Bowdun Offshore Wind Farm, Offshore EIA Report

Volume 2, Chapter 19: Marine Archaeology

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Glossary

Defined Term	Definition
Additional Mitigation	Also referred to as secondary mitigation which is defined by The Institute of Sustainability and Environmental Professionals (ISEP) (formerly Institute of Environmental Management and Assessment (IEMA)) as: Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the EIA Report (sic).
Applicant (the)	Bowdun Offshore Wind Farm Limited (BOWFL).
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Crown Estate Scotland (CES)	Public corporation accountable to Scottish Government, responsible for the management of land and property, including marine assets in Scotland owned by the monarch.
Cultural Significance	Cultural Significance means aesthetic, historic, scientific or social value for past, present or future generations. Cultural Significance can be embodied in a place itself, its fabric, setting, use, associations, meanings, records, related places and related objects.
Cumulative Effects	The effects of the Proposed Development assessed together with effects from the Onshore Infrastructure forming the Project as well as one or more different projects on the same receptor/resource.
Effect	Term used to express the consequence of an impact (i.e. the result of change or changes) on specific environmental resources or receptors. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria.
Embedded Mitigation	Measures that are adopted as part of the Proposed Development and therefore assessed within the Environmental Impact Assessment (EIA). The proposed approach for the EIA for the Proposed Development is that embedded mitigation includes both primary mitigation and tertiary mitigation. These are defined by ISEP as follows: Primary: Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken. Tertiary: Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.
Environmental Impact Assessment (EIA)	Process for the assessment of likely significant environmental effects of a project on the physical, biological and human environment during construction, Operation and Maintenance (O&M) and decommissioning.

Defined Term	Definition
Environmental Impact Assessment Regulations (EIA Regulations)	Terminology used in the Offshore EIA Report to refer to three sets of regulations: • The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and • The Marine Works (Environmental Impact Assessment) Regulations 2007.
European Economic Area	The European Economic Area consists of the Member States of the European Union and three countries of the European Free Trade Association - Iceland, Liechtenstein and Norway; excluding Switzerland.
Exclusive Economic Zone (EEZ)	An area from the outer limit of the territorial sea up to 200 nm from the coastal baseline, over which a sovereign state has rights regarding marine resources.
Export Cable Corridor	The area of seabed seaward of MHWS which connects the Array Area with the Landfall within which the Offshore Export Cables will be installed.
Find Spots	A location of an archaeological find, for example; flints or ship timbers.
Impact	A change caused by an action that occurs during a project's lifetime.
Inter-Array Cables (IAC)	Cables which link the Wind Turbines to each other and with the Offshore Substation Platforms (OSPs).
Inter-Related Effects	The potential effects of multiple impacts from the construction, O&M and decommissioning of the Project, affecting one receptor.
Interconnector Cables	Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere.
Intertidal Area	The area between MHWS and Mean Low Water Springs (MLWS).
Landfall	The area in which the Offshore Export Cables make landfall and is also the transitional area between the Offshore Transmission Assets and the Onshore Transmission Assets. Located in the Intertidal Area at Benholm.
Marine Directorate (MD)	The Marine Directorate of the Scottish Government, formerly known as Marine Scotland. The planning and licensing authority for Scotland's seas and custodian of Scotland's National Marine Plan (NMP). The Marine Directorate - Licensing Operations Team (MD-LOT) are specifically responsible for managing Section 36 Consent and Marine Licence Applications seaward of MHWS.
Marine Licence	A Marine Licence permits the undertaking of different activities in the marine environment, including construction, the deposition or removal of substances or objects, and dredging. The Marine (Scotland) Act 2010 requires Marine Licences to be obtained for licensable activities taking place within Scottish Territorial Seas (MHWS to 12 nm). The Marine and Coastal Access Act (MCAA) 2009 requires a Marine Licence to be obtained for licensable marine activities within the Scottish offshore region (12 nm – 200 nm).
Maximum Design Scenario (MDS)	The scenario within the design envelope likely to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.

Defined Term	Definition
Mean High Water Springs (MHWS)	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean Low Water Springs (MLWS)	The average tidal height throughout the year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest.
Mitigation	Measures to avoid, prevent, reduce or control effects on the environment. See also definitions for Embedded Mitigation and Additional Mitigation.
Offshore Export Cables	Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay is the location where the Offshore Export Cables terminate, and the onshore cabling begins.
Offshore Generation Assets	The infrastructure of the Proposed Development required to generate electricity comprising of the Wind Turbines, Wind Turbine foundations and associated infrastructure (e.g. IACs).
Offshore Infrastructure	All of the Offshore Infrastructure associated with the Proposed Development that is located seaward of MHWS, comprising the Offshore Generation Assets and the Offshore Transmission Assets.
Offshore Scoping Report	The report that presents the findings of the EIA scoping process undertaken for the Proposed Development with the purpose of obtaining a Scoping Opinion. The Offshore Scoping Report defines what is intended to be assessed and reported as part of the EIA.
Offshore Substation Platform(s) (OSPs)	OSPs comprise the support structure, topside and electrical components used for collecting and/or converting electricity generated by the Wind Turbines for transmission by the Offshore Export Cables.
Offshore Transmission Assets	The infrastructure of the Proposed Development required to transmit the generated electricity comprising of the OSPs, Offshore Export Cables and associated infrastructure up to MHWS.
Onshore Transmission Assets	The transmission infrastructure associated with the Project above MLWS which is subject to the Planning Permission in Principle Application submitted to Aberdeenshire Council (REF: APP/2025/1952).
Operation and Maintenance (O&M)	The phase of the Proposed Development following completion of construction. This phase of development includes routine inspections, repairs and replacement of infrastructure and equipment (including Interconnector Cables and IACs), Scour Protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, and replacement of access ladders.
Palaeolandscape	Topographic features of a past geological age.
Project (the)	An overarching term for the Bowdun Offshore Wind Farm comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore Grid Connection Point. The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets.

Defined Term	Definition
Project Design Envelope (PDE)	A description of the range of possible elements that make up the design options for the Proposed Development under consideration when the exact engineering parameters are not yet known.
Proposed Development	Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description.
Quaternary	The period of geologic time from about 1.8 million years ago to the present, including the part of the Pleistocene (2.58 million to 11,700 BP) and Holocene (11,700 BP to present) Epochs.
Scoping Opinion	A document produced by MD-LOT which is issued in response to submission and review of the Offshore Scoping Report. The Scoping Opinion is supported with feedback and advice from consultees, which details what is expected to be included in the Offshore EIA Report and what can be scoped out of the EIA process.
Scottish Marine Area	The area of sea within the seaward limits of the territorial sea of the United Kingdom adjacent to Scotland as defined by the Marine (Scotland) Act 2010.
Scottish Ministers (the)	The decision makers with regard to Marine Licence(s) and Section 36 Consent applications in Scottish Offshore Waters and the Scottish Marine Area.
Scottish Offshore Waters	The area of sea beyond 12 nm but within the Scottish Exclusive Economic Zone (EEZ) up to 200 nm from the coast.
Scottish Territorial Waters	The territorial waters of Scotland that extend out from MHWS to 12 nm.
Scour Protection	Protective materials installed to avoid sediment being eroded away from the base of the foundations and/or buried subsea cable due to the flow of water.
Sectoral Marine Plan (SMP)	A plan developed by the Scottish Government which provides the strategically planned spatial footprint for offshore wind development in Scotland.
Significance	Effect factor that is determined by the magnitude of impact along with the sensitivity of the receptor.
Site Boundary	The boundary within which all elements of the Proposed Development will be located. The Site Boundary comprises the Array Area and Export Cable Corridor which ends at MHWS.
Study Area	For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Project may be experienced by the relevant receptors (i.e. Zone of Influence).
Thistle Wind Partners (TWP)	Company established for the development of the Project.
Wind Turbines	Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator.
Zone of Influence	The geographical area within which the Proposed Development may have environmental effects.

Acronyms

Acronym	Definition
2D	Two Dimensional
ABSL	Above Seabed Level
AEZ	Archaeological Exclusion Zone
AMAAA	Ancient Monuments and Archaeological Areas Act 1979
BGS	British Geological Survey
BOWFL	Bowdun Offshore Wind Farm Limited
BP	Before Present
CEA	Cumulative Effects Assessment
CIfA	Chartered Institute for Archaeologists
CMS	Construction Method Statement
CoCP	Code of Construction Practice
DSLP	Development Specification and Layout Plan
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
HDD	Horizontal Directional Drilling
HEPS	Historic Environment Policy for Scotland
HER	Historic Environment Record
HES	Historic Environment Scotland
HMPA	Historic Marine Protected Area
HSE	Heath and Safety Executive
IAC	Inter-Array Cables
IEMA	Institute of Environmental Management and Assessment
ISEP	The Institute of Sustainability and Environment Professionals
MAG	Magnetometer
MBES	Multibeam Echosounder
MCA	Maritime and Coastguard Agency
MDS	Maximum Design Scenario
MFE	Mass Flow Excavation
MD-LOT	Marine Directorate - Licensing Operations Team
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
MPS	Marine Policy Statement
MSA	Merchant Shipping Act 1995
NMP	National Marine Plan
NRHE	National Record of the Historic Environment
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm

Acronym	Definition
O&M	Operation and Maintenance
PAD	Protocol for Archaeological Discoveries
PDE	Project Design Envelope
PMRA	Protection of Military Remains Act 1986
PWA	Protection of Wrecks Act 1973
ROV	Remotely Operated Vehicle
RoW	Receiver of Wreck
SBP	Sub-bottom Profiler
SMP	Sectoral Marine Plan
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
TEZ	Temporary Exclusion Zone
UHRS	Ultra High Resolution Seismic
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation

Table of Units

Units	Definition
%	Percent
kg	Kilogram
Kg/m^3	Kilograms per cubic metre
kg/s	Kilograms per second
km	Kilometre
kV	Kilovolt
m	Metre
m^2	Square Metre
m^3	Metres cubed
M/hour	Metres per hour
mg/l	Milligrams per litre
mm	Millimetre
MW	MegaWatt
nm	Nautical mile

19 Marine Archaeology

19.1 Introduction

19.1.1 This chapter of the Offshore Environmental Impact Assessment (EIA) Report presents the assessment of the likely significant environmental effects on marine archaeology, that may potentially occur as a result of the Offshore Infrastructure associated with the Bowdun Offshore Wind Farm (OWF) Project (hereafter referred to as the 'Proposed Development') during the construction, Operation and Maintenance (O&M) and decommissioning phases.

19.1.2 The assessment presented is informed by the following technical chapters:

- Volume 2, Chapter 7: Physical Processes;
- Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment;
- Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment;
- Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report; and
- Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discoveries.

19.2 Marine Archaeology Study Area

19.2.1 The Marine Archaeology Study Area is shown in Figure 19.1 and is defined as the Site Boundary with an additional 2 km buffer. This encompasses all elements of the Array Area and Export Cable Corridor. This Marine Archaeology Study Area allows for the capture of inaccurately or imprecisely geolocated assets, a larger Zone of Influence for indirect effects and puts relevant archaeological assets in a broader archaeological context.

19.2.2 The Marine Archaeology Study Area extends seawards from Mean High Water Springs (MHWS) and so also includes the Intertidal Area (Figure 19.1).

19.2.3 The area subject to site-specific geophysical survey is coterminous with neither the Marine Archaeology Study Area nor the Site Boundary and is referred to as the Marine Archaeology Survey Area (Figure 19.1). The Marine Archaeology Survey Area covers the entire Array Area, in line with standard practice, within the Export Cable Corridor only the proposed cable route was surveyed where any impacts would be expected to occur (Section 19.5; G-Tec, 2024a; G-Tec, 2024b).

19.2.4 This Marine Archaeology Study Area was presented to and agreed with Historic Environment Scotland (HES) and the Marine Directorate – Licensing Operations Team (MD-LOT) through the Offshore Scoping Report (Bowdun Offshore Wind Farm Limited (BOWFL), 2024).

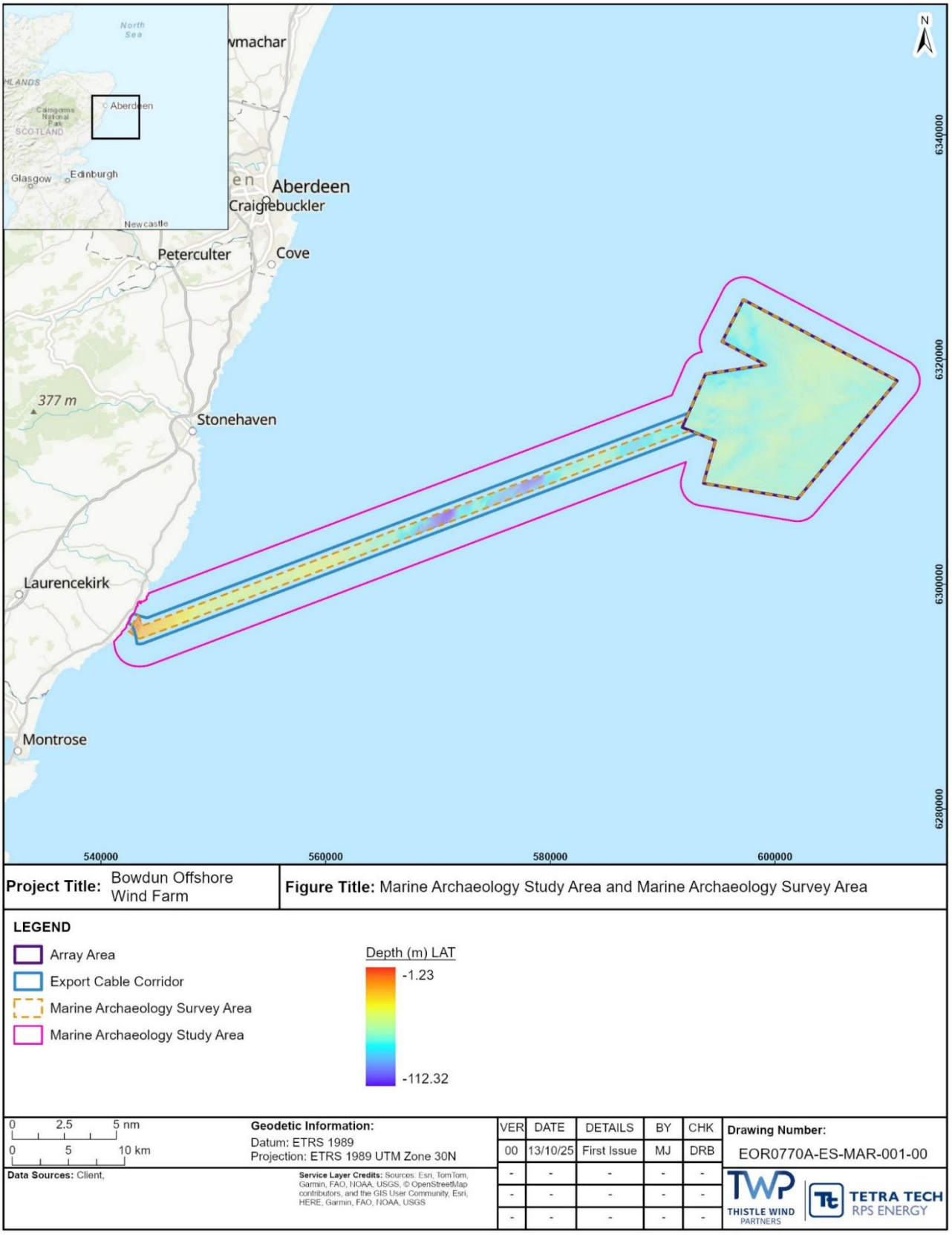

Figure 19.1: Marine Archaeology Study Area and Marine Archaeology Survey Area

19.3 Legislative and Policy Context

19.3.1 The overarching policy and legislation applicable to the Proposed Development is presented in Volume 1, Chapter 2: Policy and Legislation. A summary of the legislative provisions relevant to marine archaeology is provided in Table 19.1 below, with other relevant policy provisions set out in the following tables: Table 19.2, Table 19.3, Table 19.4 and Table 19.5. These are summarised here with further detail presented in Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report.

19.3.2 This section sets out the legislation, policy, guidance and any development plans relevant to marine archaeology in the context of offshore renewable energy development to provide an appropriate context for the baseline assessment.

19.3.3 With regard to marine licensing, the Scottish Marine Area is classed as the area of sea within the seaward limits of the territorial sea of the United Kingdom (UK) adjacent to Scotland (i.e. within 12 nm of the coastline). Scottish Offshore Waters includes any area of sea beyond 12 nm, which is within the Exclusive Economic Zone (EEZ) and the UK sector of the continental shelf (up to 200 nm).

19.3.4 Within the Scottish Marine Area the following legislation applies to marine archaeology:

- The Protection of Wrecks Act 1973;
- The Ancient Monuments and Archaeological Areas Act 1979;
- The Protection of Military Remains Act 1986;
- The Merchant Shipping Act 1995; and
- The Marine (Scotland) Act 2010.

19.3.5 Beyond the Scottish Marine Area, within Scottish Offshore Waters, marine archaeology is subject to the following legislation:

- The Merchant Shipping Act 1995; and
- The Protection of Military Remains Act 1986.

19.3.6 International policy and legislation to which marine archaeology is subject includes the United Nations Convention on the Law of The Sea 1982 (United Nations, 1982), the European Convention on the Protection of Archaeological Heritage (Council of Europe, 1992 (the Valetta Convention)) and the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) Convention on the Protection of Underwater Cultural Heritage 2001 (UNESCO, 2001).

Legislation

Table 19.1: Summary of Legislation Relevant to Marine Archaeology

Summary of Relevant Legislation	How and Where Considered in the Offshore EIA Report
Protection of Wrecks Act 1973 (PWA) **Section 2 of the PWA provides protection for wrecks that are designated as dangerous due to their contents and is administered by the Maritime and Coastguard Agency (MCA) through the Receiver of Wreck (RoW).** **Section 1 of the PWA was superseded in Scotland by the Marine (Scotland) Act 2010.**	The marine archaeology baseline, which includes all known maritime vessels and military aircraft in the Marine Archaeology Study Area, is presented in Section 19.6. Full details are given in Volume 3, Technical Appendix 19.1: Marine Archaeological Technical Report. There are no wrecks protected under the PWA in the Marine Archaeology Study Area.
Ancient Monuments and Archaeological Areas Act 1979 (AMAAA) **Scheduled Monuments and Areas of Archaeological Importance or their equivalent are afforded statutory protection by the Secretary of State, and consent is required for any works impacting them. The AMAAA was primarily terrestrial, but in recent years it has also been used to provide protection for underwater sites.**	The marine archaeology baseline, which includes all known maritime vessels and military aircraft in the Marine Archaeology Study Area, is presented in Section 19.6. Full details are given in Volume 3, Technical Appendix 19.1: Marine Archaeological Technical Report. There are no scheduled monuments in the Marine Archaeology Study Area.
Protection of Military Remains Act 1986 (PMRA) **Under the PMRA, all aircraft that have crashed in military service are automatically protected as a *"protected place"*. Named vessels can also be designated even if the position of the wreck is not known.** **The wreck of any maritime vessels or aircraft lost during military service can also be designated as a *"controlled site"*. Outside UK territorial waters the PMRA applies to British citizens, subjects and registered companies.**	The marine archaeology baseline, which includes all known maritime vessels and military aircraft in the Marine Archaeology Study Area, is summarised in Section 19.6. There are no wrecks protected under the PMRA present in the Marine Archaeology Study Area. Should material from an aircraft which crashed whilst in military service be present in the Marine Archaeology Study Area it will be automatically subject to legal protection under the PMRA. The Embedded Mitigation to be adopted as part of the Proposed Development (Section 19.9) includes the development of and adherence to a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discovery (PAD) (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery) which outlines the reporting procedure for archaeological discoveries, including aircraft material to the Ministry of Defence.
Merchant Shipping Act 1995 (MSA) **The MSA details the procedures for determining the ownership of maritime finds that turn out to be 'wreck'. 'Wreck' is defined as any flotsam, jetsam, derelict and lagan and includes all craft, parts of these, their cargo or equipment. Section 236 of the MSA stipulates that all wreck within the UK's territorial waters (up to 12 nm) and any wreck landed in the UK from outside the UK's territorial waters must**	The Embedded Mitigation adopted as part of the Proposed Development (Section 19.9) includes the development of and adherence to a WSI and PAD (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery). The WSI details the procedure for contacting and reporting to the RoW.

Summary of Relevant Legislation	How and Where Considered in the Offshore EIA Report
be declared to the RoW. If any wreck is recovered, the RoW must be notified, and the wreck material must be kept until the RoW determines ownership or requests that they be given to the RoW. All items which are raised from the seabed, regardless of age or importance, must be reported to the RoW who will act to settle questions of ownership and salvage.	
Marine (Scotland) Act 2010 **This Marine (Scotland) Act states that an area may be designated as an Historic Marine Protected Area (HMPA) if Scottish Ministers consider it desirable to preserve a marine historic asset if it is located within the area. The Marine (Scotland) Act 2010 has superseded Section one of the PWA in Scotland.**	The marine archaeology baseline, which includes all known maritime vessels and military aircraft in the Marine Archaeology Study Area, is presented in Section 19.6. Full details are given in Volume 3, Technical Appendix 19.1: Marine Archaeological Technical Report. There are no HMPAs in the Marine Archaeology Study Area.

Policy

19.3.7 The relevant policy provisions of the Marine Policy Statement (MPS) (UK Government, 2011), Sectoral Marine Plan for Offshore Wind Energy (SMP) (Scottish Government, 2020), Scottish National Marine Plan (NMP) (Scottish Government, 2015), the Historic Environment Policy for Scotland (HEPS) (HES, 2019a) are described below in the following tables; Table 19.2, Table 19.3, Table 19.4 and Table 19.5.

Table 19.2: Summary of Provisions Within the MPS Relevant to Marine Archaeology

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
MPS Paragraph 2.6.6.3 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".*	This Offshore EIA Report has assessed the impacts on all known and potential heritage assets within the Marine Archaeology Study Area using their archaeological significance (i.e. their value) to determine the sensitivity of the receptor (Section 19.8). The Embedded Mitigation adopted as part of the Proposed Development, including archaeological analysis of any future geophysical surveys to be undertaken and the reporting of discoveries of heritage assets through the PAD, will produce new archaeological data and understanding of our past (Section 19.9).
MPS Paragraph 2.6.6.5 *"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"*	This Offshore EIA Report has assessed the impacts on all known and potential heritage assets within the Marine Archaeology Study Area using their archaeological significance (i.e. their value) to determine the sensitivity of the receptor (Section 19.8). A precautionary approach has been taken where undesignated sites are considered as of equivalent archaeological significance to designated sites until further information can lead

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
	to an updated assessment of their significance (Section 19.10).

Table 19.3: Summary of Provisions Within the SMP Relevant to Marine Archaeology

Summary of relevant policy	How and where considered in the Offshore EIA Report
SMP Section 4.1 ***"The following types of potential negative impacts... will require further consideration (in addition to any specific potential impacts appropriate to the proposed development) at a project-level... loss of/damage to historic environment features and their settings".***	The loss of and damage to historic environment features have been assessed as part of the assessment of significant effects in Section 19.10. The impacts on the setting of onshore heritage assets are assessed in Volume 2, Chapter 21: Cultural Heritage.

Table 19.4: Summary of Provisions Within the Scottish NMP of Relevance to Marine Archaeology

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
NMP Policy GEN 6 ***"Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance."***	This Offshore EIA Report has assessed the impacts on all known and potential heritage assets within the Proposed Development using their archaeological significance (i.e. their value) (Section 19.10). Embedded Mitigation adopted as part of the Proposed Development will ensure protection of heritage assets in a manner proportionate to their significance (i.e. their value) (Section 19.9).
NMP Section 4.23 ***"Marine planners and decision makers should consider implications and opportunities for the historic environment taking into account the potential impacts of development and use on:*** ***Designated heritage assets – representing sites of national or international significance for which statutory requirements apply. Designated assets should be protected in situ within an appropriate setting. Substantial loss or harm to designated assets should be exceptional and should only be permitted if this is necessary to deliver social, economic or environmental benefits that outweigh the harm or loss*** ***Undesignated heritage assets – those that meet designation criteria or make a positive contribution should also be protected in situ, wherever possible, and consideration given to the potential for new discoveries of historic or archaeological interest to arise."***	The marine archaeology baseline, which includes all known maritime vessels in the Marine Archaeology Study Area, is presented in Section 19.6. Full details are given in Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report. There are no sites designated under the PMRA present in the Marine Archaeology Study Area. Known undesignated heritage assets are protected *in situ* through the implementation of Archaeological Exclusion Zones (AEZs) (Section 19.9). The potential for new discoveries to arise has been discussed in the marine archaeology baseline (Section 19.6). Embedded Mitigation for the reporting and protection of currently unknown archaeological receptors is included in Section 19.9.
NMP Section 4.24 Proposals for development that may ***"affect the historic***	The significance of all known heritage assets within the Marine Archaeology Study Area and the

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
environment should provide information on the significance of known heritage assets and the potential for new discoveries to arise. They should demonstrate how any adverse impacts will be avoided, or if not possible, minimised and mitigated. Where it is not possible to minimise or mitigate impacts, the benefits of proceeding with the proposal should be clearly set out"	potential for as yet unknown archaeological material to be encountered is presented in Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report and summarised in Section 19.6 below. Avoidance is the preferred approach to known heritage assets, as such, the Applicant will adopt AEZs around all anomalies identified through the geophysical survey to be of medium or high archaeological potential so that there is no potential for direct damage to these receptors (Section 19.9), where appropriate to do so. The Applicant has also committed to measures to report the discovery of currently unknown receptors through the PAD, and to measures to avoid or mitigate any impacts on these receptors, including through avoidance by the application of Temporary Exclusion Zones (TEZs) if appropriate (Section 19.9). The methods of reducing and mitigating unavoidable direct impacts are set out in Section 19.9. This includes the development and implementation of a WSI and PAD, which is also described in more detail in Section 19.9.
NMP Section 4.25 ***"Where the case for substantial change to heritage asset is accepted, marine decision-making authorities should require applicants to undertake suitable mitigating actions to record and advance understanding of the significance of the heritage asset before it is lost, in a manner proportionate to that significance"***	The Embedded Mitigation adopted as part of the Proposed Development, including archaeological analysis of any future geophysical surveys to be undertaken and the reporting of discoveries of heritage assets through the PAD, will produce new archaeological data and understanding of our past (Section 19.9). The methods of reducing and mitigating unavoidable direct impacts are set out in Section 19.9. Such measures will be done on a case-by-case basis, in consultation with MD-LOT, but could include, *inter alia*, recovery, relocation, excavation, conservation, stabilisation and/or recording of the receptor.

Table 19.5: Summary of Provisions Within the HEPS of Relevance to Marine Archaeology

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
HEP2 ***"Decisions affecting the historic environment should ensure that its understanding and enjoyment as well as its benefits are secured for present and future generations."***	The marine archaeology baseline, which includes all known maritime vessels and military aircraft in the Marine Archaeology Study Area, is presented in Section 19.6. Full details are given in Volume 3, Technical Appendix 19.1: Marine Archaeological Technical Report. Embedded Mitigation adopted as part of the Proposed Development will ensure protection of heritage assets in a manner proportionate to their significance (i.e. their value) (Section 19.9).
HEP4 ***"Changes to specific assets and their context should be managed in a way that protects the historic environment.***	Embedded Mitigation is set out in Section 19.9. The Embedded Mitigation adopted as part of the Proposed Development, including archaeological

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
Opportunities for enhancement should be identified where appropriate. If detrimental impact on the historic environment is unavoidable, it should be minimised. Steps should be taken to demonstrate that alternatives have been explored, and mitigation measures should be put in place."	analysis of any future geophysical surveys to be undertaken and the reporting of discoveries of heritage assets through the PAD, will produce new archaeological data and understanding of our past (Section 19.9). The methods of reducing and mitigating unavoidable direct impacts are set out in Section 19.9. Such measures will be done on a case-by-case basis, in consultation with MD-LOT, but could include, *inter alia,* recovery, relocation, excavation, conservation, stabilisation and/or recording of the receptor.

Guidance

19.3.8 There are a number of guidance documents that are relevant to marine archaeology in the context of offshore renewable development which have been considered in the production of this chapter. These include:

- Military Aircraft Crash Sites: Guidance on their Significance and future management (English Heritage, 2002 (now Historic England));
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee, 2006);
- Historic Environment Guidance for the Offshore Renewable Energy Sector (COWRIE, 2007);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
- Ships and Boats: Prehistory to Present: Designation Selection Guide (Historic England, 2012);
- PAD: Offshore Renewables Projects (The Crown Estate, 2014);
- Code of Conduct (Chartered Institute for Archaeologists (CIfA), 2014a (updated 2025));
- Environmental Impact Assessment Handbook (Scottish Natural Heritage (now NatureScot) and HES, 2018);
- Standard and Guidance for Historic Environment Desk-Based Assessment (CIfA, 2014b (updated 2020));
- Designation Policy and Selection Guidance (HES, 2019b (updated 2020));
- Archaeological Written Schemes of Investigation for OWF Projects (The Crown Estate, 2021);
- Curating the Palaeolithic (Historic England, 2023);
- Marine Licensing and Consenting: Offshore Renewable Energy Projects (Marine Directorate, 2025);

- Managing Change in the Historic Environment: Conserving our Underwater Heritage (HES, 2025a); and
- Marine Geophysics Data Acquisition, Processing, and Interpretation Guidance Notes (2nd Edition) (Historic England, 2025).

19.4 Consultation

19.4.1 The approach to consultation for the Proposed Development is set out in Volume 1 Chapter 5: Consultation and Engagement. A summary of the issues raised during consultation activities undertaken to date specific to marine archaeology is presented in Table 19.6, together with how these issues have been considered in the production of this assessment. Further detail is presented within Volume 1, Chapter 5: Consultation and Engagement, Volume 3, Technical Appendix 5.1: Consultation Log, and Volume 3, Technical Appendix 5.2: Pre-Application Consultation Report.

Table 19.6: Summary of Key Consultation Issues Raised During Consultation Activities Undertaken for the Proposed Development Relevant to Marine Archaeology

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
25/04/2024	Aberdeen City Council, HES, MD-LOT Scoping Workshop Cultural Heritage	Marine archaeology was not covered in the Scoping Workshop for cultural heritage but it was noted that it would be included in the Scoping Report.	Marine archaeology was included in the Scoping Report (BOWFL, 2024) and was scoped in for assessment in the EIA.
24/10/2024	Aberdeenshire Council (2024 Bowdun Offshore Wind Farm (OWF) Scoping Opinion – Scoping Response)	Agree with the proposed impacts to be scoped into the assessment.	The potential impacts on marine archaeology receptors are described in more detail in Section 19.10.
		Agree with the proposed Embedded Mitigation.	The Embedded Mitigation measures to be adopted as part of the Proposed Development are described in more detail in Section 19.9.
		Agree with the proposed assessment methodology outlined.	The assessment methodology relevant to marine archaeology is set out in Section 19.7.
25/11/2024	MD-LOT (2024 Bowdun OWF Scoping Opinion)	Content with the data sources, the Marine Archaeology Study Area and the Baseline Environment.	Details of the Marine Archaeology Study Area are set out in Section 19.2 and data sources are listed in Section 19.5. The Baseline Environment is described in Section 19.6.
		A number of identified wrecks and possible wreck sites have been identified within the Marine Archaeology Study Area. Physical impacts to these identified wrecks, particularly those relevant to the Protection of Military Remains Act 1986, should be avoided.	Avoidance will be the primary mitigation implemented by the Proposed Development for known archaeological features, including through micrositing and AEZs (see Section 19.9). Wrecks have been identified through desk-based assessment and archaeological analysis of geophysical data.
		The intention to carry out an archaeological assessment of the site-specific geophysical data which will provide further information on the potential for submerged prehistoric archaeology within the Marine Archaeology Study Area is noted and supported.	The archaeological assessment of the site-specific survey data (Section 19.5) was used to develop the marine archaeology baseline as summarised in Section 19.6 and set out in more detail in Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report.

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
		Agree with the proposed assessment methodology.	The assessment methodology is set out in Section 19.8.
		Agree with the list of impacts to be scoped into the assessment and the justification for those not to be included at particular phases of the Proposed Development.	Impacts that have been scoped into the assessment have been assessed in Section 19.10. The impacts scoped out of assessment are listed in Section 19.7.
		Agree with the proposed Embedded Mitigation strategies.	The Embedded Mitigation strategies are detailed in Section 19.9.
		Agree with the development of a WSI & PAD alongside this EIA Report.	A WSI and PAD has been prepared alongside this Offshore EIA Report (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery).
		Agree with the approach to assessment of cumulative effects and also that there is no potential for transboundary impacts on marine archaeology.	The Cumulative Effects Assessment (CEA) is set out in Section 19.12. Transboundary effects are considered in Section 19.14.
17/11/2024	HES (2024 Bowdun OWF Scoping Opinion – Scoping Response)	Generally content with the proposed approach to assessing impacts on our historic environment interests.	The assessment methodology is set out in Section 19.8.
		Advice on the nature of any likely impacts on our historic environment interests, and any potential mitigation measures, are included in an annex.	The advice and requirements laid out in the mentioned annex have been taken into account when writing the EIA and are discussed further in the rows below. This includes the use of AEZs and the development of a WSI and PAD.
		Decisions that affect the historic environment should take the HEPS into account as a material consideration.	HEPS has been taken into account and the summary of where and when it has been used are listed in Table 19.5.
		Direct physical impacts to identified wrecks, including where wreckage is dispersed, particularly those relevant to the Protection of Military Remains Act 1986, should be avoided.	Avoidance will be the Embedded Mitigation measures implemented by the Proposed Development for known archaeological features, including through micrositing and AEZs (Section 19.9). Wrecks have been identified through desk-based assessment and

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Chapter
			archaeological analysis of geophysical data. There are no wrecks designated under the PMRA in the Marine Archaeology Study Area (Section 19.6).
		It has been noted that impacts on the marine archaeological baseline will be scoped into the assessment and are content with the study areas defined for marine archaeology.	The Marine Archaeology Study Area is set out in Section 19.2. Impacts that have been scoped into the assessment have been assessed in Section 19.10.
		Agree with the proposal to use project-specific survey outputs to enhance the understanding of marine archaeology within the study area.	Details of the site-specific survey data are set out in Section 19.5 and resulting Baseline Environment is detailed in Section 19.6.
		We are content that the potential impacts on marine archaeology and cultural heritage have been identified adequately.	Impacts that have been scoped into the assessment have been assessed in Section 19.10.
		Content with the proposed mitigation strategies to manage and mitigate impacts on marine archaeology. This includes appropriately sized AEZs around marine archaeological assets.	The Embedded Mitigation measures to be adopted as part of the Proposed Development, including the implementation of AEZs are described in more detail in Section 19.9.
		Content with the proposal to develop a marine archaeological WSI and PAD.	A WSI and PAD has been prepared alongside this Offshore EIA Report (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery).
25/02/2025	HES Correspondence	No comments to offer on the WSI and PAD (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery) as HES no longer provide advice on undesignated underwater cultural heritage, including the preparation of documents for post-consent activities including WSIs and PADs.	The WSI and PAD (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery) was sent to HES for pre-application consultation in line with the relevant MD-LOT guidance (Marine Directorate, 2025). The proposed contents of the WSI and PAD were commented on by HES in their Scoping Response as they stated they were content with the proposed mitigation strategies to manage and mitigate impacts on marine archaeology including appropriately sized AEZs around marine archaeological assets.

19.5 Data Sources

19.5.1 Information on marine archaeology within the Marine Archaeology Study Area has been reviewed and analysed to inform this marine archaeology baseline.

Desktop Study

19.5.2 Information on marine archaeology within the Marine Archaeology Study Area was collected through a detailed desktop review of existing studies and datasets which are summarised in Table 19.7.

19.5.3 Both the literature review of the reports and review of the datasets were used to characterise the baseline. Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report includes full details of the analysis undertaken to develop the marine archaeology baseline.

Table 19.7: Summary of Key Data Sources

Title	Source	Year	Author
United Kingdom Hydrographic Office (UKHO) Wreck and Obstructions Data	UKHO	2025	UKHO
National Record of the Historic Environment (NRHE) records (Trove)	HES	2025b	HES
Aberdeenshire Council Historic Environment Record (HER) records	Aberdeenshire Council	2025	Aberdeenshire Council
Geoindex	British Geological Survey (BGS)	2025	BGS
Coastal Zone Assessment Survey: Aberdeenshire and City of Aberdeen, Cullen to Milton Ness	Scottish Coastal Archaeology and the Problem of Erosion	2023	Boyd and Hambly
Protected Wrecks Map	Marine Directorate	2023	Marine Directorate
BRITICE Glacial Mapping Project version 2.0	University of Sheffield	2017	University of Sheffield
BGS Offshore Regional Report: The Geology of the Central North Sea	BGS	1994	Gatliff *et al.*

Site-Specific Surveys

19.5.4 Site-specific surveys were undertaken to inform this assessment, these were carried out in two campaigns between July 2023 and October 2023, and between June 2024 and September 2024. These consisted of Sidescan Sonar (SSS), Multibeam Bathymetry (MBES), Magnetometer (MAG), Parametric Sub-Bottom Profiler (SBP), and Sparker (Two Dimensional (2D) Ultra High Resolution Seismic (UHRS) (G-Tec, 2024a; G-Tec, 2024b) (see Table 19.8 for further details).

19.5.5 The site-specific survey extent covers the majority of the Site Boundary, however it does not cover the whole extent of the Export Cable Corridor, nor

does it extend into the Marine Archaeology Study Area beyond the Site Boundary (Figure 19.1). The area covered is referred to as the Marine Archaeology Survey Area, which is described above in Section 19.2.

Table 19.8: Summary of Site-Specific Survey Data

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date
Geophysical Survey Campaign	Array Area	SSS,MBES, MAG, SBP and 2D UHRS	G-Tec	2023 and 2024
	Part of the Export Cable Corridor	SSS,MBES, MAG, SBP and 2D UHRS	G-Tec	2023 and 2024

19.6 Baseline Environment

Overview of Baseline Environment

19.6.1 The following sections provide a summary of the marine archaeology baseline environment. Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report includes full details of the analysis undertaken to develop the marine archaeology baseline.

Designated Sites

19.6.2 A screening of designated sites in the vicinity of the Proposed Development has been undertaken and has identified that there are no designated heritage assets located within the Marine Archaeology Study Area.

Submerged Prehistory

19.6.3 The potential for submerged prehistoric archaeology within the Marine Archaeology Study Area is considered to be generally low, due primarily to relatively high sea levels and the likelihood of ice coverage for much of prehistory.

19.6.4 Following the Last Glacial Maximum, when ice sheets were at the greatest extent, the Marine Archaeology Study Area is thought to have been quickly submerged, with a period of high relative sea level seen at approximately 27,000 to 24,000 Before Present (BP). It then remained submerged until approximately 13,000 BP (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report). Parts of the Export Cable Corridor were then likely to have been exposed from c. 13,000 BP to approximately 8,000/7,000 BP (i.e. from the Late Upper Palaeolithic to the Late Mesolithic). During this time sea levels may have been as low as -35 m, rising to present day levels (and above, after c. 7,000 BP). This suggests exposure of the Export Cable Corridor out to approximately 4 km from the coast (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report). During this period humans may have inhabited the landscape. The entire Export Cable Corridor and Array Area were submerged thereafter. The landscape that was subaerial (i.e. exposed to air) is therefore now submerged and is visible in the geophysical survey data. It has been designated as Unit 20A by the site-specific survey contractor (G-Tec, 2024b). This suggests there could be potential for archaeological and palaeoenvironmental remains from the Late Upper Palaeolithic to the Late Mesolithic surviving in the Marine Archaeology

Study Area, concentrated within Unit 20A in the nearshore area. Erosion may have affected the upper parts of this deposit, though some potential for uneroded palaeoenvironmental remains still exists (Stoker *et al.*, 2008). Potential for *in situ* remains in other units is limited, though remains redeposited from other contexts could occur.

Known Maritime and Aviation Receptors

19.6.5 Within the desktop data a total of 29 archaeological records have been identified in the Marine Archaeology Study Area (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report). Of these, 13 are named wrecks or Find Spots that can be tied to a known wreck. There are a further 16 unknown wrecks recorded within the data and no other known obstructions.

19.6.6 There is one recorded aviation loss and one further record of a possible aircraft located within the Marine Archaeology Study Area (Trove 313229 and Trove 328314). Unidentified aviation assets may be present in the Marine Archaeology Study Area despite there being no identified wreckage.

19.6.7 A total of 180 surface anomalies of archaeological interest have been identified within the Marine Archaeology Survey Area (Figure 19.1). Of these, four are interpreted as of high potential, all of which are located in the Export Cable Corridor. There are nine medium potential anomalies in total with three being located within the Array Area and six within the Export Cable Corridor in addition to the 167 low potential anomalies ((Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report) Table 19.9).

Table 19.9: Distribution of Archaeological Anomalies by Potential

Potential	Array Area	Export Cable Corridor	Total
Low	100	67	167
Medium	3	6	9
High	0	4	4
Total	103	77	180

Maritime Archaeology and Aviation Potential

19.6.8 There is potential for currently unknown maritime archaeology receptors from all periods to be present in the Marine Archaeology Study Area (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report).

19.6.9 There is potential for unknown aviation archaeology to be present in the Marine Archaeology Study Area. While the aviation archaeology record is potentially very large, the ephemeral nature of aircraft wrecks ensures that many sites remain unknown and unrecorded or difficult to locate to an accurate position. In addition, despite the potential extensive losses at sea, records are seldom tied to an accurate position. These difficulties complicate any assessment of the likely presence of aircraft wreckage on any particular area of seabed.

Intertidal Archaeology

19.6.10 There are two archaeological records located within the Intertidal Area of the Export Cable Corridor. Both records are for harbours; one is an artificial basin and the other is a natural harbour with evidence of artificial enhancement. More detail on intertidal records can be found in Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report.

19.6.11 There is potential for unknown archaeological assets from all periods, from Prehistory to Modern, to be present in the Intertidal Area of the Marine Archaeology Study Area.

Future Baseline Scenario

19.6.12 The EIA Regulations require that "*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the project 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 Offshore EIA Report.

19.6.13 If the Proposed Development does not come forward, an assessment of the 'without development' future baseline conditions has also been carried out and is described within this section.

19.6.14 The baseline environment of the Marine Archaeology Study Area as described in Section 19.6 should be considered as a snapshot of gradually changing marine archaeology receptors within a dynamic environment. All marine archaeology receptors will be subject to natural processes, physical, chemical and biological, and so will deteriorate over time. The greatest change will typically be seen in upstanding metal wrecks, which will corrode and collapse over time. In addition, sediment mobility will likely continue, and this natural process will potentially expose marine archaeology receptors, allowing their deterioration to accelerate. It is also possible that sediment mobility will bury or rebury marine archaeology receptors, resulting in a deceleration of their deterioration.

19.6.15 The current baseline as described in Section 19.6 will change, albeit slowly. It is unlikely that significant change will occur to marine archaeology within the Marine Archaeology Study Area over the next few decades (over the lifespan of the Proposed Development), although some visible deterioration may be seen on any upstanding wrecks, including the high potential anomalies BN25_0141 and BN25_0142 (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report).

Data Limitations and Assumptions

19.6.16 The records held by the UKHO, NRHE and other sources used in this assessment are not a record of all surviving archaeological assets, but a record of discovery of a diverse range of archaeological and historical components of the marine environment. The datasets used are incomplete records of the totality of potential marine archaeology present on the seabed and do not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown.

19.6.17 The interpretation of geophysical and hydrographic data is, by its very nature, subjective. However, with experience and by analysing the form, size, and characteristics of an anomaly, a reasonable degree of certainty as to the origin of an anomaly can be achieved. Measurements can be taken in most data processing software; while this is reasonably accurate, some discrepancies may occur. Where there is uncertainty of an anomaly's potential or origin, a precautionary approach is taken to ensure the most appropriate mitigation for the historic environment is recommended. There may be instances where a receptor may exist on the seabed but is not visible in the geophysical data. This may be due to the anomaly being buried or out of the sonar's line-of-sight. The desktop sources and the site-specific data examined represent a comprehensive and robust sequence of datasets and observations that allow for a detailed assessment of archaeological constraints, however, there remains the possibility that as yet unknown marine archaeology receptors are present within the Marine Archaeology Study Area.

19.6.18 The Marine Archaeology Survey Area does not cover the entire extent of the Export Cable Corridor but in line with standard practice only the proposed cable route was surveyed where any impacts are expected to occur (Figure 19.1; G-Tec, 2024a; G-Tec, 2024b). Additional data collection, and interpretation, may be required prior to construction in the post-consent phase should any activities be planned outside this area (Section 19.9).The data collected across the extents of the pre-defined survey boundary are of good quality overall, however some limitations are noted (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report). However, the data consisted of an appropriate specification, coverage, and quality, to undertake a robust archaeological assessment to inform the EIA process.

19.7 Key Parameters for Assessment

Maximum Design Scenario

19.7.1 The Maximum Design Scenario (MDS) identified in Table 19.10 are those parameters expected to have the potential to result in the greatest effect on an identified receptor or receptor group. Any other development scenario within the Project Design Envelope (PDE), will result in the same, or less, level of environmental effect. The scenario has been selected from the details provided in Volume 1, Chapter 3: Project Description.

19.7.2 The assessment within this chapter is informed by assessments undertaken for Volume 2, Chapter 7: Physical Processes and Volume 3, Technical Appendix 7.1: Physical Processes Technical Report.

Table 19.10: MDS Considered for Each potential Impact as Part of the Assessment of Likely Significant Effects on Marine Archaeology

Potential Impact	Phase*			MDS	Justification
	C	O	D		
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	✓	✓	✓	**Construction Phase** Drilling for pile installation Up to 318,086 m^3 of drill arising for all piles in the Array Area for the 40 x 25 MW fixed monopile Wind Turbine layout, comprising: • Maximum number of drilled piles: 40 (max foundations = 40; max piles per foundation = 1); • Maximum dimensions of drilled pile section: 15 m diameter, 45 m maximum penetration depth; • Maximum volume of drill arisings per pile: 7,952.12 m^3; and • Maximum concurrent drilling events: 2. Inter-Array Cable (IAC) installation • Maximum total length of IAC on the seabed for the whole Array Area: 151 km; • Trench dimensions: up to 6 m wide; 1.5 m deep (average); 'V' shape profile; • Trench excavation method: Jetting, Mass Flow Excavation (MFE), Ploughing/Pre-Ploughing, Trenching/Pre-Trenching (inclUDING dredging, cutting); and • MFE pre-lay trenching rate: 400 m/hour. Offshore Export Cable installation • Maximum number of Offshore Export Cables: 3; • Maximum total length of each Offshore Export Cable: 70 km; • Trench dimensions: up to 6 m wide; 1.5 m deep (average); 'V' shape profile;	The MDS corresponds to (a combination of) the greatest amount of material disturbed and the greatest geographical extent of the impact. **Construction Phase** Drilling for pile installation Based on the greatest amount of material disturbed in a drilling event, considering the largest pile dimension, largest pile penetration depth and number of concurrent drilling events. Assumes two concurrent drilling events can occur for neighbouring foundations, resulting in the MDS for instantaneous Suspended Sediment Concentrations (SSC). Piles relating to OSPs are smaller in diameter and require less drilling depth than Wind Turbine foundations therefore do not represent the MDS. IAC installation Pre-lay trenching by MFE will give the MDS for sediment disturbance. Conservatively assumes 100% fluidisation of material expelled from trench. In reality, pre-lay jetting will move a proportion of material rather than bringing it fully into suspension. Modelling was carried out for sediment release along a section of an indicative cable route which runs parallel and then perpendicular to the tidal axis for two full tidal cycles.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				• Excavation method: Jetting, MFE, Ploughing/Pre-Ploughing, Trenching/Pre-Trenching (including dredging, cutting); and • MFE pre-lay trenching rate: 400 m/hour. <u>Interconnector Cable installation</u> • Maximum number of Interconnector Cables: 3; • Maximum total length of each Interconnector Cable: 12 km; • Trench dimensions: up to 6 m wide; 1.5 m deep (average); 'V' shape profile; • Excavation method: Jetting, MFE, Ploughing/Pre-Ploughing, Trenching/Pre-Trenching (including dredging, cutting); and • MFE Pre-lay trenching rate: 400 m/hour. <u>Sandwave clearance</u> • Sandwave clearance width along IAC: 58.6 m; • Area of IAC sandwave clearance: 49,552 m^2 for the 40 x 25 MW and 50 x 20 MW Wind Turbine layouts; • Area of Interconnector Cable sandwave clearance: 11,814 m^2; • Area of Offshore Substation Platform (OSP) Scour Protection sandwave clearance: 24,359 m^2 for up to three OSP option; • Area of Wind Turbine foundation sandwave clearance: 141,000 m^2 for the 50 x 15 MW Wind Turbine Layouts; • Sandwave clearance width along Offshore Export Cable: 58.6 m; • Area of Offshore Export Cable sandwave clearance: 609,147 m^2; and	<u>Offshore Export Cable installation</u> Pre-lay trenching by MFE will give the MDS for sediment disturbance. Conservatively assumes 100% fluidisation of material expelled from trench. In reality pre-lay jetting will move a proportion of material rather than bringing it fully into suspension. Export Cable Corridor pre-lay trenching modelling assumes sediment release along the whole Export Cable Corridor. <u>Interconnector Cable installation</u> Pre-lay trenching by MFE will give the MDS for sediment disturbance. Conservatively assumes 100% fluidisation of material expelled from trench. In reality pre-lay jetting will move a proportion of material rather than bringing it fully into suspension. Covered by Offshore Export Cable and IAC installation model scenarios. <u>Sandwave clearance</u> Sandwave clearance/levelling activities may be undertaken using a range of techniques – MFE and suction hopper dredging. Releases via both are modelled. A MFE near-bed sediment release rate of 1,000 kg/s is conservatively estimated based on the MDS trench cross section dimensions, the speed of progress of the tool, and the bulk density of the local sediment type. Dredge spoil release is

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				• Clearance method: MFE and/or Dredger. <u>Trenchless technique installation (e.g. Horizontal Directional Drilling (HDD))</u> • Number of exit pits: up to 3; • 2,800 m^3 excavated material for each pit for the 220 kV scenario (8,400 m^3 for all pits); and • Exit pit dimensions: 2.2 m x 50 m. <u>Drilling fluid release (at Landfall)</u> • Number of exit/release events: up to 3; • Up to 2,870 m^3 drilling mud generated per trenchless technique duct, based on bore diameter of 2.2 m and duct length of 755 m (8,610 m^3 total for all three ducts); • 100,000 mg/l (100 kg/m^3) assumed conservative maximum concentration of bentonite in drilling mud; and • Wet punch-out. **O&M Phase** <u>Cable repairs</u> • Number of annual IAC repairs: 1; • Maximum annual length of IAC reburial: 4,915 m; • Number of Interconnector Cable repairs: 1 every 5.5 years; • Maximum annual length of Interconnector Cable reburial: 2,040 m; • Number of annual static Offshore Export Cable repairs: 1; and	simulated as an instantaneous release at the water surface. 10% of a representative large (11,000 m^3) hopper is assumed to form the passive phase of the plume (ABPMer, 2011). Other seabed preparation such as boulder clearance is not considered here as the activity does not represent the MDS in terms of potential increases in SSC and associated changes to seabed substrate. <u>Trenchless technique installation</u> Based on maximum exit pit dimensions. <u>Drilling fluid release (at Landfall)</u> Based on maximum trenchless technique duct dimensions. Assumes a conservative bentonite concentration of 100 kg/m^3 in drilling mud. Other stages of drilling (pilot hole drilling and stages of reaming) may result in smaller release events separated in time, but the MDS is considered as a release of drilling mud from a single conduit. **O&M Phase** The MDS for sediment disturbance during operation will be no greater than that set out for the construction phase of the Proposed Development. <u>Cable repairs</u> These limited activities would disturb a much smaller volume of material for each

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				• Maximum annual length of Offshore Export Cable reburial: 6,390 m. **Decommissioning Phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS total removal of all infrastructure including buried cables and cable protection as a worst-case scenario has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction.	repair/reburial event than simulated for the construction phase. **Decommissioning Phase** The removal of infrastructure is expected to result in some localised seabed disturbance accompanied by temporary increases in SSC. Leaving the infrastructure in place will create less sediment disturbance. Therefore, the MDS is for the removal of all infrastructure. The MDS for sediment disturbance during decommissioning will be no greater than that set out for the construction phase of the Proposed Development.
Direct damage to maritime archaeology receptors	✓	✓	✓	**Construction phase - Subtidal** Up to **10,652,673 m²** of subtidal seabed impacts,: <u>Trenchless Techniques Excavation (e.g. HDD)</u> up to 330 m^2 of habitat disturbance associated with excavation of exit pits comprising: • up to 330 m^2 of seabed impacts from the installation of up to 3 trenchless techniques exit pits. <u>Sandwave clearance</u> Up to 679,872 m^2 of seabed impacts associated with sandwave clearance comprising: • OSP foundations: 9,359 m^2 for the installation of up to 3 OSP foundations, additional to the area of foundation and Scour Protection.	The MDS for this impact considers the maximum seabed footprint which would be affected by novel seabed impacts during the construction, O&M and decommissioning phases. The MDS for this impact is represented by the 50 x 20 MW Wind Turbine layout scenario. **Construction Phase** Sandwave clearance is based on up to: • 151 km total length of IACs on the seabed; • 36 km total length Interconnector Cables; and

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				• IACs: up to 49,552 m^2 (assumes 0.56% requires clearance with a 58.6 m width of disturbance). • Interconnector Cables: up to 11,814 m^2 (assumes 0.56% requires clearance with a 58.6 m width of disturbance). • Offshore Export Cables: up to 609,147 m^2 (assumes 4.95% requires clearance with a 58.6 m width of disturbance). <u>Wind Turbine and OSP foundations</u> • Footprint area of 170,000 m^2 due to fixed 3-legged suction bucket jacket Wind Turbine foundations (up to 50 foundations with a seabed footprint of 3,400 m^2 per foundation including Scour Protection). • Footprint area of 15,000 m^2 due to OSP foundations (up to 3 OSPs) and their Scour Protection. <u>Cable installation (including boulder clearance)</u> Up to 9,638,945 m^2 of seabed impacts associated with cable installation comprising: • IACs: up to 3,753,860 m^2 disturbance from installation of up to 151 km of IACs (99.44% of the total length, including the length which requires boulder clearance, both with a 25 m width of disturbance, separate to sandwave clearance); • Interconnector Cable: up to 894,960 m^2 from installation of up to 36 km of Interconnector Cable (99.44% of the total length, including the length which requires boulder clearance, both with a 25 m width of disturbance, separate to sandwave clearance); and • Offshore Export Cables: up to 4,990,125 m^2 of disturbance from installation of up to 210 km of Offshore Export Cables (95.05% of the total length, including the length which requires boulder clearance, both with a	• 210 km total length of Offshore Export Cables. Sandwave and boulder clearance areas are within the footprints of the Wind Turbines and their Scour Protection, so have been excluded from MDS. The footprint of the OSP foundations and Scour Protection is less than the area of sandwave clearance, so the additional sandwave clearance area has been added to the MDS. The MDS assumes that up to 151 km of the IACs will be on the seabed, with up to 16 km within the Wind Turbine foundations. Cable installation is based on the assumption that the width of disturbance for sandwave also includes subsequent cable installation as repeat disturbance. As such, up to 95.05% of the length of Offshore Export Cables, and up to 99.44% of the length of IACs and Interconnector Cables will need burial only. Boulder clearance, cable protection and cable crossings are captured within the disturbance corridor for cable installation. Jack-up-events are based on the assumption that there will be up to a

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				25 m width of disturbance, separate to sandwave clearance). <u>Jack-up events</u> Up to 148,400 m^2 of seabed impacts due to jack-up vessel use for the installation of up to 3 OSPs and up to 50 Wind Turbine foundations. Up to 126 m^2 of seabed impacts due to jack-up vessel use for the installation of up to 3 trenchless techniques exit pits. <u>Unexploded Ordnance (UXO)</u> In addition, up to 13,987 m^2 of seabed impacts could occur due to crater formation from the clearance of UXO. This value has not been included in the total disturbance presented above, as the footprint from UXO clearance will likely overlap with area subject to seabed impacts from other site preparation activities. Additionally, the footprint associated with the UXO clearance has not been derived from Volume 1, Chapter 3: Project Description. Instead, it has been calculated based on appropriate crater sizes estimated in Ordtek (2018) and applied to the 40 UXOs that may require clearance during the construction phase of the Proposed Development (30 in the Array Area and 10 along the Export Cable Corridor). <u>Construction phase – Intertidal</u> There is no impact in the Intertidal Area as cables will be installed via trenchless techniques with exit pits located below MLWS and above MHWS. **O&M Phase** O&M phase up to 30 years.	maximum of up to 2 jack-up positions per OSP and Wind Turbine foundation. UXO clearance MDS calculated from the maximum estimated crater diameter of 21.10 m in Ordtek, 2018. **O&M Phase** The seabed impact associated with cable maintenance is assumed to fall within the footprint of cable installation so is excluded from the MDS. **Decommissioning Phase** Parameters for decommissioning will be significantly lower than for the construction phase, as sandwave clearance and pre-lay preparation will not be required.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Footprints of impacts due to the O&M phase are considered to be of a similar or lower extent to those of the construction phase, and within area already impacted during the construction phase. **Decommissioning Phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS, total removal of all infrastructure including buried cables and cable protection has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction.	
Direct damage to deeply buried marine archaeology receptors	✓	×	×	**Construction Phase** • Wind Turbine foundation installation: Three-legged jacket foundation for the 50 x 20 MW Wind Turbine Layout with up to 3 driven piles per foundation and a pile penetration depth of 85 m; and • OSP foundation installation: two OSPs requiring 18 piles per foundation with a pile penetration depth of 70 m.	Maximum depth of pile penetration for foundation installation represents the maximum impact to submerged prehistoric archaeology receptors. The 2 OSP option is the MDS as it has 36 total piles, compared to 24 piles for the 3 OSP option, and 18 piles for the 1 OSP option. Potential impacts could only occur during piling in the construction phase.
Alteration of sediment transport regimes leading to indirect impacts on marine	×	✓	×	**O&M phase** **Wave and Tidal Regime** <u>Wind Turbine foundation – Fixed structure</u> • Maximum number of Wind Turbines: 67; • Four-legged jacket foundation on pin piles;	**O&M phase** Sediment transport is driven by the combination of waves and tides. The relative contribution of these driving processes will vary spatially and temporally in response to, amongst other

Potential Impact	Phase*			MDS	Justification
	C	O	D		
archaeological receptors				• 4 piles per foundation (268 in total for Array Area); • Pile diameter: 3.8 m; • Pile height Above Seabed Level (ABSL): 5 m; • Jacket primary member diameter: 3.1 m; • Scour Protection height ABSL: 1 m; • Scour Protection diameter (including pile): 28.8 m; • Total cross-sectional area within the water column per Wind Turbine foundation (including Scour Protection): 1,647 m^2; • Depth-average blockage width per Wind Turbine foundation (including anchors and Scour Protection): 25 m; • Depth-average blockage width for all Wind Turbine foundations (including anchors and Scour Protection): 1,690 m; and • Minimum separation between Wind Turbines: 1,038 m. <u>OSP Foundation</u> • Six-legged jacket on pin piles; • Maximum number of OSPs: 2; • Jacket primary member diameter: 3 m; • Total cross-sectional area within the water column per OSP foundation: 3,890 m^2; • Depth-average blockage width per OSP foundation: 60 m; and • Depth-average blockage width for all OSP foundations: 119 m.	things, variation in water depth, tidal strength and meteorological events. <u>Wind Turbine foundation</u> The MDS for changes to the tidal regime is given by the greatest depth-average blockage width for the Array Area as a whole. This considers the number of Wind Turbine foundations, fixed foundation type, foundation components, and Scour Protection. Depth-averaged blockage is calculated assuming a representative (mean) water depth across the Array Area of 65.3 m. The MDS for changes to the wave regime is given by the greatest depth-average blockage width for the Array Area as a whole. This considers the number of Wind Turbine foundations, foundation type, foundation components, and Scour Protection. Depth-averaged blockage is calculated using a representative (mean) water depth across the Array Area, which is 65.3 m. <u>OSP foundation</u> The MDS for changes to the tidal regime is given by the greatest OSP depth-average blockage for the Array Area as a whole. This considers the number of OSP foundations, primary and secondary jacket member diameters.

Potential Impact	Phase*			MDS	Justification
	C	O	D		
				Scour Wind Turbine foundation • 3-legged jacket foundations for the 67 x 15 MW Wind Turbine layout; • Maximum number of Wind Turbines: 67; • Width of structure base: 37 m; and • Diameter of jacket legs: 3.3 m. OSP foundation • 4-legged jacket foundations for the 3 x OSP option; • Maximum number of OSPs: 3; • Width of structure base: 48 m; and • Diameter of jacket legs: 3 m. Cable protection • Maximum number of Offshore Export Cables: 3; • Cable protection height ABSL: 2 m; and • Cable protection width: Up to 10 m.	The MDS for changes to the wave regime is given by the greatest OSP depth-average blockage for the Array Area as a whole. This considers the number of OSP foundations, primary and secondary jacket member diameters and anchor system. Scour Each foundation type may produce different scour patterns. The foundation type, size and number producing the greatest area and/or volume of influence is defined based on the outputs of the scour assessment in Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment. Scour Protection may be used to protect the stability of foundations if necessary. Where Scour Protection is used, primary scour is unlikely to occur, although a small amount of secondary scour may develop at the edges of the scour. However, the extent and volume of secondary scour will be considerably less than the MDS calculated for primary scour.

*Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

Impacts Scoped Out of the Assessment

19.7.3 On the basis of the baseline environment and the project description outlined in Volume 1, Chapter 3: Project Description, no impacts are scoped out of the assessment for marine archaeology. However, impacts in some phases for the alteration of sediment transport regimes impact were proposed to be scoped out in the Bowdun Offshore EIA Scoping Report (BOWFL, 2024) and this was confirmed in the Scoping Opinion received (Section 19.4, MD-LOT, 2024). A list of the potential impacts scoped out of this assessment for certain phases is listed in Table 19.11.

19.7.4 Impacts from the alteration of sediment transport regimes were proposed to be scoped out for the construction and decommissioning phases in the Bowdun Offshore EIA Scoping Report (BOWFL, 2024) and this was confirmed in the Scoping Opinion received (Section 19.4, MD-LOT, 2024). This impact is outlined, together with a justification for scoping it out, in Table 19.11.

19.7.5 It is also proposed to further scope out direct damage to deeply buried marine archaeology receptors in the O&M and decommissioning phases, despite these being scoped in for assessment in the Bowdun OWF Offshore Scoping Report (BOWFL, 2024). Justification is provided in Table 19.11.

Table 19.11: Impact Scoped Out of the Assessment for Marine Archaeology

Potential Impact	Phase			Justification
	C	O&M	D	
Alteration of sediment transport regimes leading to indirect impacts on marine archaeology receptors	✓	×	✓	The physical presence of infrastructure associated with the Proposed Development and any scour/cable protection may lead to localised changes in tide and wave climate. These changes could affect the distribution of sediment, which could then be directed towards or away from known archaeological receptors. In line with Volume 2, Chapter 7: Physical Processes, the assessment focuses on those Proposed Development phases in which impacts will potentially be greatest. There will be no, or fewer, infrastructure present in the construction and decommissioning phases, so the O&M phase represents the MDS and the other phases are not assessed. This was confirmed in the Scoping Opinion received (Section 19.4).
Direct damage to deeply buried marine archaeology receptors	×	✓	✓	The impact-receptor pathway is through construction activities, such as piling, that penetrate the shallower marine sediments to those which represent potentially submerged palaeolandscapes. There are no activities during the O&M and decommissioning phases that will do this. For this reason, this impact is assessed for the construction phase but not assessed for the O&M and decommissioning phases.

*Phase refers to construction (C), O&M (O) and decommissioning (D).

19.8 Methodology for Assessment of Effects

Overview

19.8.1 The marine archaeology assessment of effects has followed the methodology set out in Volume 1, Chapter 4: Environmental Impact Assessment Methodology. Specific to the marine archaeology assessment of effects, the following guidance documents have also been considered:

- Designation Policy and Selection Guidance (HES, 2019b);
- HEPS (HES, 2019a);
- Principles of Cultural Heritage Impact Assessment (Institute of Environmental Management and Assessment (IEMA) *et al.*, 2021 (now Institute of Sustainability and Environmental Professionals (ISEP))); and
- Managing Change in the Historic Environment: Conserving our Underwater Heritage (HES, 2025a).

Criteria for Assessment

19.8.2 When determining the significance of effects, a process is used which involves defining the magnitude of the potential 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 4: Environmental Impact Assessment Methodology.

19.8.3 The criteria for defining magnitude in this chapter are outlined in Table 19.12. Each assessment considered the spatial extent, duration, frequency and reversibility of impact when determining magnitude which are outlined within the magnitude section of the impact assessment (e.g. a duration of hours or days would be considered for most receptors to be of short term duration, which is likely to result in a low magnitude of impact).

19.8.4 The approach for determining the significance of effects is a two-stage process that involves defining the magnitude of the potential impacts and the sensitivity of the receptors. This section describes the criteria applied 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 4: Environmental Impact Assessment Methodology.

Table 19.12: Definition of Terms Relating to Magnitude

Magnitude of Impact	Description
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements; loss of Cultural Significance (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality; enhancement of Cultural Significance; a considerable enhancement to the archaeological or historical interest and knowledge of the asset (Beneficial).

Magnitude of Impact	Description
Medium	Loss of resource, but not adversely affecting integrity of resource; partial loss of/damage to key characteristics, features or elements; partial loss of Cultural Significance (Adverse).
	Benefit to, or addition of, one (maybe more) key characteristics, features or elements; improvement of attribute quality; enhancement to the archaeological or historical interest and knowledge of the asset (Beneficial).
Low	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements; slight loss of Cultural Significance (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring; slight enhancement to the archaeological or historical interest and knowledge of the asset (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements; Cultural Significance not materially affected (Adverse).
	Very minor benefit to, or positive addition of one or more characteristics, features or elements; Cultural Significance not materially affected (Beneficial).

19.8.5 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 by its:

- 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; and
- value: a measure of the receptor's importance, rarity and worth (Highways England *et al.,* 2019).

19.8.6 For indirect impacts such as smothering, burial or exposure, marine archaeology receptors can typically tolerate some temporary change without significant adverse impact.

19.8.7 However, marine archaeology receptors cannot typically adapt, tolerate, or recover from impacts resulting in damage or loss to the receptors themselves, or their context and relationship with their wider environment. As a result, the sensitivity of a marine archaeology receptor to direct damage can only be determined through its value.

19.8.8 Based on current policy and guidance, the Cultural Significance (i.e. value) of a historic asset means the aesthetic, historic, scientific or social value for past, present or future generations (HES, 2019a). Cultural Significance can be embodied in a place itself, its fabric, setting, use, associations, meanings, records, related places and related objects.

19.8.9 Criteria of value for assessing if marine historic assets are of Cultural Significance for designation purposes in Scotland are:

- **Intrinsic characteristics:** how the physical remains of a marine historic asset contributes to our understanding of the past;
- **Contextual characteristics:** how a marine historic asset relates to its surroundings and/or to our existing knowledge of the past; and
- **Associative characteristics:** how a marine historic asset relates to people, events and/or historic and social movements (HES, 2019b).

19.8.10 The understanding of the value of a receptor can be revised as more information becomes available (e.g. through further investigation). Both designated and undesignated receptors can hold value, as can both known and unknown receptors.

19.8.11 The criteria for defining sensitivity in this chapter are outlined in Table 19.13 below.

Table 19.13: Definition of Terms Relating to Sensitivity of the Receptor

Value (sensitivity of the receptor)	Description
Very High	Very high importance and rarity, 'international' significance. Wrecked ships and aircraft that are protected under the Marine (Scotland) Act 2010, AMAAA, or PMRA with an international dimension of their importance, as well as currently undesignated sites that are demonstrably of equivalent 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. For indirect effects, this may include receptors with a very high level of vulnerability.
High	High importance and rarity, 'national' significance. This category includes sites designated by the laws as above, as well as currently undesignated sites that do not have statutory protection or equivalent significance, but have a high potential for archaeological interest based on an assessment of their importance in terms of relevant designation criteria HES, 2019b). Prehistoric deposits with high potential to contribute to an understanding of the palaeoenvironment. For indirect effects, this may include receptors with a high level of vulnerability.
Medium	High or medium importance and rarity, 'regional' or 'local' significance. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance but have moderate archaeological interest. Also includes isolated finds of wreck material. Prehistoric deposits with moderate potential to contribute to an understanding of the palaeoenvironment. For indirect effects, this may include receptors with a medium level of vulnerability.
Low	Low importance and rarity. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance and have a low archaeological interest. Also includes finds of wreck material with little context or potential.

Value (sensitivity of the receptor)	Description
	Prehistoric deposits with low potential to contribute to an understanding of the palaeoenvironment. For indirect effects, this may include receptors with a low level of vulnerability.
Negligible	Very low importance and rarity. Assets with little or no surviving archaeological interest. For indirect effects, this may include receptors with a very low level of vulnerability.

19.8.12 The magnitude of the impact and the sensitivity of the receptor are combined when determining the significance of the effect upon marine archaeology receptors. The particular method employed for this assessment is presented in Table 19.14 and Table 19.15.

19.8.13 Where a range is suggested for the significance of effect, for example, minor to moderate, it is possible that this may span the significance threshold. The technical specialist's professional judgement will be applied to the determine which outcome defines the most likely effect, which takes into account the sensitivity of the receptor and the magnitude of the impact. Where professional judgement is applied to quantify final significance from a range, the assessment will set out the factors that result in the final assessment of significance. These factors may include the likelihood that an effect will occur, data certainty and relevant information about the wider environmental context.

19.8.14 EIA Regulations require the identification and reporting of significant environmental effects. For the purposes of this assessment:

- a level of moderate or more will be considered a 'significant' effect in terms of the EIA Regulations; and
- a level of minor or less will be considered 'not significant' in terms of the EIA Regulations.

Table 19.14: Matrix Used for the Assessment of the Significance of the Effect

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or Moderate	Moderate or Major	Major
Very High	Minor	Moderate or Major	Major	Major

Table 19.15: Definition of Significance

Impact	Justification
Negligible	No effects or those that are beneath levels of perception, within normal bounds of variation, or within the margin of forecasting error.
Minor	These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the Proposed Development.
Moderate	These beneficial or adverse effects have the potential to be important and may influence the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.
Major	These beneficial or adverse effects are very important and are likely to be material in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national, or regional importance. However, a major change in a site or feature of local importance may also enter this category.

19.9 Embedded Mitigation

19.9.1 As part of the Proposed Development design process, a number of Embedded Mitigation measures have been proposed to reduce the potential for impacts on marine archaeology (see Table 19.16). They are considered at every stage of the Proposed Development through design and best practice and, as there is a commitment to implementing these measures, these have been considered in the assessment presented in Section 19.8 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These Embedded Mitigation measures are considered standard industry practice for this type of development.

Table 19.16: Embedded Mitigation Adopted as Part of the Proposed Development

ID*	Embedded Mitigation Adopted as Part of the Proposed Development	Justification
7	Development of and adherence to, a Construction Method Statement (CMS) along with a Code of Construction Practice (CoCP).	Construction procedures will follow the CMS and CoCP, with measures to control specific health and safety risks identified.
8	All relevant Health and Safety Executive (HSE) procedures will be followed.	As with the CMS, construction procedures will consider all relevant health and safety risks and follow HSE legislation and guidance to mitigate these potential risks.
24	Development of, and adherence to, a Development Specification and Layout Plan (DSLP). The development of the DSLP includes consultation with the relevant authorities for approval, including the MCA and Northern Lighthouse Board.	Best practice favours the preservation *in situ* of archaeological remains (The Crown Estate, 2021), therefore the ideal preferred mitigation for archaeological remains is avoidance. The DSLP will detail the layout of the Proposed Development which will avoid known archaeological receptors where practicable. Anomalies should be further investigated if directed impacts cannot be avoided. Reporting through the PAD will be undertaken should material of potential archaeological interest be encountered (The Crown Estate, 2014).
29	The identification and implementation of AEZs around receptors identified as having a known archaeological potential.	Best practice favours the preservation *in situ* of archaeological remains (The Crown Estate, 2021), therefore the ideal preferred mitigation for archaeological remains is avoidance. For the Proposed Development, AEZs have been proposed and will be agreed with MD-LOT through the WSI (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery).
30	The development and implementation of a WSI and PAD.	To ensure all development activities avoid significant impacts on marine archaeology receptors, and to ensure reporting and further mitigation is applied to discoveries on marine archaeology receptors (The Crown Estate, 2021). To ensure that discoveries of unknown archaeological receptors are reported and subject to suitable further mitigation (The Crown Estate, 2014). To ensure that further mitigation measures are implemented if a significant effect on a maritime archaeology receptor cannot be avoided. To be agreed on a case-by-case basis with MD-LOT as applicable (The Crown Estate, 2021).
31	Archaeological input into the specifications of relevant site pre-construction geophysical, geotechnical and Remotely Operated Vehicle (ROV) surveys with appropriate monitoring or analysis, if necessary.	To identify any sites of archaeological importance that may require further investigation, avoidance or engagement with MD-LOT (The Crown Estate, 2014). Relevant surveys will cover areas that will be subject to impacts, which may be within or outside areas that have previously been surveyed.

ID*	Embedded Mitigation Adopted as Part of the Proposed Development	Justification
34	Drafting and implementation of a decommissioning programme, prepared in accordance with the requirements of the Energy Act 2004, and which will set out the extent of infrastructure to be removed as well as the methods and processes which will be used.	The aim if this plan is to adhere to the existing legislation and guidance (at the time of writing) during the decommissioning phase. This programme will be developed to reduce the amount of long-term disturbance to the environment as far as reasonably practicable.
38	Identification and implementation of Temporary Exclusion Zones (TEZs) around encounters of previously unknown archaeological sites.	To ensure that discoveries of unknown archaeological receptors of significance are avoided and subject to suitable mitigation (The Crown Estate, 2014).
39	Design and micrositing of Offshore Infrastructure to avoid known archaeological receptors, including those identified in pre-construction surveys.	Best practice favours the preservation *in situ* of archaeological remains (the Crown Estate, 2021). Therefore, the ideal preferred mitigation for archaeological remains is avoidance. Anomalies should be further investigated if direct impacts cannot be avoided. Reporting through the PAD will be undertaken should material of potential archaeological interest be encountered (The Crown Estate, 2014).

*See Volume 3, Technical Appendix 4.6: Schedule of Mitigation and Commitments

19.10 Assessment of Significance

19.10.1 Table 19.10 summarises the potential effects arising from the construction, O&M and decommissioning phases of the Proposed Development, as well as the MDS against which each impact has been assessed. An assessment of the likely significance of the effects of the Proposed Development on marine archaeology receptors caused by each identified impact is given below.

IMPACT 1 – SEDIMENT DISTURBANCE AND DEPOSITION LEADING TO INDIRECT IMPACTS ON MARINE ARCHAEOLOGY RECEPTORS

19.10.2 Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors may arise due to seabed activities associated with the construction, O&M and decommissioning phases of the Proposed Development. The MDS includes drilling for pile installation, sandwave clearance and cable installation in the construction phase, cable repair and reburial in the O&M phase and decommissioning activities such as cable removal. These activities are presented in Table 19.10.

All Phases

Magnitude of Impact

19.10.3 The magnitude of indirect impacts on marine archaeological receptors from sediment disturbance and deposition has been considered using numerical modelling, at multiple locations in the Array Area and along the Export Cable Corridor. A full description of each sediment disturbance scenario is set out in Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment.

19.10.4 The sediment plumes are characterised as spatially constrained, transient and aligned with the tidal axis. A rectilinear pattern of tidal currents is observed

across the Proposed Development and is approximately parallel to the coastline.

19.10.5 The coarser sand and gravel at each disturbance site is predicted to settle to the seabed within a limited time of release (from seconds to up to five minutes) and so will tend to be deposited within a relatively small footprint (from metres up to 200 m), resulting in a relatively greater local average deposited sediment thickness of <500 mm during spring tides in the Array Area and Export Cable Corridor, and <800 mm during neap tides. Finer sediments will remain in suspension for longer, becoming relatively more dispersed over time, resulting in a locally limited or an immeasurable thickness settled sediment layer (in the order of <5 mm, but potentially over a larger area). The predicted effect of plumes (measurable changes in SSC and sediment deposition) are therefore largely confined to the near vicinity of disturbance activities (Section 2.4, Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment).

19.10.6 Analysis set out in the Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment confirms that changes to the SSC and deposition within designated areas of seabed would be limited and largely confined to the vicinity of construction and decommissioning activities, this is also the case for any O&M activities.

19.10.7 For upstanding wrecks, overburden deposited as a result of sediment plumes has the potential to compress and collapse the fabric of the wreck, leading to an adverse impact. For all other receptors, in general, burial will provide some level of protection from biological, chemical and physical erosion to the receptor, and could be classified as beneficial (Björdal and Nilsson, 2008).

19.10.8 The impact is predicted to be of regional spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude of impact is therefore considered to be low adverse with respect to upstanding wrecks or low beneficial with respect to additional protection to erosion for all other receptors.

Sensitivity of the Receptor

19.10.9 The disturbance of sediment can result in the burial or smothering of known and as yet unknown marine archaeology receptors (e.g. wreck sites and geophysical anomalies).

19.10.10 Whilst marine archaeology receptors cannot typically adapt, tolerate or recover from impacts resulting in damage or loss to the receptors themselves, they can tolerate some indirect impacts, such as burial or exposure without significant adverse impact, particularly if these impacts are temporary and short term, and if they are subject to periodic burial or exposure through the normal physical process of their environment. Marine archaeology receptors can typically tolerate some smothering caused by sediment deposition.

19.10.11 Marine archaeology receptors still cannot recover from any changes in their fabric or context caused by these indirect impacts, for instance, the collapse of their fabric through smothering effects. Upstanding wrecks are the most susceptible to these impacts and would usually also represent the most valuable receptors. There are high potential marine archaeology receptors in

the Marine Archaeology Study Area, one of which is an upstanding wreck, but these are subject to AEZs which will preclude the greatest impacts. There may be more upstanding wrecks within the Marine Archaeology Study Area that are outside the Marine Archaeology Survey Area, particularly associated with UKHO or Trove records. Any such upstanding wrecks present will have the benefit of TEZs as a part of the Embedded Mitigation listed in Section 19.9. Therefore, the vulnerability of the receptor is considered medium.

19.10.12 Marine archaeology receptors are deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore considered to be high.

Significance of the Effect

19.10.13 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 or moderate adverse significance, which is not significant in EIA terms.

19.10.14 Expert professional judgement has been used in concluding that the significance is minor, rather than moderate, which is not significant in EIA terms. This is due to the majority of receptors receiving a beneficial effect (i.e. protection through burial), with only high potential receptors susceptible to adverse effect and the application of AEZs and TEZs, which will limit the magnitude of impact on high potential receptors, the significance of effect is considered to be **Minor** adverse.

Additional Mitigation and Residual Effect

19.10.15 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

IMPACT 2 – DIRECT DAMAGE TO MARINE ARCHAEOLOGY RECEPTORS

19.10.16 Direct damage to marine archaeology receptors may arise from activities in the construction, O&M and decommissioning phases. All activities that impact the seabed have the potential to directly impact archaeological material, and include:

- seabed preparation including sandwave clearance;
- the installation of the IACs, Interconnector Cables and Offshore Export Cables;
- the installation of Wind Turbine and OSP foundations; and
- any vessel anchoring and jack-up activities.

19.10.17 Such activities may also impact the relationship between a receptor and the wider environment (a source of archaeological information known as archaeological context). Marine archaeological receptors with height, such as shipwrecks, may also be impacted by activities that occur within the water column, including mooring and anchoring activities. The MDS for direct damage to marine archaeology receptors is presented in Table 19.10.

19.10.18 For the purposes of this assessment, the impacts of O&M and decommissioning activities are predicted to be no greater than those for construction. As the

construction phase represents the MDS, all impacts during O&M and decommissioning would take place entirely within the area impacted by construction activities. Therefore, there is no impact pathway to novel direct impacts on marine archaeology receptors during the O&M and decommissioning phase.

All Phases

Magnitude of Impact

19.10.19 For known marine archaeology receptors, following the application of Embedded Mitigation measures as outlined in Section 19.9, impacts will be avoided. This is particularly the case through the implementation of AEZs around high and medium potential anomalies and known wrecks. These measures interrupt the impact pathway for direct impacts on known marine archaeology receptors.

19.10.20 Currently classified low potential geophysical anomalies are not presently believed to be of archaeological significance. Further investigation and classification of these can take place during the pre-construction phase and avoidance of receptors that transpire to be of archaeological significance can also take place, through the implementation of AEZs, TEZs and micrositing, as appropriate. More detail can be found in Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery.

19.10.21 However, it is not possible to plan to avoid heritage assets that have not yet been discovered and so the greatest magnitude of impact would involve impacts on potential receptors.

19.10.22 Much of the Embedded Mitigation measures set out in Section 19.9 will serve to reduce the likelihood of impacts, for instance archaeological assessment and interpretation of pre-construction geophysical data would reduce, as far as possible, the potential for unintended impacts on currently unknown receptors during construction phase activities. If features of archaeological interest are identified during these pre-construction surveys, they would be subject to the same mitigation as described for known heritage assets. Where impacts to potential marine archaeology receptors are foreseen (particularly low potential geophysical anomalies), they are subject to pre-construction site investigation geophysical survey, UXO identification surveys by a ROV or diver, or potentially targeted archaeological works. Similarly, the PAD attempts to ensure that features of archaeological interest identified during all construction activities are reported, following which the Embedded Mitigation can be applied as appropriate.

19.10.23 These Embedded Mitigation measures cannot exclude entirely the possibility of a significant effect to receptors that are not identified through geophysical survey (often very high value receptors such as aircraft material and buried wooden wrecks have little geophysical expression).

19.10.24 Where an unknown receptor is discovered through construction phase activities, often the act of discovery is through an impact of high adverse magnitude, damaging the archaeological receptor itself and/or removing it from its archaeological context. There may also be situations where a receptor is

discovered or already known, but impacts are unavoidable due to other project constraints. In these cases, the WSI and PAD (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery) sets out a framework for further remedial measures which will be applied on a case-by-case basis, in consultation with MD-LOT, but could include, *inter alia,* recovery, relocation, excavation, conservation, stabilisation and/or recording of the receptor. The level of mitigation would be determined by the importance of the archaeological receptor. For example, a World War II aircraft or medieval wooden shipwreck may require full excavation, whereas modern debris would require no Additional Mitigation.

19.10.25 In line with the MPS, 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 (UK Government, 2011). The discovery and any subsequent investigation will provide new information on a previously unknown receptor of medium to very high value. This will create the potential for the site to contribute to regional, national and/or international research objectives and provide considerable enhancement to the archaeological or historical interest and knowledge of the asset. Thus, for sites with the highest archaeological value, previously unknown to the archaeological community and the public, this would be defined as an impact of high beneficial magnitude, allowing the application of a beneficial impact to counterbalance the magnitude of the adverse impact. A potential significant effect can therefore be offset by measures to research and publicise the previously unknown receptor.

19.10.26 Direct impacts will occur from a range of activities, most of which would be short term, and intermittent such as seabed preparation activities. In all cases the initial impact to the marine archaeology receptor is likely to be of the highest magnitude, and in all cases will be irreversible. The likelihood of the impact, following application of the Embedded Mitigation, is low.

19.10.27 The impact 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 directly. The magnitude of impact is therefore considered to be negligible adverse.

Sensitivity of the Receptor

19.10.28 Following the application of Embedded Mitigation as outlined in Section 19.9, there is no impact pathway for impacts to known marine archaeology receptors. It is not possible to plan to avoid heritage assets that have not yet been discovered, and so the relevant receptors for this impact are potential (currently unknown) receptors. Potential receptors could include maritime, aviation or seabed prehistory assets. Geophysical anomalies currently identified as being of low archaeological potential also have the possibility to be of higher archaeological value than is currently expected.

19.10.29 Marine archaeology receptors cannot typically adapt, tolerate, or recover from impacts resulting in damage or loss to the receptors themselves, or their context and relationship with their wider environment. As a result, the

sensitivity of a marine archaeology receptor to direct damage can only be determined through its value.

19.10.30 Shipwrecks of all periods and aircraft material have the potential to be of very high value, and so in line with the MPS (UK Government, 2011) and using the precautionary principle, these receptors should be classed as very high sensitivity, at least until further characterisation can be undertaken (Table 19.15).

19.10.31 Isolated maritime, aviation and prehistoric artefacts in secondary contexts have slightly more capacity to tolerate impacts. As their relationship to their context is of lesser meaning than *in situ* remains, impacts would result in a lesser loss of Cultural Significance. In the terminology of relevant guidance, such artefacts would have intrinsic characteristics, and possible associative characteristics, but fewer contextual characteristics (HES, 2019b). However, they still have the potential to be of medium archaeological value and so should be classified as having medium sensitivity.

19.10.32 The greatest sensitivity is for *in situ* currently unknown marine archaeology receptors.

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

Significance of Effect

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

19.10.35 As the relevant receptors are currently unknown, there is a level of uncertainty attached to this level of significance (i.e. it is not certain that any effects of this significance will occur). However, the assessment is based on the precautionary principle and so needs to highlight these potential effects.

Additional Mitigation and Residual Effect

19.10.36 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

IMPACT 3 – DIRECT DAMAGE TO DEEPLY BURIED MARINE ARCHAEOLOGY RECEPTORS

19.10.37 The seabed activities associated with the construction phase, particularly piling, theoretically have the potential to directly damage palaeolandscapes and associated archaeological material deeply buried within the Marine Archaeology Study Area that would be unaffected by other more superficial seabed impacts. The relevant receptors for this impact would usually be Pleistocene or Holocene deposits with archaeological or geoarchaeological potential that underlie more recent Quaternary units as well as the surface seabed sediments. This impact would only occur during piling which only takes place in the construction phase, therefore there is no pathway to impact deeply buried receptors during the O&M and decommissioning phases.

Construction Phase

Magnitude of Impact

19.10.38 All direct impacts that result in damage to, or disturbance of, *in situ* prehistoric sites would result in a loss of resource and/or quality and integrity of resource or severe damage to key characteristics, features or elements. Any of these would result in the loss of Cultural Significance. Such an impact would be of high adverse magnitude.

19.10.39 The impact 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 directly. The magnitude of impact is therefore considered to be high.

Sensitivity of the Receptor

19.10.40 Following the palaeolandscapes assessment in Volume 3, Technical Appendix 19.1: Marine Archaeological Technical Report, there is potential for deposits of archaeological value in the nearshore area of the Export Cable Corridor. However, there is very low to no potential for the existence of palaeolandscapes in the Array Area, where piling activities will take place (Volume 3, Technical Appendix 19.1: Marine Archaeology Technical Report). As the only receptors that could be impacted by piling would be located in the Array Area, they can be classified as of negligible value.

19.10.41 Overall, the marine archaeology receptors are deemed to be of low vulnerability, low recoverability and negligible value. The sensitivity of the receptor is therefore considered to be negligible.

Significance of the Effect

19.10.42 Overall, for deeply buried marine archaeology receptors the magnitude of the impact is deemed to be high adverse and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

19.10.43 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

IMPACT 4 - ALTERATION OF SEDIMENT TRANSPORT REGIMES LEADING TO INDIRECT IMPACTS ON MARINE ARCHAEOLOGY RECEPTORS

19.10.44 The presence of infrastructure on the seabed during the O&M phase has the potential to alter sediment transport regimes. As a result, changes in sediment may indirectly impact marine archaeology receptors present in the Marine Archaeology Study Area through burial or exposure. The MDS for the relevant activities are presented in Table 19.10.

19.10.45 The alteration of sediment transport regimes can result in the exposure or further exposure of known marine archaeology receptors (e.g. wreck sites and geophysical anomalies) and the exposure of as yet unknown marine archaeology receptors. Such processes can also result in the burial of known and unknown receptors.

O&M Phase

Magnitude of Impact

19.10.46 The installation of the Proposed Development may lead to altered sediment transport pathways (Volume 3, Technical Appendix 7.1: Physical Processes Technical Report). The MDS includes the installation of Wind Turbine foundations, OSP foundations and associated Scour Protection. These have the potential to alter sediment transport pathways in a manner that would impact marine archaeology receptors.

19.10.47 Numerical modelling of sediment transport (driven by tidal currents) was carried out in order to consider the changes associated with the MDS for blockage due to foundations within the Array Area. These are described in full in Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment. No measurable change in residual sand transport rate or direction is predicted either within the Array Area, or elsewhere, at the resolution of the model (approximately 100 m). In addition, for all areas in which cable protection is used it is not expected that the presence of the cable protection devices will continuously affect patterns of sediment transport following the initial period of accumulation (Volume 2, Chapter 7: Physical Processes).

19.10.48 Localised narrow wake features may result in changes to seabed morphology immediately around the foundation bases in the form of scour. Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment also provides a scour assessment. Scour is expected to be highly localised in areas where infrastructure foundations are installed. The Embedded Mitigation measures mean following the completion of a scour assessment, where there is the potential for scour to develop around Offshore Infrastructure, appropriate Scour Protection will be put in place. Where Scour Protection is used, primary scour is unlikely to occur, although a small amount of secondary scour may develop at the edges of the Scour Protection in response to the interaction between the Scour Protection materials and foundation, and the hydrodynamic and sediment transport regimes.

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

Sensitivity of the Receptor

19.10.50 Whilst marine archaeology receptors cannot typically adapt, tolerate, or recover from impacts resulting in damage or loss to the receptors themselves, they can tolerate some indirect impacts such as burial or exposure without significant adverse impact, particularly if these impacts are temporary and short term, and if they are subject to periodic burial/exposure through the normal physical processes of their environment.

19.10.51 However, marine archaeology receptors still cannot recover from any changes in their fabric or context caused by these indirect impacts, for instance deterioration in their fabric through increased erosion or scour causing undermining and collapse. The upstanding and partially upstanding wrecks

classified as high potential (Section 19.6) are most susceptible to these impacts. In addition, these indirect impacts may affect any unknown marine archaeology receptor and taking a precautionary approach the value of the receptor is considered to be very high.

19.10.52 Overall, the marine archaeology receptors are deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore considered to be high.

Significance of the Effect

19.10.53 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.

Additional Mitigation and Residual Effect

19.10.54 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

19.11 Inter-Related Effects

19.11.1 A description of the likely Inter-Related Effects arising from the Proposed Development on marine archaeology receptors is provided in Volume 2, Chapter 23: Inter-Related Effects.

19.11.2 Inter-relationships are considered to be the impacts and associated effects of different aspects of Bowdun OWF on the same receptor. Inter-Related Effects are considered to be either:

- Lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of Bowdun OWF (construction, O&M and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three project stages (e.g. underwater sound effects from piling, operational Wind 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 Infrastructure and Other Users, such as displacement of recreational activities and impacts to cables or pipelines or restrictions on access to these assets, 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.

19.11.3 For marine archaeology, the following potential impacts have been considered within the inter-related assessment:

- sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors; and
- alteration of sediment transport regimes leading to indirect impacts on marine archaeology receptors.

19.11.4 Table 19.17 lists the Inter-Related Effects (project lifetime effects) that are predicted to arise during the construction, O&M, and decommissioning of the Proposed Development and also the Inter-Related Effects (receptor-led effects) that are predicted to arise for marine archaeology receptors.

Table 19.17: Summary of Likely Significant Inter-Related Effects for Marine Archaeology from Individual Effects Occurring Across the Construction, O&M and Decommissioning Phase of the Proposed Development (Project Lifetime Effects) and from Multiple Effects Interacting Across all Phases (Receptor-led Effects)

Description of Impact	Phase			Likely Significant Inter-Related Effects
	C	O&M	D	
Project Lifetime Effects				
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	✓	✓	✓	When sediment disturbance and deposition are considered additively across all phases, the volume of sediment deposited is larger than when considered across an individual phase (i.e. just construction). The majority of seabed disturbance (resulting in highest SSC and deposition) will occur during the construction and decommissioning phases, with effects being short lived and intermittent across each phase. Meaningful sediment plume interaction generally only has the potential to occur if the activities generating the sediment plumes occur at the same time. Due to this, and the medium vulnerability and medium recoverability of marine archaeology receptors to indirect impacts from sediment disturbance and deposition, the interaction of these impacts across the stages of the Proposed Development lifecycle are not anticipated to interact in such a way as to result in Inter-Related Effects of greater significance than the assessments presented for each individual phase. As a result, the Inter-Related Effects are of minor adverse significance, which is not significant in EIA terms.
Receptor-led Effects				
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors **Alteration of sediment transport regimes leading to indirect impacts on marine archaeology receptors**	×	✓	×	Potential exists for spatial and temporal interactions between the effects arising from increased SSC and sediment deposition and alteration of sediment transport regimes on marine archaeology receptors during the O&M phase of the Proposed Development. The impacts of sediment disturbance and deposition are predicted to be short lived and intermittent. In addition the majority of seabed disturbance resulting in the highest SSC and deposition will occur during the construction and decommissioning phases, whereas the largest magnitude of impact for the alteration of sediment transport regimes is predicted in the O&M phase, although this is assessed to be of negligible magnitude. It is therefore predicted that any Inter-Related Effect will not be of any greater significance than those impacts already assessed in isolation (i.e. minor adverse). Furthermore, the impacts of the alteration of sediment transport regimes may expose or bury marine archaeology receptors, and sediment deposition could only bury them. In general, burial can be seen as a beneficial impact, as it slows the physical, chemical and biological deterioration of marine archaeology receptors (Björdal and Nilsson, 2008). The receptor-led impact would therefore likely be burial and therefore beneficial in nature. As a result, the receptor-led effects are of minor adverse significance which is not significant in EIA terms.

19.12 Cumulative Effects Assessment

Methodology

19.12.1 The CEA assesses the impact associated with the Proposed Development together with other relevant projects and activities. Cumulative effects are defined as the effect of the Proposed Development in combination with the effects from a number of different projects, on the same receptor or resource. Further details on CEA methodology are provided in Volume 1, Chapter 4: Environmental Impact Assessment Methodology.

19.12.2 The projects selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening) which provides further information in relation to other projects and how this information is obtained and applied to the assessment. 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. For marine archaeology, projects that overlap the with the 2 km Marine Archaeology Study Area have been screened into the CEA. As impacts from the Proposed Development would be limited and largely confined to the vicinity of construction, O&M and decommissioning activities (Section 19.10), there is no pathway for cumulative impacts on marine archaeology receptors beyond the Marine Archaeology Study Area.

19.12.3 In undertaking the CEA for the Proposed Development, it is important to bear in mind that other projects under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside the Proposed Development. Therefore, a tiered approach has been adopted. This provides a framework for placing relative weight upon the potential for each project to be included in the CEA to ultimately be realised, based upon the project's current stage of maturity and certainty in the projects' parameters. The tiered approach which will be utilised within the Proposed Development CEA employs the following tiers:

- Tier 1 – The onshore elements of the Project;
- Tier 2 – Projects that have an application submitted, are consented, under construction or operational to the extent not already captured with the baseline;
- Tier 3 – Projects which have submitted a scoping report and/or have received a Scoping Opinion; and
- Tier 4 – Reasonably foreseeable projects including those with Crown Estate Scotland option or lease agreements.

19.12.4 The specific projects scoped into the CEA for marine archaeology, are outlined in Table 19.18 and are displayed in Figure 19.2. The onshore elements of the Project in general have no physical effect-receptor pathway with marine archaeology receptors. The onshore elements of the Project are therefore not scoped into the CEA. There are also no Tier 4 projects within the Marine Archaeology Study Area that have a conceptual effect-receptor pathway with

marine archaeology receptors. Therefore, only Tier 2 and Tier 3 projects are assessed in the CEA.

19.12.5 The range of potential cumulative impacts that are identified and included in Table 19.19 below, is a subset of those considered for the Proposed Development alone assessment. This is because some of the potential impacts identified and assessed for the Proposed Development alone, are localised and temporary in nature. It is considered therefore, that these potential impacts have limited or no potential to interact with similar changes associated with other plans or projects. These have therefore been scoped out of the CEA. The potential impacts scoped out of the CEA are:

- alteration of sediment transport regimes leading to indirect impacts on marine archaeology receptors, as the Project alone assessment considered the magnitude of this impact to be negligible and therefore it has limited or no potential to interact with similar changes associated with other plans or projects. In addition, the projects scoped into the CEA are both cables, and will have a lower magnitude of impact for alteration of sediment transport regimes than the Proposed Development (National Grid Electricity Transmission and Scottish Hydro Electric Transmission, 2022a); and
- direct damage to deeply buried marine archaeology receptors, as the relevant receptor is of negligible sensitivity, and there are no other projects that include piling overlapping the Marine Archaeology Study Area.

19.12.6 Similarly, some of the potential impacts considered within the Proposed Development alone assessment are specific to a particular phase of development (e.g. construction, O&M or decommissioning). Where the potential for cumulative effects with other projects only have potential to occur where there is spatial or temporal overlap with the Proposed Development during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no projects have been identified that have the potential for cumulative effects during this period.

Table 19.18: List of Other Projects Considered within the CEA for Marine Archaeology

Project	Status	Distance from Proposed Development (km)	Description of Project	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development
Tier 2						
Eastern Green Link 2	Under Construction	0.00	2 GW subsea cable connecting Peterhead in Aberdeenshire and Drax in North Yorkshire.	Present - 2028	2029 - unknown	Project O&M phase overlaps with the construction and O&M phases of the Proposed Development
Tier 3						
Morven Hawthorn Pit Grid Connection Project	Pre-Application	1.81	Consists of the onshore and offshore infrastructure associated with the Morven Offshore Wind Farm. Up to six export cables with a capacity of 525 kV.	2029 - 2032	2033 - unknown	Project construction and O&M phases overlap with the construction and O&M phases of the Proposed Development

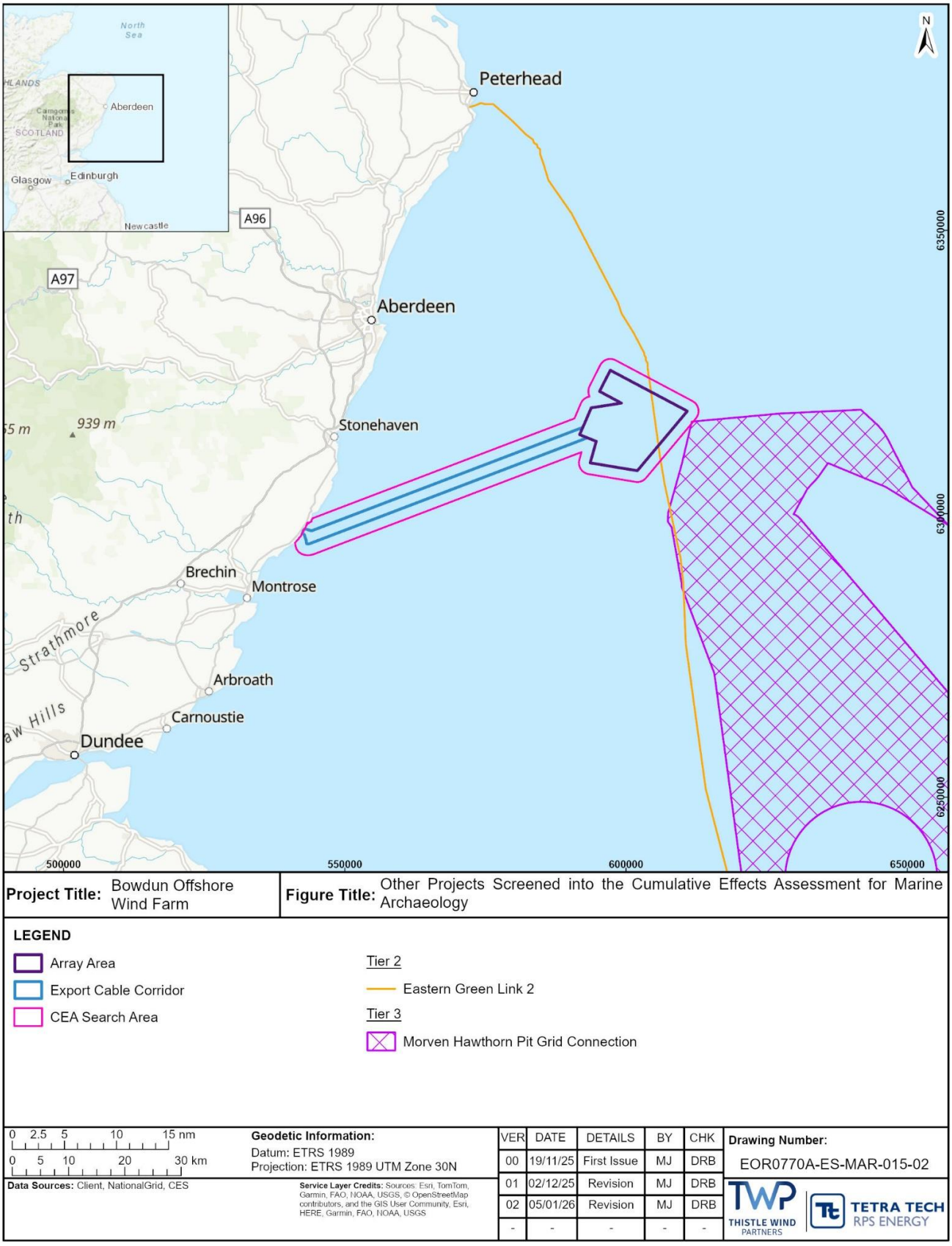

Figure 19.2: Other Projects Screened into the Cumulative Effects Assessment for Marine Archaeology

Maximum Design Scenario

19.12.7 The MDS identified in Table 19.19 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 details provided in Volume 1, Chapter 3: Project Description as well as the information available on other projects (see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening), to inform an MDS. Any other development scenario within the PDE, will result in the same, or less, level of environmental effect.

Table 19.19: Maximum Design Scenario Considered for Each Impact as part of the Assessment of Likely Significant Cumulative Effects on Marine Archaeology

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	✓	✓	✓	MDS as described for the Proposed Development (Table 19.10) assessed cumulatively with: • Eastern Green Link 2 (Tier 2); and • Morven Hawthorn Pit Grid Connection Project (Tier 3).	A CEA search area of 2 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. This area is equivalent to the Marine Archaeology Study Area. As sediment disturbance and deposition from the Proposed Development would be limited and largely confined to the vicinity of construction, O&M and decommissioning activities (Section 19.10), there is no pathway for cumulative impacts on marine archaeology receptors beyond the Marine Archaeology Study Area. The Tier 2 to Tier 3 projects detailed in the MDS column have been screened in as they have the potential to cause cumulative sediment disturbance and deposition and therefore require consideration at a cumulative scale with the Proposed Development.
Direct damage to marine archaeology receptors	✓	✓	✓	MDS as described for the Proposed Development (Table 19.10) assessed cumulatively with: • Eastern Green Link 2 (Tier 2); and • Morven Hawthorn Pit Grid Connection Project (Tier 3).	A CEA search area of 2 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. This area is equivalent to the Marine Archaeology Study Area. As direct damage from the Proposed Development would be confined to the location of the relevant activities (Section 19.10), there is no pathway for cumulative impacts on marine archaeology receptors beyond the Site Boundary. The Tier 2 to Tier 3 projects detailed in the MDS column have been screened in as they have the potential to cause cumulative direct damage to marine archaeology receptors and therefore require consideration at a cumulative scale with the Proposed Development.

* Project Phase refers to construction (C), O&M (O) and decommissioning (D).

Cumulative Effects Assessment

19.12.8 An assessment of the likely significance of the cumulative effects of the Proposed Development upon marine archaeology receptors arising from each identified impact is given below.

CUMULATIVE SEDIMENT DISTURBANCE AND DEPOSITION LEADING TO INDIRECT IMPACTS ON MARINE ARCHAEOLOGY RECEPTORS

Tiers 2 and 3

All Phases

19.12.9 There is potential for indirect impacts to marine archaeology receptors as a result of the Proposed Development's construction, O&M and decommissioning activities alongside other offshore cables within the Marine Archaeology Study Area. The relevant activities include site preparation including sandwave clearance, foundation installation, cable installation, maintenance operations (e.g. cable repair/reburial) and decommissioning activities (e.g. foundation removal), listed in full in Table 19.19. If these are undertaken concurrently, they could result in increased SSC, and associated deposition of sediment.

Magnitude of Impact

19.12.10 Eastern Green Link 2 cable (Tier 2) O&M phase will overlap with the construction and O&M phases of the Proposed Development throughout its entire construction period, while the Morven Hawthorn Pit Grid Connection Project (Tier 3) construction phase will coincide with the construction phase of Proposed Development for approximately two years. However, these activities are expected to be intermittent, short term, and unlikely to occur concurrently in the same location. Specific O&M activities on these cables are also unlikely to take place in close proximity or at the same time as the construction and O&M of the Proposed Development. In particular, safety zones of 500 m and advisory safe passing distances around cable installation vessels will be in place for the Proposed Development during construction and decommissioning as well as O&M (Volume 2, Chapter 16: Infrastructure and Other Users), and these can be expected for the other projects scoped into the CEA as well (National Grid Electricity Transmission and Scottish Hydro Electric Transmission, 2022b). Therefore, the potential for cumulative impacts from SSC on marine archaeology receptors is considered negligible (Table 19.19).

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

Sensitivity of Receptor

19.12.12 Marine archaeology receptors are deemed to be of medium vulnerability, medium recoverability and very high value. The sensitivity of the receptor is therefore considered to be high (Section 19.10).

Significance of Effect

19.12.13 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.

Additional Mitigation and Residual Effect

19.12.14 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation (beyond the Embedded Mitigation outlined in Section 19.9) is not significant in EIA terms.

CUMULATIVE DIRECT DAMAGE TO MARINE ARCHAEOLOGY RECEPTORS IN THE MARINE ARCHAEOLOGY STUDY AREA

Tiers 2 and 3

All Phases

Magnitude of Impact

19.12.15 Known seabed features will be avoided through Embedded Mitigation by the Proposed Development. The other relevant cable projects have also gone, or will also go, through the EIA process, and known receptors are similarly expected to be avoided by those projects through mitigation.

19.12.16 If a receptor does receive a direct impact from a project (likely to be an unknown receptor), the impact is expected to be permanent and irreversible (Paragraph 19.10.16). Therefore, the significance of any further impact from a separate project on the same receptor will then be negligible.

19.12.17 Eastern Green Link 2 cable (Tier 2) O&M phase will overlap with the construction phase and O&M phase of the Proposed Development, while the Morven Hawthorn Pit Grid Connection Project (Tier 3) construction phase will coincide with the construction phase of Proposed Development for approximately two years. The O&M phase of Morven Hawthorn Pit Grid Connection Project will also overlap the O&M phase of the Proposed Development for four years (Table 19.18). Most direct impacts to marine archaeology receptors in the construction phases will have already happened in Eastern Green Link 2 and would form part of the baseline of the Proposed Development.

19.12.18 The cumulative impact 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 directly. The magnitude of impact is therefore, considered to be negligible.

Sensitivity of Receptor

19.12.19 Overall, the marine archaeology receptors are deemed to be of high vulnerability, low recoverability and very high value. The sensitivity of the receptor is therefore considered to be very high (Paragraph 19.10.16).

Significance of Effect

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

Additional Mitigation and Residual Effect

19.12.21 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation (beyond the Embedded Mitigation outlined in Section 19.9) is not significant in EIA terms.

19.13 Proposed Monitoring

19.13.1 All of the potential effects to marine archaeology receptors are identified as not significant in terms of EIA Regulations, with the current acknowledgement of the Embedded Mitigation (e.g. the implementation of AEZs, Table 19.16). However, in line with relevant guidance, monitoring is proposed to verify there have been no significant adverse impacts related to marine archaeology. Proposed monitoring measures are outlined in Table 19.20 below.

Table 19.20: Proposed Monitoring and the Method of Implementation for Marine Archaeology

Potential Environmental Effect	Monitoring Commitment	Means of Implementation
Direct or indirect impacts on marine archaeological receptors within the proposed AEZs	Monitoring of AEZs should be carried out to confirm that no impact has occurred to the archaeological receptors within the proposed AEZs (The Crown Estate, 2021). This should be undertaken at a minimum. • Post-construction; ad • Post-decommissioning.	Through the archaeological assessment on relevant geophysical data (acquired by the Applicant for any purpose) or by other means (such as ROV survey) agreed with MD-LOT in a method statement. Further details are provided in the WSI and PAD (Volume 4, Appendix 33: Written Scheme of Investigation and Protocol for Archaeological Discovery).

19.14 Transboundary Effects

19.14.1 A screening of transboundary effects has been carried out (see Volume 3, Technical Appendix 4.5: Transboundary Impacts Screening) and any potential for significant transboundary effects with regard to marine archaeology from the Proposed Development upon the interests of European Economic Area States has been assessed as part of the EIA. All predicted impacts on marine archaeology are likely to be limited in extent to the Marine Archaeology Study Area. As such there is no pathway for impacts (direct or indirect) arising from the Proposed Development to occur outside of the Marine Archaeology Study Area, and therefore there is no potential for transboundary impacts.

19.15 Summary of Impacts, Mitigation, Likely Significant Environmental Effects and Monitoring

19.15.1 Information on marine archaeology within the Marine Archaeology Study Area was collected through desktop review and site-specific geophysical survey. This information is summarised in Table 19.7 and Table 19.8.

19.15.2 Table 19.21 presents a summary of the assessment of significance in respect to marine archaeology.

19.15.3 Overall, it is concluded that there will be no likely significant environmental effects on marine archaeology arising from the Proposed Development during the construction, O&M or decommissioning phases.

19.15.4 Table 19.22 presents a CEA on marine archaeology in EIA terms.

19.15.5 Overall, it is concluded that there will be no likely significant cumulative effects on marine archaeology from the Proposed Development alongside other projects.

19.15.6 No likely significant transboundary effects have been identified in regard to effects of the Proposed Development.

Table 19.21: Summary of Assessment of Significance

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
All Phases							
Impact 1: Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	7, 8, 24, 29, 30, 31, 34, 38, 39	Low	High	Minor adverse	None required	N/A	Monitoring of AEZs to confirm that no impact has occurred to the archaeological receptors within AEZs.
Impact 2: Direct damage to marine archaeology receptors	7, 8, 24, 29, 30, 31, 34, 38, 39	Negligible	Very High	Minor adverse	None required	N/A	Monitoring of AEZs to confirm that no impact has occurred to the archaeological receptors within AEZs.
Construction Phase							
Impact 3: Direct damage to deeply buried marine archaeology receptors	7, 8, 24, 29, 30, 31, 34, 38, 39	High	Negligible	Minor adverse	None required	N/A	None
O&M Phase							
Impact 4: Alteration of sediment transportation regimes to indirect impacts	7, 8, 24, 29, 30, 31, 34, 38, 39	Negligible	High	Minor adverse	None required	N/A	Monitoring of AEZs to confirm that no impact has occurred to the archaeological

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
on marine archaeology receptors							receptors within AEZs

Table 19.22: Summary of Cumulative Effects Assessment

Description of Impact	Cumulative Effects Assessment Tier	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
All Phases							
Sediment disturbance and deposition leading to indirect impacts on marine archaeology receptors	Tier 2 and Tier 3	Negligible	High	Minor adverse	None required	N/A	Monitoring of AEZs to confirm that no impact has occurred to the archaeological receptors within AEZs
Direct damage to marine archaeology receptors	Tier 2 and Tier 3	Negligible	Very High	Minor adverse	None required	N/A	Monitoring of AEZs to confirm that no impact has occurred to the archaeological receptors within AEZs

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