those for construction, as set out above.

13.8.3.5 These activities have the potential to directly and permanently impact upon marine archaeology receptors and areas of archaeological potential that lie concealed below the covering sands. These activities also have the potential to expose previously unrecorded marine archaeology receptors.

13.8.3.6 As described in section 13.7, borehole data acquired from geotechnical surveys will be reviewed by a marine archaeologist and the findings will be communicated to Cadw and HE. Archaeological Exclusion Zones will be established around each known shipwreck site and potential site, within which no installation activities will take place unless permitted by the Cadw and HE. Pre-construction surveys will be reviewed by a marine archaeologist to inform the refined layout of infrastructure around any newly identified archaeological constraints. Provision will also be made for the recording of any new discoveries.

13.8.3.7 The impact is predicted to be of local spatial extent, long term duration and with no reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of receptor

13.8.3.8 The Mona marine archaeology study area retains a significant number of shipwrecks and the potential for more discoveries arises with the installation works proposed. Shipwrecks are vulnerable sites that can be exposed by disturbance activities. Each known shipwreck site is regarded as being of importance.

13.8.3.9 The marine archaeology receptor is deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore considered to be high.

Significance of effect

13.8.3.10 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. Based on professional judgement it is considered that the effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

13.8.4 Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g. palaeolandscapes and associated archaeological receptors)

13.8.4.1 The seabed activities required to facilitate the construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project have the potential to impact on previously unrecorded palaeo-landscape locations within the Mona marine archaeology study area.

Construction phase

Magnitude of impact

13.8.4.2 The maximum design scenario for the construction phase is comprised of seabed installation of up to 107 wind turbines and four OSPs with pile penetration depth of up to 75m.

13.8.4.3 These activities have the potential to directly and permanently impact palaeolandscape locations that might lie deeply buried below the covering sands.

13.8.4.4 As described in section 13.7, borehole data acquired from the geotechnical surveys will be reviewed by a maritime archaeologist and the findings will be communicated to Cadw and HE, as detailed in the WSI and PAD which will be prepared to also facilitate the recording and reporting of any archaeological material discovered during installation works.

13.8.4.5 The impact is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be low.

Sensitivity of receptor

13.8.4.6 There is some potential for palaeolandscapes and associated submerged prehistoric archaeology to survive in the southwest of the Mona Array area and therefore the installation of wind turbine and OSP foundations have the potential to directly impact marine archaeology receptors.

13.8.4.7 The marine archaeology receptor is deemed to be of high vulnerability, low recoverability and of high value. The sensitivity of the receptor is therefore considered to be high.

Significance of effect

13.8.4.8 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. Based on professional judgement it is considered that the effect will, therefore, be of minor adverse significance, which is not significant in EIA terms.

13.8.5 Alteration of sediment transport regimes

13.8.5.1 The presence of infrastructure on the seabed can obstruct flow in the water column and lead to localised changes in the sediment transport regimes. This has the potential to impact on marine archaeology within the Mona marine archaeology study area and the immediate vicinity.

Operations and maintenance phase

Magnitude of impact

13.8.5.2 The maximum design scenario is comprised of the presence of up to 68 wind turbines installed with four-legged suction bucket foundations, each jacket leg with a diameter of 5m, spaced 48m apart, each bucket with a diameter of 16m and scour protection to a height of 2.5m. Up to four OSPs will be installed on four-legged suction bucket foundations, each jacket leg with a diameter of 3m, spaced 30m apart, each bucket with a diameter of 14m and scour protection to a height of 2.5m. Cable protection (including at cable crossings) is proposed of up to 3m in height. Changes in the sediment transport regime as a result of the presence of the Mona Offshore Wind Project infrastructure have the potential to bury known archaeological sites and to expose others and previously unknown sites.

13.8.5.3 Potential impacts are assessed in relation to the locations of known shipwrecks within the Mona marine archaeology study area.

13.8.5.4 The physical processes modelling found that the presence of the foundation structures for the wind turbines and OSPs does not have a significant influence on either tide or wave conditions and therefore sediment transport modelling has predicted the

maximum change in residual current and sediment transport is circa ±10% which is largely sited within close proximity to the turbine foundation structures (i.e. as a result of the scour protection). Changes in the residual current and sediment transport reduce with increasing distance from the wind turbines towards baseline levels.

13.8.5.5 The impact is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore considered to be negligible.

Sensitivity of the Receptor

13.8.5.6 The Mona marine archaeology study area lies in a wider area that retains a significant number of shipwrecks. Shipwrecks are vulnerable sites that can be exposed or buried by significant alteration of the sediment transport regimes.

13.8.5.7 The marine archaeology receptor is deemed to be of medium vulnerability, low recoverability and of national value. The sensitivity of the receptor is therefore considered to be medium.

Significance of effect

13.8.5.8 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. Based on professional judgement it is considered that the effect will, therefore, be of **negligible adverse** significance, which is not significant in EIA terms.

13.9. Cumulative effect assessment methodology

13.9.1 Methodology

13.9.1.1 The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Mona Offshore Wind Project together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see volume 5, annex 5.3: CEA screening matrix). Each project has been considered on a case by case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

13.9.1.2 The marine archaeology CEA methodology has followed the methodology set out in volume 1, chapter 5: EIA methodology of the PEIR. As part of the assessment, all projects and plans considered alongside the Mona Offshore Wind Project have been allocated into ‘tiers’ reflecting their current stage within the planning and development process, these are listed below.

13.9.1.3 A tiered approach to the assessment has been adopted, as follows:

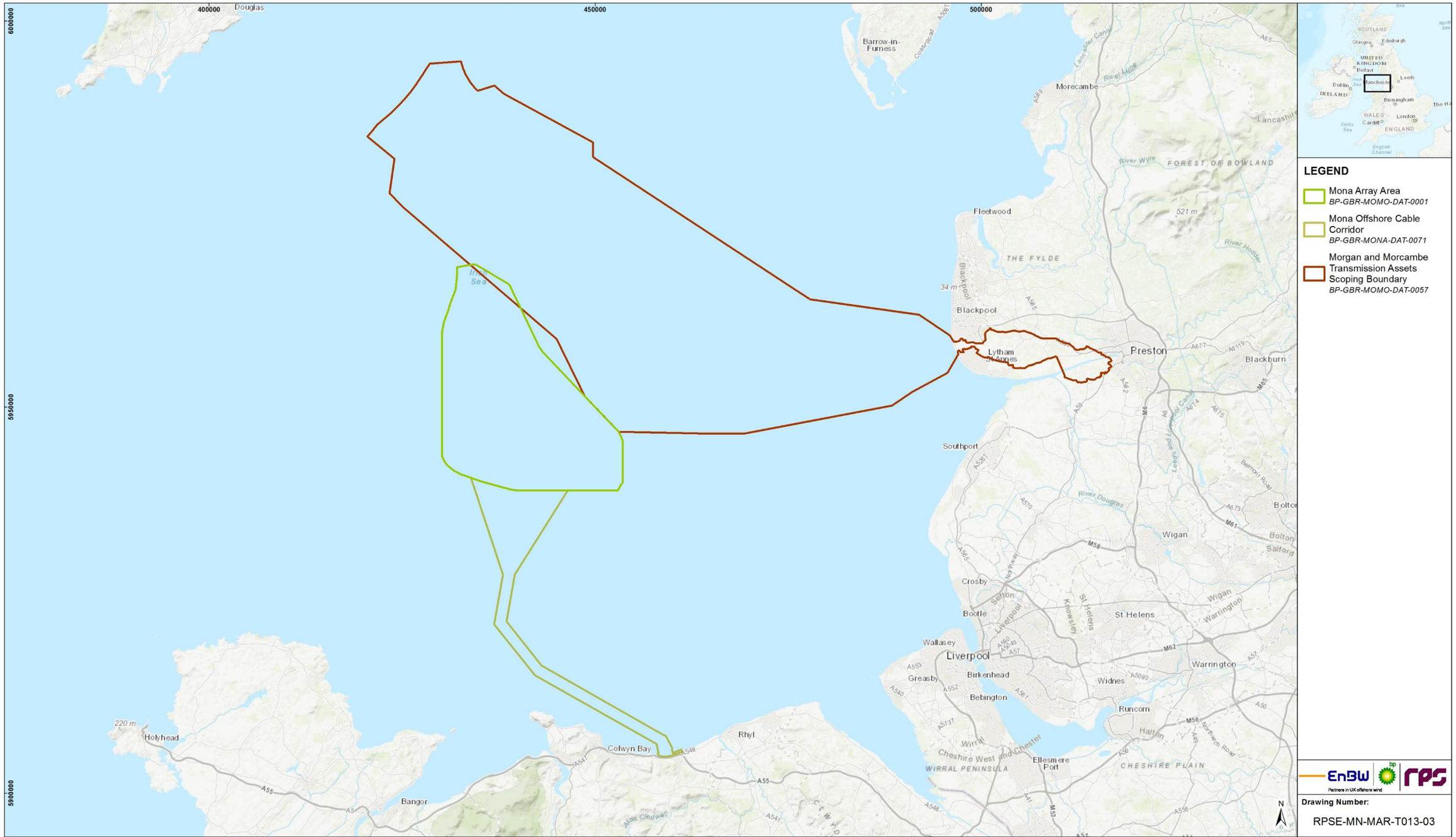
- Tier 1: the Mona Offshore Wind Project considered alongside:
- No projects or plans were identified in this tier.
- Tier 2: the Mona Offshore Wind Project considered alongside Tier 1 project, as well as:
- Morgan and Morecambe Transmission Assets

13.9.1.4 This tiered approach is adopted to provide a clear assessment of the Mona Offshore Wind Project alongside other projects, plans and activities.

13.9.1.5 The specific projects, plans and activities scoped into the CEA, are outline in Table 13.16.

Table 13.16: List of other projects, plans and activities considered within the CEA [to be based on the CIA screening matric].

Project/Plan	Status	Distance from the Mona array area (km)	Distance from the Mona offshore/onshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Tier 2-							
Morgan and Morcambe Transmission Assets	Pre-application	5.5	33.0	Morgan and Morcambe Transmission Assets	01/01/2028-31/12/2029	01/01/2030-31/12/2065	Temporal overlap during the construction and operations and maintenance phase of the Mona Offshore Wind Project.



Project Name: MONA OFFSHORE WIND PROJECT	**Drawing Title:** OTHER PROJECTS, PLANS AND ACTIVITIES SCREENED INTO THE CUMULATIVE EFFECTS ASSESSMENT	0 2 4 8 nm 0 5 10 km	**Geodetic Information:** Datum: ETRS 1989 Projection: ETRS 1989 UTM Zone 30N Scale@379mmx231mm: 1:500,000	**Data Sources:** Client, TCE	**Service Layer Credits:** Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community			

VER	DATE	DETAILS	BY	CHECK
00	08/09/22	Initial Issue	NA	LD
03	14/02/23	Revision	NA	LD

Figure 13.5: Other projects, plans and activities screened into the cumulative effects assessment.

13.9.2 Maximum design scenario

13.9.2.1 The maximum design scenarios identified in Table 13.17 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the Project Design Envelope provided in volume 1, chapter 3: Project description of the PEIR as well as the information available on other projects and plans, in order to inform a 'maximum design scenario'. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different turbine layout), to that assessed here, be taken forward in the final design scheme.

Table 13.17: Maximum design scenario considered for the assessment of potential cumulative effects on marine archaeology.

[a] C=construction, O=operations and maintenance, D=decommissioning

Potential cumulative effect	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Direct damage to marine archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)	✓	✓	✓	Maximum design scenario as described for the Mona Offshore Wind Project (Table 13.13) assessed cumulatively with the following other projects/plans: **Tier 2** • Morgan and Morecambe Transmission Assets	Maximum potential for culminative effects of direct damage to marine archaeology receptors.
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors.	✓	✓	✓	Maximum design scenario as described for the Mona Offshore Wind Project (Table 13.13) assessed cumulatively with the following other projects/plans: **Tier 2** • Morgan and Morecambe Transmission Assets	Maximum potential for culminative effects of sediment disturbance and deposition leading to indirect effects on marine archaeology receptors.
Alteration of sediment transport regimes.		✓		Maximum design scenario as described for the Mona Offshore Wind Project (Table 13.13) assessed cumulatively with the following other projects/plans: **Tier 2** • Morgan and Morecambe Transmission Assets	Maximum potential for culminative effects of alteration of transport regimes to have indirect impacts on marine archaeology receptors.

13.10. Cumulative effects assessment

13.10.1.1 A description of the significance of cumulative effects upon marine archaeology receptors arising from each identified impact is given below.

13.10.2 Direct damage to maritime archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)

13.10.2.1 The Mona Offshore Wind Project, together with the projects and plans identified in Table 13.16, may result in direct damage to marine archaeology receptors. Other projects and plans screened into the assessment include the construction, operations and maintenance and decommissioning phases of Morgan and Morecambe Transmission Assets.

Tier 2

Construction phase

Magnitude of impact

13.10.2.2 The construction phases of Morgan and Morecambe Transmission Assets is due to happen simultaneously with the construction phase of Mona Offshore Wind Farm and therefore activities such as site preparation/sandwave clearance and cable installation have the potential to lead to a culminative direct impact on marine archaeology receptors.

13.10.2.3 As described in section 13.7, AEZs will be established for any identified archaeology receptors and therefore the probability for direct damage to occur is low. An Outline WSI and PAD will be developed to inform the construction works and to facilitate the recording and reporting of any archaeological material discovered as a result of construction activities.

13.10.2.4 The cumulative effect is predicted to be of local spatial extent, long term duration, and be irreversible. It is predicted that the impact will affect the receptor directly. Based on the probability, however, the magnitude is considered to be low.

Sensitivity of the receptor

13.10.2.5 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.10.2.6 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

13.10.2.7 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure avoidance of an archaeological receptors that any newly exposed archaeological assets are recorded.

13.10.2.8 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

13.10.2.9 The operations and maintenance phases of Morgan and Morecambe Transmission Assets are due to happen simultaneously with the operations and maintenance phase of Mona Offshore Wind Farm and therefore activities such as offshore export cable repair and reburial activities and any associated jack-up vessel and vessel anchoring have the potential to lead to a culminative direct impact on marine archaeology receptors.

13.10.2.10 For the purposes of this assessment, the impacts of the operational and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction, as set out above.

13.10.2.11 As described in section 13.7, AEZs will be established for any identified archaeology receptors and therefore the probability for direct damage to occur is low. An Outline WSI and PAD will be developed to inform the construction works and to facilitate the recording and reporting of any archaeological material discovered as a result of construction activities.

13.10.2.12 The cumulative effect is predicted to be of local spatial extent, long term duration, and be irreversible. It is predicted that the impact will affect the receptor directly. Based on the probability, however, the magnitude is considered to be low.

Sensitivity of the receptor

13.10.2.13 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.10.2.14 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

13.10.2.15 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded.

13.10.2.16 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

13.10.2.17 The decommissioning phase of Morgan and Morecambe Transmission Assets is due to happen simultaneously with the decommissioning phase of Mona Offshore Wind Farm and therefore activities such as the removal of cables have the potential to lead to a cumulative direct impact on marine archaeology receptors.

13.10.2.18 For the purposes of this assessment, the impacts of the decommissioning activities are predicted to be no greater than those for construction, as set out above.

13.10.2.19 As described in section 13.7, AEZs will be established for any identified archaeology receptors and therefore the probability for direct damage to occur is low. An Outline WSI and PAD will be developed to inform the construction works and to facilitate the recording and reporting of any archaeological material discovered as a result of construction activities.

13.10.2.20 The cumulative effect is predicted to be of local spatial extent, long term duration, and be irreversible. It is predicted that the impact will affect the receptor directly. Based on the probability, however, the magnitude is considered to be low.

Sensitivity of the receptor

13.10.2.21 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.10.2.22 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

13.10.2.23 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded.

13.10.2.24 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

13.10.3 Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors

13.10.3.1 The Mona Offshore Wind Project, together with the projects and plans identified in Table 13.16, may result in sediment disturbance and deposition leading to indirect effects on marine archaeology receptors. Other projects and plans screened into the assessment include the construction, operations and maintenance and decommissioning phases of Morgan and Morecambe Transmission Assets.

Tier 2

Construction phase

Magnitude of impact

13.10.3.2 The construction phases of Morgan and Morecambe Transmission Assets is due to happen simultaneously with the construction phase of Mona Offshore Wind Farm and therefore activities such as site preparation/sandwave clearance and cable installation have the potential to increase sediment disturbance and deposition leading to a culminative indirect impact on marine archaeology receptors.

13.10.3.3 As described in section 13.7, an Outline WSI and PAD will be developed to inform the construction works and to facilitate the recording and reporting of any archaeological material discovered as a result of increased sediment disturbance.

13.10.3.4 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be low.

Sensitivity of the receptor

13.10.3.5 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.10.3.6 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

13.10.3.7 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded.

13.10.3.8 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

13.10.3.9 The operations and maintenance phases of Morgan and Morecambe Transmission Assets are due to happen simultaneously with the operations and maintenance phase of Mona Offshore Wind Project and therefore activities such as offshore export cable repair and reburial activities and any associated jack-up vessel and vessel anchoring have the potential to increase sediment disturbance and deposition leading to a culminative indirect impact on marine archaeology receptors.

13.10.3.10 Any suspended sediments and associated deposition will be of the same magnitude as, or lower than, the construction phase. For the purposes of this assessment, the impacts of the operational and maintenance activities (i.e. cable repair and reburial) are predicted to be no greater than those for construction, as set out above.

13.10.3.11 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded. As described in section 13.7, a WSI and PAD will be implemented to facilitate the recording and reporting of any archaeological material discovered during the operational and maintenance phase.

13.10.3.12 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be negligible.

Sensitivity of the receptor

13.10.3.13 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.10.3.14 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

13.10.3.15 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded.

13.10.3.16 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Decommissioning phase

Magnitude of impact

13.10.3.17 The decommissioning phase of Morgan and Morecambe Transmission Assets is due to happen simultaneously with the decommissioning phase of Mona Offshore Wind Project and therefore activities such as the removal of cables and foundations have the potential to increase sediment disturbance and deposition leading to a culminative indirect impact on marine archaeology receptors.

13.10.3.18 Any suspended sediments and associated deposition will be of the same magnitude as, or lower than, the construction phase. For the purposes of this assessment, the impacts of the decommissioning activities are predicted to be no greater than those for construction, as set out above.

13.10.3.19 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded. As described in section 13.7, a WSI and PAD will be implemented to facilitate the recording and reporting of any archaeological material discovered during the operational and maintenance phase.

13.10.3.20 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and low reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be negligible.

Sensitivity of the receptor

13.10.3.21 The east Irish Sea has historically been an area of high maritime activity and the number of shipwrecks associated with the area highlight the potential for more discoveries to arise. The marine archaeology receptors are vulnerable sites that can be exposed further by disturbance activities.

13.10.3.22 The marine archaeology receptors are deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

13.10.3.23 The measures adopted as part of the Mona Offshore Wind Project outlined in section 13.7 include measures to ensure that any newly exposed archaeological assets are recorded.

13.10.3.24 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

13.10.4 Alteration of sediment transport regimes

13.10.4.1 The Mona Offshore Wind Project, together with the projects and plans identified in Table 13.16, may result in alteration of transport regimes. During the operations and maintenance phase the presence of infrastructure may alter the sediment transport and sediment transport pathways leading to changes in the Mona Offshore Wind Project area.

13.10.4.2 Other projects and plans screened into the assessment include the operations and maintenance phase of Morgan and Morecambe Transmission Assets.

Tier 2

Operations and maintenance phase

Magnitude of impact

13.10.4.3 The operations and maintenance phase of Morgan and Morecambe Transmission Assets is due to take place during the operations and maintenance phase of the Mona Offshore Wind Project, therefore activities such as using jack-up vessels and offshore export cable repair or reburial activities, any associated vessel anchor deployments and the removal of cables and foundations have the potential to increase the likelihood of indirect damage to maritime archaeology receptors.

13.10.4.4 The proposed development of the Morgan and Morecambe Transmission Assets may be in operation during the operations and maintenance phase of the Mona Offshore Wind Project. The modelling carried out for Mona Offshore Wind Project and presented in Chapter 6: Physical Processes concluded that the impact on sediment transport and sediment transport pathways was low when considering the development alone. Therefore, no overlap is expected to create cumulative changes in the sediment transport and sediment transport pathways between the two wind farm developments.

13.10.4.5 The cumulative effect is predicted to be local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact may affect the receptor indirectly. The magnitude is therefore, considered to be negligible.

Sensitivity of the receptor

13.10.4.6 The marine archaeology study area retains a significant number of shipwrecks and the potential for more discoveries arises with the installation works proposed. Shipwrecks are vulnerable sites that can be exposed by disturbance activities. Each known shipwreck site is regarded as being of importance.

13.10.4.7 The marine archaeology receptor is deemed to be of high vulnerability, low recoverability and of varying value. The sensitivity of the receptor is therefore, considered to be high.

Significance of effect

1.1.1.4 Overall, the magnitude of the cumulative effect is deemed to be negligible and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

13.11. Transboundary effects

1.1.1.5 A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regard to marine archaeology from the Mona Offshore Wind Project upon the interests of other states.

13.12. Inter-related effects

13.12.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Mona Offshore Wind Project (construction, operations and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases (e.g. subsea noise effects from piling, operational turbines, vessels and decommissioning).
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on marine archaeology, such as sediment disturbance and deposition and direct damage to marine archaeology receptors, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.
- A description of the likely interactive effects arising from the Mona Offshore Wind Project on marine archaeology is provided in volume 2, chapter 15: Inter-related effects of the PEIR.

13.13. Summary of impacts, mitigation measures and monitoring

13.13.1.1 Information on marine archaeology within the Mona marine archaeology study area was collected through desktop review, site surveys and consultation.

- Table 13.18 presents a summary of the potential impacts, measures adopted as part of the project and residual effects in respect to marine archaeology. The impacts assessed include: sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors; direct damage to marine archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors); direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (eg. Palaeolandscapes and associated archaeological receptors); and alteration of sediment transport regimes. Overall, it is concluded that there will be no significant effects arising from the Mona Offshore Wind Project during the construction, operations and maintenance or decommissioning phases.
- Table 13.19 presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include: Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors and alteration of transport regimes.
- Overall, it is concluded that there will be no significant cumulative effects from the Mona Offshore Wind Project alongside other projects/plans
- No potential transboundary impacts have been identified in regard to effects of the Mona Offshore Wind Project.

Table 13.18: Summary of potential environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of impact	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	✓	✓	✓	Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	C: Low O: Negligible D: Negligible	C: High O: High D: High	C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	N/A
Direct damage to marine archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)	✓	✓	✓	Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	C: Low O: Low D: Low	C: High O: High D: High	C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	N/A
Direct damage to deeply buried marine archaeology receptors – submerged prehistoric receptors (e.g. Palaeolandscapes and associated archaeological receptors)	✓	✓	✓	Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	C: Low O: Negligible D: Low	C: High O: High D: High	C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	N/A
Alteration of sediment transport regimes		✓		Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	O: Negligible	O: High	O: Minor adverse	N/A	O: Negligible	N/A

Table 13.19: Summary of potential cumulative environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of effect	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Tier 2										
Direct damage to marine archaeology receptors (e.g. wrecks, debris, submerged prehistoric receptors (palaeolandscapes and associated archaeological receptors)	✓	✓	✓	Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	C: Low O: low D: low	C: High O: High D: High	C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	N/A
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	✓	✓	✓	Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	C: Negligible O: Negligible D: Negligible	C: High O: High D. High	C: Minor adverse O: Minor adverse D: Minor adverse	N/A	C: Minor adverse O: Minor adverse D: Minor adverse	N/A
Alteration of sediment transport regimes		✓		Avoidance where possible; Archaeological Exclusion Zones; Pre-construction marine geophysical surveys and archaeological review; WSI and PAD; review and agreement of the WSI and PAD and review and agreement of the AEZs by HE and Cadw.	O: Negligible	O: High	O: Minor adverse	N/A	O: Negligible	N/A

13.14. Next steps

13.14.1.1 As discussed in section 13.4, further Mona Offshore Wind Project geophysical and geotechnical surveys of the Mona Array Area and Mona Offshore Cable Corridor have been undertaken from April to September 2022. Together with the existing data, this survey will, where possible, be used to refine the marine archaeology baseline and inform the Environmental Statement.

13.14.1.2 As discussed in section 13.2.3 an Archaeology and Heritage Engagement Forum has been established in order to consult with the MMO, HE, CADW and RCAHMW on the potential impacts that the Mona Offshore Wind Project may have on archaeology. This group covers both onshore and offshore historic environment topics. The first meeting of the AHEF Offshore was held in November 2022 to present the scoping responses to the identified stakeholders, further consultation will be ongoing throughout the Mona Offshore Wind Project.

13.15. References

Bournemouth University (2009) Refining Areas of Maritime Archaeological Potential (AMAPs) for Shipwrecks [data-set]. York: Archaeology Data Service [distributor] https://doi.org/10.5284/1000171. Accessed September 2022.

Brooks AJ, Bradley SL, Edwards RJ and Goodwyn N (2011) The palaeogeography of Northwest Europe during the last 20,000 years. Journal of Maps, 573-587

Cadw (2011) Conservation Principles for the Sustainable Management of the Historic Environment in Wales. Online, available at: Conservation Principles Doc ENG (gov.wales). Accessed September 2022.

Chartered Institute for Archaeologists (CIfA) (2014 updated 2020) Standard and Guidance for Historic Environment Desk Based Assessment. Online, available at: CIfAS&GDBA_2.pdf (archaeologists.net). Accessed September 2022.

Department of Energy and Climate Change (DECC) (2011a) Overarching National Policy Statements for Energy (NPS EN-1). Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Department of Energy and Climate Change (DECC) (2011b) National Policy Statement for Renewable Energy Infrastructure. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf

Department of Energy and Climate Change (DECC) (2011c) National Policy Statements for Electricity Networks Infrastructure (NPS EN-5). Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47858/1942-national-policy-statement-electricity-networks.pdf Accessed January 2022

Dunkley, M. (2016) Ships and Boats: Prehistory to 1840 Historic England.

English Heritage (now Historic England) (2008) Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment. Online, available at: Conservation Principles, Policies and Guidance | Historic England. Accessed September 2022.

Fitch, S., Gaffney, V., Ramsey, E., and Kitchen, E. (2011) West Coast Palaeoloandscapes Survey. Online, Available: https://research.birmingham.ac.uk/en/publications/west-coast-palaeolandscapes-project-pilot-project Accessed June 2022

Gribble and Leather (2010) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector, Available at: 2011-01-offshore-geotechnical-investigations-and-historic-environment-analysis-guidance-for-the-renewable-energy-sector.pdf. Accessed August 2022.

Highways England, Transport Scotland, Welsh Government, Department for Infrastructure (2019) Design Manual for Roads and Bridges (DMRB) LA 104, Environmental assessment and monitoring, Revision 1, Available at: https://www.standardsforhighways.co.uk/prod/attachments/0f6e0b6a-d08e-4673-8691-cab564d4a60a?inline=true Accessed April 2022.

Historic England (2017) Ships and Boats: Prehistory to Present – Selection Guide. Online, available at: Ships and Boats: Prehistory to Present | Historic England. Accessed September 2022

Jackson DI, Jackson AA, Evans D, Wingfield RTR, Barnes RP, Arthur MJ (1995) United Kingdom Offshore Regional Report: The geology of the Irish Sea. British Geological Survey.

Joint Nautical Archaeology Policy Committee (2006) Code of Practice for Seabed Developers. Available: Jnapc 1. Accessed October 2022.

Mellet., C, Long, D, Carter,G, Chiverrell, R &Van Landegham, K. (2015) Geology of the seabed and shallow subsurface: The Irish Sea. British Geological Survey Commissioned Rep.

MMO (2021) North West Inshore and North West Offshore Marine Plan, June 2021.

The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects. Available: https://www.wessexarch.co.uk/sites/default/files/field_file/2_Protocol%20For%20Archaeological%20Discoveries.pdf. Accessed September 2022.

The Planning Inspectorate (2017) Advice Note ten, Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects. Version 8. Available: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-ten/. Accessed April 2022.

Wessex Archaeology. (2007a) COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector.

Wessex Archaeology (2007b) UKCS Offshore Oil and Gas and Wind Energy Strategic Environmental Assessment.

Wessex Archaeology (2008) Aircraft Crash Sites at Sea: A Scoping Study. Archaeological Desk-based Assessment.

Wessex Archaeology for The Crown Estate. (2021) Archaeological Mitigation for Offshore Wind Farms: Model Clauses for Written Schemes of Investigation. Available: https://www.thecrownestate.co.uk/media/3917/guide-to-archaeological-requirements-for-offshore-wind.pdf Accessed August 2022.

Wood G (2022) Technical File Note Preliminary Ground Model Morgan & Mona Windfarm Development Irish Sea. Report for EnBW and bp.