RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Environmental Statement

Volume 7

Chapter 17 – Offshore Archaeology and Cultural Heritage

June 2024

Application Reference: 7.17

APFP Regulation: 5(2)(a)

Revision: 01

Unrestricted

Company:	**RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited**	Asset:	**Development**
Project:	**Dogger Bank South Offshore Wind Farms**	Sub Project/Package:	**Consents**
Document Title or Description:	Environmental Statement– Chapter 17 – Offshore Archaeology and Cultural Heritage		
Document Number:	004300158-01	Contractor Reference Number:	PC2340-RHD-OF-ZZ-RP-Z-0100

Rev No.	Date	Status/Reason for Issue	Author	Checked by	Approved by
01	June 2024	Final for DCO Application	RHDHV	RWE	RWE

Contents

17 Offshore Archaeology and Cultural Heritage 17
17.1 Introduction 17
17.2 Consultation 17
17.3 Scope 18
17.3.1 Study Area 18
17.3.2 Realistic Worst Case Scenario 19
17.3.2.1 General Approach 19
17.3.2.2 Development Scenarios 29
17.3.2.3 Operation Scenarios 31
17.3.2.4 Decommissioning Scenarios 31
17.3.3 Embedded Mitigation 32
17.4 Assessment Methodology 33
17.4.1 Policy, Legislation and Guidance 33
17.4.1.1 National Policy Statements 33
17.4.1.2 Other 36
17.4.2 Data and Information Sources 40
17.4.2.1 Site Specific Surveys 40
17.4.2.2 Other Available Sources 45
17.4.3 Impact Assessment Methodology 47
17.4.4 Historic Seascape Character Assessment Methodology 52
17.4.5 Cumulative Effects Assessment Methodology 53
17.4.6 Transboundary Effect Assessment Methodology 53
17.4.7 Assumptions and Limitations 54
17.5 Existing Environment 57
17.5.1 Seabed Prehistory 57
17.5.1.1 Description of Heritage Assets 57
17.5.1.2 Cultural Significance of Heritage Assets 65
17.5.1.3 Importance of Heritage Assets 66
17.5.2 Maritime and Aviation Archaeology 67
17.5.2.1 Description of Heritage Assets 67
17.5.2.2 Cultural Significance of Heritage Assets 78

17.5.2.3 Importance of Heritage Assets 80
17.5.3 Intertidal Archaeology 81
17.5.3.1 Description of Heritage Assets 81
17.5.3.2 Cultural Significance of Heritage Assets 87
17.5.3.3 Importance of Heritage Assets 87
17.5.4 Historic Seascape Character 88
17.5.5 Future Trends 95
17.6 Assessment of Significance 96
17.6.1 Potential Effects During Construction 96
17.6.1.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets 96
17.6.1.2 Impact 2 Direct Impact to Potential Heritage Assets 105
17.6.1.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes 110
17.6.1.4 Impact 4 Changes to the Setting of Heritage Assets 115
17.6.2 Potential Effects During Operation 117
17.6.2.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets 117
17.6.2.2 Impact 2 Direct (Physical) Impact to Potential Heritage Assets 117
17.6.2.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes 120
17.6.2.4 Impact 4: Changes to the Setting of Heritage Assets 121
17.6.3 Potential Effects During Decommissioning 122
17.6.3.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets 122
17.6.3.2 Impact 2 Direct (Physical) Impact to Potential Heritage Assets 122
17.6.3.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes 125
17.6.3.4 Impact 4 Changes to the Setting of Heritage Assets 125
17.7 Potential Monitoring Requirements 125
17.8 Cumulative Effects 126
17.8.1 Screening for Cumulative Effects 126
17.8.2 Schemes Considered for Cumulative Impacts 130
17.8.3 Assessment of Cumulative Effects 133
17.8.3.1 Impact 2 Direct impact to potential heritage assets 133
17.8.3.2 Impact 3 Indirect impact to heritage assets from changes to physical processes 140

17.9 Transboundary Effects 140
17.10 Interactions 141
17.11 Inter-relationships 144
17.12 Summary 145

Tables

Table 17-1 Realistic Worst Case Design Parameters 21
Table 17-2 Development Scenarios and Construction Durations 30
Table 17-3 Embedded Mitigation Measures. 32
Table 17-4 NPS Assessment Requirements 33
Table 17-5 Wessex Archaeology Criteria Discriminating Relevance of Identified Features to the Projects 43
Table 17-6 Other Available Data and Information Sources 45
Table 17-7 Definition of Importance for Cultural Heritage Assets 49
Table 17-8 Definition of Magnitude of Impacts 50
Table 17-9 Definition of Effect Significance 52
Table 17-10 Shallow Geology of the Offshore Archaeology Study Area 59
Table 17-11 Heritage Importance (Seabed Prehistory) 66
Table 17-12 Anomalies of Archaeological Potential Within the Offshore Archaeology Study Area 68
Table 17-13 Types of Anomaly Identified 69
Table 17-14 Known Wrecks and Unidentified A1 Anomalies Within the Offshore Archaeology Study Area 71
Table 17-15 A3 Historic Records Within the Offshore Archaeology Study Area 75
Table 17-16 Heritage Importance (Maritime and Aviation Archaeology) 81
Table 17-17 Heritage Importance (Intertidal Archaeology) 88
Table 17-18 Summary of Historic Seascape Character Types 90
Table 17-19 Recommended AEZs within the Offshore Archaeology Study Area 100
Table 17-20 Potential Cumulative Effects 127
Table 17-21 List of Projects Screened in for CEA 131
Table 17-22 Interactions Between Impacts - Screening 142
Table 17-23 Interaction Between Impacts - Phase and Lifetime Assessment 143
Table 17-24 Offshore Archaeology and Cultural Heritage Inter-Relationships 144

Table 17-25 Summary of Potential Likely Significant Effects on Offshore Archaeology and Cultural Heritage 149

Volume 7 - Figures

Figure 17-1 Historic Seascape Character

Figure 17-2 Historic Seascape Character – Previous Sub Types

Figure 17-3 Cumulative Effects Assessment

Volume 7 – Appendices

Appendix 17-1 Consultation Responses

Appendix 17-2 Archaeological assessment of Geophysical Data for EIA

Appendix 17-3 Palaeolandscapes Assessment of 2022 Marine Geophysical Data

Appendix 17-4 Stage 1 Geoarchaeological Review of Geotechnical Data

Appendix 17-5 Gazetteer of Recorded Losses

Glossary

Term	Definition
Accommodation Platform	An offshore platform (situated within either the DBS East or DBS West Array Area) that would provide accommodation and mess facilities for staff when carrying out maintenance activities for the Projects.
Agreement for Lease (AfL) Area	The Area of the seabed leased by The Crown Estate to the Applicants.
Array Areas	The DBS East and DBS West offshore Array Areas, where the wind turbines, offshore platforms and array cables would be located. The Array Areas do not include the Offshore Export Cable Corridor or the Inter-Platform Cable Corridor within which no wind turbines are proposed. Each area is referred to separately as an Array Area.
Array cables	Offshore cables which link the wind turbines to the Offshore Converter Platform(s).
Aviation archaeology	The remains of crashed aircraft and archaeological material associated with historic aviation activities.
Concurrent Scenario	A potential construction scenario for the Projects where DBS East and DBS West are both constructed at the same time.
Construction Buffer Zone	1km zone around the Array Areas and Offshore Export Cable Corridor, and 500m zone around the Inter-Platform Cabling Corridor. Construction vessels may occupy this zone but no permanent infrastructure would be installed within these areas.
Cumulative effects	The combined effect of the Projects in combination with the effects of a number of different (defined cumulative) schemes, on the same single receptor / resource.
Cumulative Effects Assessment (CEA)	The assessment of the combined effect of the Projects in combination with the effects of a number of different

Term	Definition
	(defined cumulative) schemes, on the same single receptor / resource.
Cumulative impact	The combined impact of the Projects in combination with the effects of a number of different (defined cumulative) schemes, on the same single receptor / resource.
'Dead' wreck	A wreck which has not been detected by repeated surveys, and is therefore considered not to exist
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Project (NSIP).
Development Scenario	Description of how the DBS East and / or DBS West Projects would be constructed either in isolation, sequentially or concurrently.
Dogger Bank South (DBS) Offshore Wind Farms	The collective name for the two Projects, DBS East and DBS West.
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the value, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Electrical Switching Platform (ESP)	The Electrical Switching Platform (ESP), if required would be located either within one of the Array Areas (alongside an Offshore Converter Platform (OCP)) or the Export Cable Platform Search Area.
Environmental Statement (ES)	A document reporting the findings of the EIA and produced in accordance with the EIA Directive as transposed into UK law by the EIA Regulations.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be

Term	Definition
	made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement (ES).
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the Environmental Impact Assessment (EIA) and Habitats Regulations Assessment (HRA) for certain topics.
Expert Topic Group (ETG)	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Fishermen's fastener	An unidentified feature on the seabed recorded by fishermen as an obstruction to trawling.
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record. Includes the study of soils and sediments and of natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes and the effects on buried sites and artefacts.
Glacial / Interglacial	A glacial period is a period of time within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last 1 million years, the Elsterian, the Saalian and the Weichselian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.
Historic seascape character	The attributes that contribute to the formation of the historic character of the seascape.
Horizontal Directional Drill (HDD)	HDD is a trenchless technique to bring the offshore cables ashore at the landfall and can be used for crossing other

Term	Definition
	obstacles such as roads, railways and watercourses onshore.
In Isolation Scenario	A potential construction scenario for one Project which includes either the DBS East or DBS West array, associated offshore and onshore cabling and only the eastern Onshore Converter Station within the Onshore Substation Zone and only the northern route of the onward cable route to the proposed Birkhill Wood National Grid Substation.
Inter-Platform Cable Corridor	The area where Inter-Platform Cables would route between platforms within the DBS East and DBS West Array Areas, should both Projects be constructed.
Inter-Platform Cables	Buried offshore cables which link offshore platforms.
Intertidal	Area on a shore that lies between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS).
Landfall	The point on the coastline at which the Offshore Export Cables are brought onshore, connecting to the onshore cables at the Transition Joint Bay (TJB) above mean high water.
Landfall Evaluation Area	The four fields adjacent to the cliff top within the Landfall Zone of the Onshore Development Area where trial trenching was undertaken by AOC Archaeology Group.
Marine isotope stage	Marine isotope stages are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.
Maritime archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
Mean High Water Springs (MHWS)	MHWS is the average of the heights of two successive high waters during a 24 hour period.

Term	Definition
Mean Low Water Springs (MLWS)	MLWS is the average of the heights of two successive low waters during a 24 hour period.
Mesolithic	10000 to 4000 BC The Middle Stone Age, falling between the Palaeolithic and Neolithic and marking the beginning of a move from a hunter gatherer society towards a food producing society.
Nanotesla	A unit of measurement of a magnetic field, equal to one billionth of a tesla.
Nearshore	The zone which extends from the swash zone to the position marking the start of the offshore zone (~20m).
Offshore Converter Platforms (OCPs)	The OCPs are fixed structures located within the Array Areas that collect the AC power generated by the wind turbines and convert the power to DC, before transmission through the Offshore Export Cables to the Project's Onshore Grid Connection Points.
Offshore Development Area	The Offshore Development Area for ES encompasses both the DBS East and West Array Areas, the Inter-Platform Cable Corridor, the Offshore Export Cable Corridor, plus the associated Construction Buffer Zones.
Offshore Export Cable Corridor	This is the area which will contain the offshore export cables (and potentially the ESP) between the Offshore Converter Platforms and Transition Joint Bays at the landfall.
Offshore Export Cables	The cables which would bring electricity from the offshore platforms to the Transition Joint Bays (TJBs).
Onshore Development Area	The Onshore Development Area for ES is the boundary within which all onshore infrastructure required for the Projects would be located including Landfall Zone, Onshore Export Cable Corridor, accesses, Temporary Construction Compounds and Onshore Converter Stations.

Term	Definition
Outline Marine Written Scheme of Investigation (WSI)	Project specific document forming the agreement between the Applicants, the appointed archaeologists, contractors and the relevant stakeholders seaward of Mean High Water Springs (MHWS). The document sets out the methods to mitigate the effects on all the known and potential archaeological receptors within the Hornsea Four offshore Order Limits.
Palaeogeographic features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing prehistoric physical landscape features such as former river channels (palaeochannels).
Palaeolithic	500000 to 10000 BC The Old Stone Age defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into Lower, Middle and Upper Palaeolithic.
Palaeoenvironmental analysis	The study of sediments and the organic remains of plants and animals to reconstruct the environment of a past geological age.
Preliminary Environmental Information Report (PEIR)	Defined in the EIA Regulations as information referred to in part 1, Schedule 4 (information for inclusion in environmental statements) which has been compiled by the applicant and is reasonably required to assess the environmental effects of the development.
Scoping opinion	The report adopted by the Planning Inspectorate on behalf of the Secretary of State.
Scoping report	The report that was produced in order to request a Scoping Opinion from the Secretary of State.
Seabed features	Features seen on the seafloor in the sidescan sonar or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also

Term	Definition
	includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Seabed prehistory	Archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower.
Sequential Scenario	A potential construction scenario for the Projects where DBS East and DBS West are constructed with a lag between the commencement of construction activities. Either Project could be built first.
The Applicants	The Applicants for the Projects are RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited. The Applicants are themselves jointly owned by the RWE Group of companies (51% stake) and Masdar (49% stake).
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).
Wind turbine	Power generating device that is driven by the kinetic energy of the wind.

Acronyms

Term	Definition
AEZ	Archaeological Exclusion Zones
BP	Before Present
CIfA	Chartered Institute of Archaeologists
CEA	Cumulative Effects Assessment
CHIA	Cultural Heritage Impact Assessment
CITiZAN	Coastal and Intertidal Zone Archaeology Network
DBS	Dogger Bank South
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for the Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ESP	Electrical Switching Platform
ETG	Expert Topic Group
GBS	Gravity Base Structure
GIS	Geographical Information System

Term	Definition
HDD	Horizontal Directional Drilling
HER	Historic Environment Record
HSC	Historic Seascape Characterisation
HVDC	High-Voltage Direct Current
IEMA	Institute of Environmental Management and Assessment
IHBC	Institute of Historic Building Conservation
IPMP	In-Principle Monitoring Plan
JNAPC	Joint Nautical Archaeology Policy Committee
ka	Kilo annum
km	Kilometre
LAT	Lowest Astronomical Tide
LVIA	Landscape and Visual Impact Assessment
m	Metre
Mag.	Magnetometer
MBBS	Multibeam Backscatter
MBES	Multibeam Echosounder
MHWS	Mean High Water Springs
MIS	Marine Isotope Stage
MLWS	Mean Low Water Springs
MoD	Ministry of Defence
MW	Megawatts

Term	Definition
nT	Nanotesla
NHLE	National Heritage List for England
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NRHE	National Record of the Historic Environment
OASIS	Online Access to the Index of Archaeological Investigations
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
OCP	Offshore Converter Platform
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
RAF	Royal Air Force
ROV	Remotely Operated Vehicle
SBP	Sub-bottom Profiler
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
UHRS	Ultra High Resolution Seismic
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation

17 Offshore Archaeology and Cultural Heritage

17.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the likely significant effects of the Projects on Offshore Archaeology and Cultural Heritage. The chapter provides an overview of the existing environment for the proposed Offshore Development Area, followed by an assessment of likely significant effects for the construction, operation, and decommissioning phases of the Projects.

2. The assessment should be read in conjunction with the following linked chapters in **Volume 7**:

   - **Chapter 8 Marine Physical Environment (application ref: 7.8)**; and
   - **Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**.

3. Additional information to support this Offshore Archaeology and Cultural Heritage chapter is included in **Volume 7**:

   - **Appendix 17-1: Consultation Responses (application ref: 7.17.17.1)**
   - **Appendix 17-2: Archaeological Assessment of Geophysical Data for EIA (application ref: 7.17.17.2)**;
   - **Appendix 17-3: Palaeolandscapes Assessment of 2022 Marine Geophysical Data (application ref: 7.17.17.3)**;
   - **Appendix 17-4: Stage 1 Geoarchaeological Review of Geotechnical Data (application ref: 7.17.17.4)**; and
   - **Appendix 17-5: Gazetteer of Recorded Losses (application ref: 7.17.17.5)**.

17.2 Consultation

4. Consultation with regard to offshore archaeology and cultural heritage has been undertaken in line with the general process described in **Volume 7, Chapter 7 Consultation (application ref: 7.7)** and the **Consultation Report (application ref: 5.1)**. The key elements to date include Scoping, formal consultation on the Preliminary Environmental Information Report (PEIR) under Section 42 of the Planning Act 2008 and the ongoing Evidence Plan Process (EPP) via the Historic Environment Expert Topic Group (ETG). The following ETG meetings have been carried out for Offshore Archaeology and Cultural Heritage:

- 15th September 2021 Pre-Scoping ETG for both onshore and offshore archaeology and cultural heritage attended by Historic England, East Riding of Yorkshire Council, Lincolnshire County Council and East Lindsey District Council.
- 19th January 2023 Pre-PEIR ETG for both onshore and offshore archaeology and cultural heritage attended by Historic England and East Riding of Yorkshire Council.
- 10th May 2023 ETG meeting for offshore archaeology and cultural heritage to discuss the approach to geophysical and geoarchaeological assessment attended by Historic England and Wessex Archaeology.
- 20th September 2023 ETG meeting for offshore archaeology and cultural heritage to discuss the interim results of the geophysical and geoarchaeological assessments attended by Historic England and Wessex Archaeology.
- 14th December 2023 ETG meeting for offshore archaeology and cultural heritage to discuss the final results of the geophysical assessment and the approach to the WSI attended by Historic England.

5. In addition, a draft version of the archaeological assessment report (**Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**) was provided to Historic England for comment and a written response was received 19th December 2023.

6. The feedback received throughout this process has been considered in preparing the ES. This chapter has been updated following consultation in order to produce the final assessment submitted within the Development Consent Order (DCO) application. **Volume 7, Appendix 17-1 (application ref: 7.17.17.1)** provides a summary of the consultation responses received to date relevant to this topic, and details how the comments have been addressed within this chapter.

17.3 Scope

17.3.1 Study Area

7. The offshore archaeology and cultural heritage study area (referred to as the Offshore Archaeology Study Area) is defined as the Offshore Development Area, including the intertidal zone at the landfall up to Mean High Water Springs (MHWS) (**Volume 7, Figure 5-1 (application ref: 7.5.1)**). The Offshore Archaeology Study Area corresponds to the footprint within which development activities could occur and, consequently, the area of potential impacts to the offshore archaeology and cultural heritage existing environment.

8. At the landfall, reference is also made to areas of the Onshore Development Area (and study areas as defined in **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**) which are located below MHWS and overlap with the Offshore Archaeology Study Area. The onshore archaeology study areas comprise:

   - Non-Designated Heritage Assets Study Area – known non-designated heritage assets, potential buried archaeological remains and previously unrecorded above ground heritage assets within 500m of the Onshore Development Area (**Volume 7, Figure 22-1 (application ref: 7.22.1)**); and
   - Designated Heritage Assets Study Area – designated heritage assets within 1km of the Onshore Development Area and 5km of the onshore Substation Zones, to inform a setting assessment of heritage assets identified as potentially being affected by the development through a change in their setting (**Volume 7, Figure 22-1 (application ref: 7.22.1)**).

9. As there are no designated heritage assets within the Offshore Archaeology Study Area below MHWS, reference is made only to the Non-Designated Heritage Assets Study Area as relevant to intertidal archaeology, as described in section 17.5.3.

17.3.2 Realistic Worst Case Scenario

17.3.2.1 General Approach

10. The realistic worst case design parameters for likely significant effects scoped into the ES for the offshore archaeology and cultural heritage assessment are summarised in **Table 17-1**. These are based on the project parameters described in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**, which provides further details regarding specific activities and their durations.

11. In addition to the design parameters set out in **Table 17-1**, consideration is also given to the different Development Scenarios still under consideration and the possible phasing of the construction as set out in sections 17.3.2.2 to 17.3.2.4.

12. The worst case scenario for archaeology below MHWS is based upon the general assumption that the greatest potential footprint for the Projects represents the greatest potential for direct impacts (e.g. damage / destruction) to surviving archaeological material which could be present on the sea floor or buried within seabed deposits.

13. The worst case scenario for indirect impacts equates to those aspects of the Projects which result in the greatest potential for increased scour and sediment stripping across an area as a result of changes to physical processes. Conversely, those aspects of the Projects which result in the greatest increase in sediment deposition also represent the greatest potential effect in terms of the beneficial impact of increased protection for archaeology.

14. With regard to historic seascape character, the worst case scenario is considered in terms of the capacity for the seascape to accommodate change. Whilst **Table 17-1** makes reference to the maximum intrusive effect (e.g. number and type of new infrastructure elements, height of infrastructure etc.) for the longest duration (i.e. the maximum potential change), this is further qualified by the narrative description provided in section 17.5.4.

Table 17-1 Realistic Worst Case Design Parameters

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
Construction In the instance of sequential development of the two Projects, up to a two-year lag between construction activities is possible, final overall area would be identical to the concurrent design scenario.				
Impact 1: Direct (physical) impact to known heritage assets **Impact 2: Direct impact to potential heritage assets**	**Array Areas** **Total Array Area assessed for ES – 427km²** (349km² for Array Area + 78km² construction buffer area) **Total area of disturbance within Array Areas – 11,207,499m²**	**Array Areas** **Total Array Area assessed for ES – 434km²** (355km² for Array Area + 79km² construction buffer area) **Total area of disturbance within Array Areas – 11,517,499m²**	**Array Areas** **Total Array Area assessed for ES – 1008km²** (874km² for Array Areas and Inter Platform Cabling Area + 134km² construction buffer area) **Total area of disturbance within Array Areas – 24,924,843m²**	The worst case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits. Total area disturbance includes Array and Inter-Platform Cables trenching, sandwave levelling, foundation installation and vessel impacts. Construction buffer Zone measures 1km surrounding each Array Area, and 500m surrounding the Inter-Platform Cable Corridor. Construction vessels may occupy this area but no construction will occur within these areas. Figure totals include a mix of large and small turbine parameters to represent an absolute worst-case situation. As such covers for a scenario where a mix of small and large turbines are utilised in the build-out of the Projects. Pre-lay grapnel run (PLGR) activities will fall within the area of the cable trench disturbance width of 20m. In situations where a number does not divide equally between DBS East and DBS West (e.g. 113 large turbines), rounded up to higher number (e.g. 57 large turbines as opposed to 56.5).
	Array and Inter-Platform Cables **Maximum area disturbed (trenching + sandwave levelling) – 9,900,000m²** Array cable trench area (325,000m x 20m boulder plough width) – 6,500,000m² Inter-Platform Cables trench area (115,000m x 20m disturbance width) – 2,300,000m² Maximum seabed area disturbed by sandwave levelling – 1,100,000m²	Array and Inter-Platform Cables **Maximum area disturbed (trenching + sandwave levelling) – 10,210,500m²** Array cable trench area (325,000m x 20m boulder plough width) – 6,500,000m² Inter-Platform Cables trench area (129,000m x 20m disturbance width) – 2,576,000m² Maximum seabed area disturbed by sandwave levelling – 1,134,500m²	Array and Inter-Platform Cables **Maximum area disturbed (trenching + sandwave levelling) – 22,309,875m²** Array cable trench area (650,000m x 20m boulder plough width) – 13,000,000m² Inter-platform cable trench area (342,000m x 20m disturbance width) – 6,831,000m² Maximum seabed area disturbed by sandwave levelling – 2,478,875m²	
	Foundations, Offshore Platforms and Vessel Impacts Within Array Areas **Maximum area disturbed (foundations, platforms, vessel jack-up locations and anchoring) – 1,307,591m²** Maximum penetration depth for wind turbines and offshore platforms (monopile and pin pile jacket foundations) – 60m	Foundations, Offshore Platforms and Vessel Impacts Within Array Areas **Maximum area disturbed (Maximum area disturbed (foundations, platforms, vessel jack-up locations and anchoring) – 1,307,591m²** Maximum penetration depth for wind turbines and offshore platforms (monopile and pin pile jacket foundations) – 60m	Foundations, Offshore Platforms and Vessel Impacts Within Array Areas **Maximum area disturbed (foundations, platforms, vessel jack-up locations and anchoring) – 2,614,968m²** Maximum penetration depth for wind turbines and offshore platforms (monopile and pin pile jacket foundations) – 60m	

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
	Seabed preparation area for 100 small turbine monopile foundations (including scour protection) – 358,498m² Seabed preparation area for four offshore platforms (monopile foundations), including scour protection – 24,889m² Area of seabed contact for vessel jack-up assuming six jack-up locations per turbine (275m² per jack up leg x four legs x six operations per turbine x 100 small turbines) – 660,000m² Area of seabed contact for vessel jack-up for all platforms in Array Areas (1,100m² combined leg area x five operations per platform x four platforms) – 22,000m² Anchoring area (116m² area x four anchors per activity x five activities requiring the deployment of anchors x 100 small turbines + four offshore platforms) – 242,112m²	Seabed preparation area for 100 small turbine monopile foundations (including scour protection) – 358,498m² Seabed preparation area for four offshore platforms (monopile foundations), including scour protection – 24,889m² Area of seabed contact for vessel jack-up – assuming six jack-up locations per turbine (275m² per jack up leg x four legs x six operations per turbine x 100 small turbines) – 660,000m² Area of seabed contact for vessel jack-up for all platforms in Array Areas (1,100m² combined leg area x five operations per platform x four platforms) – 22,000m² Anchoring area (116m² area x four anchors per activity x five activities requiring the deployment of anchors x 100 small turbines + four offshore platforms) – 242,112m²	Seabed preparation area for 200 small turbine monopile foundations (including scour protection) – 716,966m² Seabed preparation area for eight offshore platforms (monopile foundations), including scour protection – 49,778m² Area of seabed contact for vessel jack-up vessel jack-up assuming six jack-up locations per turbine (275m² per jack up leg x four legs x six operations per turbine x 200 small turbines) – 1,320,000m² Area of seabed contact for vessel jack-up for all platforms in Array Areas (1,100m² combined leg area x five operations per platform x eight platforms) – 44,000m² Anchoring area (116m² area x four anchors per activity x five activities requiring the deployment of anchors x 200 small turbines+ eight offshore platforms) – 484,224m²	Anchoring events assumes four activities per turbine foundation installation + one activity for topside installation per turbine. In some instances the projects in sequence / concurrently are not double those of the projects In Isolation. For example there is only ever one accommodation platform and one ESP under any design scenario. To ensure the WCS has been assessed, however, such platforms are accounted for in each possible. Final totals are based on the unrounded figures of the above parameters. As such there is a small variation in the total figures stated in the table compared to the figure reached when adding the rounded figures of each parameter. The ESP may be located either within the Array Areas or Offshore Export Cable Corridor. However, as the final location of the ESP would be determined to avoid known heritage assets, and the final location would be subject to further geophysical survey and assessment prior to construction, neither location can currently be determined to represent a worst case for offshore archaeology and cultural heritage. For this assessment the ESP parameters have been included within the Array Area(s).
	Offshore Export Cable Corridor **Total area disturbed for export cable installation (trenching, sandwave levelling, anchoring and foundation installation) – 19,885,242m²**	Offshore Export Cable Corridor **Total area disturbed for export cable installation (trenching, sandwave levelling, anchoring and foundation installation) – 17,046,667m²**	Offshore Export Cable Corridor **Total area disturbed for export cable installation (trenching, sandwave levelling, anchoring and foundation installation) – 36,861,507m²**	Maximum export cable length assumes worst case that cable circuits are laid and buried in separate trenches rather than bundled. Sandwaves were divided into three categories: small bedforms (maximum height <0.4m); medium bedforms (maximum height <0.4m to 0.75m); and

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
	Total offshore cable length per cable – 188km Maximum number of cables required – Two Max. offshore cable length for all cables – 376km *Note – Assumes a worst-case of a separate cable trench for each cable, spaced 50m apart.* Maximum disturbance area for cable installation – 7,510,800m² (based on 376,000m distance x 20m width of disturbance) Maximum seabed area disturbed by sandwave levelling – 12,282,010m² Maximum total area impacted by anchoring – 22,061m² *Note – 10km stretch along the offshore export cable corridor <10m Lowest Astronomical Tide (LAT), may require use of anchoring.* Foundation disturbance area for up to one ESP within the Offshore Export Cable Corridor (Gravity Based Structures (GBS) foundations) – 64,871m² Vessel jack-up area for all platforms in offshore export cable corridor (1,100m² combined leg area x five operations per platform x one platforms) – 5,500m²	Total offshore cable length per cable – 153km Maximum number of cables required – Two Max. offshore cable length for all cables – 306km *Note – Assumes a worst-case of a separate cable trench for each cable, spaced 50m apart.* Maximum disturbance area for cable installation – 6,120,400m² (based on 306,000m distance x 20m width of disturbance) Maximum seabed area disturbed by sandwave levelling – 10,833,835m² Maximum total area impacted by anchoring – 22,061m² *Note – 10km stretch along the offshore export cable corridor <10m LAT, may require use of anchoring.* Foundation disturbance area for up to one ESP within the Offshore Export Cable Corridor (GBS foundations) – 64,871m² Vessel jack-up area for all platforms in offshore export cable corridor (1,100m² combined leg area x five operations per platform x one platforms) – 5,500m²	Total offshore cable length per cable – 188km for DBS East, 153km for DBS West. Maximum number of cables required – Four Max. offshore cable length for all cables – 682km *Note – Assumes a worst-case of a separate cable trench for each cable, spaced 50m apart.* Maximum disturbance area for cable installation – 13,631,200m² (based on 682,000m distance x 20m width of disturbance) Maximum seabed area disturbed by sandwave levelling – 23,115,845m² Maximum total area impacted by anchoring – 44,091m² *Note – 10km stretch along the offshore export cable corridor <10m LAT, may require use of anchoring.* Foundation disturbance area for up to one ESP within the Offshore Export Cable Corridor (GBS foundations) – 64,871m² Vessel jack-up footprint for all platforms in offshore export cable corridor (1,100m² combined leg area x five operations per platform x one platform) – 5,500m²	large or very large bedforms (maximum height 5m) The total sandwave levelling volumes were calculated by estimating the profile area of a trenched sandwave (separately for small, medium and large or very large) and multiplying this figure by the estimated worst-case length of each bedform that may be encountered along that particular Offshore Export Cable Corridor. The separate figures for small, medium and large or very large bedforms were then added together and multiplied by the maximum number of Offshore Export Cables for that particular scenario to give the final estimated volume of sediment disturbed by sandwave levelling activities.

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
	Landfall **Total volume of sediment excavated from trench between exit pits and MLWS (based on 110m length x 6m width x 1.5m depth) – 2,290m³** **Total volume of sediment disturbed by exit pits – 1,800m³** No. of exit pits – 3 Size of each exit pit – 20m length x 10m width x 3m depth Volume of displaced sediment per exit pit – 600m³ **Total volume of sediment disturbed by trenching in the intertidal - 990m³** Maximum temporary disturbance area for cable installation (based on 110m distance x 6m width) – 660m² Depth of cable – 1.5m	Landfall **Total volume of sediment excavated from trench between exit pits and MLWS (based on 130m length x 6m width x 1.5m depth) – 2,290m³** **Total volume of sediment disturbed by exit pits - 1,800m³** No. of exit pits – 3 Size of each exit pit – 20m length x 10m width x 3m depth **Total volume of sediment disturbed by trenching in the intertidal - 990m³** Maximum temporary disturbance area for cable installation (based on 110m distance x 6m width) – 660m² Depth of cable – 1.5m	Landfall **Total volume of sediment excavated from trench between exit pits and MLWS (based on 130m length x 6m width x 1.5m depth) – 4,590m³** **Total volume of sediment disturbed by exit pits - 3,600m³** No. of exit pits – 6 Size of each exit pit – 20m length x 10m width x 3m depth **Total volume of sediment disturbed by trenching in the intertidal - 990m³** Maximum temporary disturbance area for cable installation (based on 110m distance x 6m width) – 660m² Depth of cable – 1.5m	If the Projects are built together there will be one phase of trenchless duct installation. Technique for trenchless cable installation is not yet decided, however Horizontal Directional Drilling (HDD) is preferred and would represent the worst case scenario in terms of impacts from trenchless installation methods. Number of trenchless duct installations assumes ducts for two power cables and one communications cable for each Project. Landfall exit pits may be located within the intertidal area. Length of trench assumes 160m based on the distance between MHWS and MLWS minus mitigation to place exit pits at least 50m from the toe of the cliff.
	Total Displaced sediment during sandwave levelling (Array Area, Inter-Platform Cables and Offshore Export Cable Corridor) - 33,567,300m³ Maximum volume of sandwave material to be dredged / relocated for Array Cables and Inter-Platform Cables – 445,500m³ Maximum volume of sandwave material to be dredged / relocated for Export Cables – 33,121,800m³ **Maximum volume of displaced sediment during cable trenching – 6,369,000m³**	**Total Displaced sediment during sandwave levelling (Array Area, Inter-Platform Cabling Corridor and Offshore Export Cable Corridor) - 29,762,372m³** Maximum volume of sandwave material to be dredged / relocated – 459,473m³ Maximum volume of sandwave material to be dredged / relocated – 29,302,899m³ **Maximum volume of displaced sediment during cable trenching – 5,865,000m³**	**Total Displaced sediment during sandwave levelling (Array Cables, Inter-Platform Cables and Export Cables) - 63,428,644m³** Maximum volume of sandwave material to be dredged / relocated – 1,003,944m³ Maximum volume of sandwave material to be dredged / relocated – 62,424,700m³ **Maximum volume of displaced sediment during cable trenching – 13,116,000m³**	Maximum burial depth for array cables is 1m. Maximum burial depth for array cables and Offshore Export Cables is 1.5m. These depths have been assumed across the entire length of the each cable type to determine the worst-case volume of sediment disturbed. 6m trench width based on worst-case pre-lay ploughing width.

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
	Array cable – 1,950,000m³ (325,000m length x 6m width x 1m depth) Inter-Platform Cables – 1,035,000m³ (115,000m length x 6m width x 1.5m depth) Export cable – 3,384,000m³ (376,000m length x 6m width x 1.5m depth) **Maximum volume of drill arisings – 37,197m³** Drill arisings from 57 large wind turbines = 34,382m³ Drill arisings from four offshore platform monopile foundations = 2,815m³	Array cable – 1,950,000m³ (325,000m length x 6m width x 1m depth) Inter-Platform Cables – 1,161,000m³ (129,000m length x 6m width x 1.5m depth) Export cable –2,754,000m³ (306,000m length x 6m width x 1.5m depth)**Maximum volume of drill arisings – 37,197m³** Drill arisings from 57 large wind turbines = 34,382m³ Drill arisings from four offshore platform monopile foundations = 2,815m³	Array cable – 3,900,000m³ (650,000m length x 6m width x 1m depth) Inter-Platform Cables – 3,078,000m³ (342,000m length x 6m width x 1.5m depth) Export cable – 6,138,000³ (682,000m length x 6m width x 1.5m depth) **Maximum volume of drill arisings – 73,790m³** Drill arisings from 113 large wind turbines = 68,160m³ Drill arisings from eight monopile foundations = 5,630m³	
	Scour / Cable Protection and Crossings Array Area **Total area of protection within the Array Area (foundations, scour protection, cable protection and cable crossings) – 890,879m²** Total worst case turbine foundation area, including scour protection – 311,725m² (100 small turbines x 3,117m² total protection per turbine) Total worst-case offshore platforms foundation area, including scour protection– 21,642m² Total area of array and inter-platform cable protection – 496,212m² (312,900m² array cable protection + 183,312m² inter-platform cable protection)	**Scour / Cable Protection and Crossings** Array Area **Total area of protection within the Array Area (foundations, scour protection, cable protection and cable crossings) – 922,971m²** Total worst case turbine foundation area, including scour protection – 311,725m² (100 small turbines x 3,117m² total protection per turbine) Total worst-case offshore platforms foundation area, including scour protection – 21,642m² Total area of array and inter-platform cable protection – 516,004m² (310,500m² array cable protection + 205,504m² inter-platform cable protection)	**Scour / Cable Protection and Crossings** Array Area **Total area of protection within the Array Area (foundations, scour protection, cable protection and cable crossings) – 2,053,218m²** Total worst case turbine foundation area, including scour protection – 623,449m² (200 small turbines x 3,117m² total protection per turbine) Total worst-case offshore platforms foundation area, including scour protection – 43,285m² Total area of array and inter-platform cable protection – 1,159,884m² (623,400m² array cable protection + 536,484m² inter-platform cable protection)	

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
	Estimated number of array / Inter-Platform Cables / pipeline / cable crossings – 19 Total area of pipeline / cable crossing material (array + inter-platform cables) – 61,300m² Offshore Export Cable Corridor **Total area of protection within the Offshore Export Cable Corridor (scour protection, cable protection and cable crossings) – 1,203,825m²** Total area of cable protection – 1,000,282m² Total worst case area of scour protection for ESP– 56,410m² Estimated number Offshore Export Cable Corridor pipeline / cable crossings – 24 Total area of pipeline / cable crossing material – 147,133m²	Estimated number of array / Inter-Platform Cable / pipeline/cable crossings – 27 Total area of pipeline / cable crossing material (array + inter-platform cables) – 73,600m² Offshore Export Cable Corridor **Total area of protection within the Offshore Export Cable Corridor (scour protection, cable protection and cable crossings) – 992,484m²** Total area of export cable protection – 788,941m² Total worst case area of scour protection for ESP– 56,410m² Estimated number Offshore Export Cable Corridor pipeline / cable crossings – 24 Total area of pipeline / cable crossing material – 147,133m²	Estimated number of array / Inter-Platform Cable / pipeline / cable crossings – 61 Total area of pipeline / cable crossing material (array + inter-platform cables) – 226,600m² Offshore Export Cable Corridor **Total area of protection within the Offshore Export Cable Corridor (scour protection, cable protection and cable crossings) – 2,139,899m²** Total area of export cable protection – 1,789,222m²[22] Total worst case area of scour protection for ESP– 56,410m² Estimated number Offshore Export Cable Corridor pipeline / cable crossings – 48 Total area of pipeline / cable crossing material – 294,267m²	
Impact 3: Indirect impact to heritage assets from changes to physical processes	The worst case scenarios for marine physical processes are set out in Table 8-1 of **Volume 7, Chapter 8 Marine Physical Environment** (**application ref: 7.8**). The following impacts are relevant to the worst case for offshore archaeology and cultural heritage (i.e. increased exposure of buried archaeological material to marine processes due to loss of sediment cover): • Changes to bedload sediment transport due to cable installation at the landfall; and • Indentations on the seabed due installation vessels. Conversely, marine physical processes impacts which correspond to increased bed-level and consequent increased potential for the protection of heritage assets which are currently exposed through additional sediment cover (sediment deposited from plume) are: • Changes to seabed level due to seabed preparation for foundation installation; • Changes to seabed level due to drill arisings from foundations; and • Changes to seabed level due to array, inter platform and offshore export cable installation.			

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
Impact 4: Impacts to the setting of heritage assets	Maximum duration of offshore construction: 5 years Up to 80 construction vessels on-site simultaneously and up to 3,857 round trips to port.	Maximum duration of offshore construction: 5 years Up to 80 construction vessels on-site simultaneously and up to 3,857 round trips to port.	Maximum duration of offshore construction: 7 years Up to 137 construction vessels on-site simultaneously and up to 7,510 round trips to port.	The worst case scenario represents the maximum intrusive effect of construction activities for the longest duration. If built non-concurrently, it is anticipated that there would be up to a two year lag between the start of construction for the first project and the start of construction for the second project. Taking the above into account, the maximum construction period over which the construction of both Projects could take place is seven years.
Operation				
Impact 1: Direct (physical) impact to known heritage assets **Impact 2: Direct impact to potential heritage assets**	Array Area **Area of seabed disturbance from jacking-up activities over Projects lifetime – 306,900m²** (10,230m² per year x 30 year lifespan) **Area of seabed disturbance from array cable repairs over Projects lifetime – 54,000m²** (Nine events x 6,000m² per event) Export Cable Route **Area of seabed disturbance from export cable repairs over Projects lifetime – 42,000m²** (Seven events x 6,000m² per event)	Array Area **Area of seabed disturbance from jacking-up activities over Projects lifetime – 306,900m²** (10,230m² per year x 30 year lifespan) **Area of seabed disturbance from array cable repairs over Projects lifetime – 54,000m²** (Nine events x 6,000m² per event) Export Cable Route **Area of seabed disturbance from export cable repairs over Projects lifetime – 30,000m²** (Five events x 6,000m² per event)	Array Areas and Inter-Platform Cable Corridor **Area of seabed disturbance from jacking-up activities over Projects lifetime – 613,800m²** (20,460m² per year x 30 year lifespan) **Area of seabed disturbance from array cable repairs over Projects lifetime – 102,000m²** (17 events x 6,000m² per event) Export Cable Route **Area of seabed disturbance from export cable repairs over Projects lifetime – 72,000m²** (12 events x 6,000m² per event)	The worst case scenario represents the maximum area of disturbed seabed sediments with the potential for archaeological material to be present either on the seafloor or buried within seabed deposits. Assumes impacts will be less than for construction (i.e. for maintenance activities within the same footprint, impacts would already have occurred during construction)
	All cables will be buried below landfall, assumed no maintenance activities required during the operational stage. As such no operational impacts predicted to occur at landfall.			
Impact 3: Indirect impact to heritage assets from changes to physical processes	The worst case scenarios for marine physical processes are set out in **Chapter 8 Marine Physical Environment** (**Table 8-1**). The following impacts are relevant to the worst case for offshore archaeology and cultural heritage (i.e. increased exposure of buried archaeological material to marine processes due to loss of sediment cover): • Changes to the tidal regime due to the presence of infrastructure (wind turbines and offshore platforms); • Changes to the wave regime due to the presence of infrastructure (wind turbines and offshore platforms);			

	Maximum Parameters			
	DBS East In Isolation	**DBS West In Isolation**	**DBS West and DBS East concurrently or in sequence**	**Notes and rationale**
	• Changes to bedload sediment transport and seabed morphology due to the presence of infrastructure (wind turbines and offshore platforms); • Changes to bedload sediment transport and seabed morphology due to the presence of cable protection measures; • Cable repairs and reburial; and • Indentations on the seabed due to installation vessels.			
Impact 4: Impacts to the setting of heritage assets	**Presence of wind farm infrastructure across Offshore Development Area:** Up to 100 wind turbines Up to four offshore platforms **Maximum temporal footprint:** The operational lifetime is expected to be 30 years **Vessels** Maximum number of operation & maintenance (O&M) vessels on site at any one time – 20 Up to 239 annual round trips to port.	**Presence of wind farm infrastructure across Offshore Development Area:** Up to 100 wind turbines Up to four offshore platforms **Maximum temporal footprint:** The operational lifetime is expected to be 30 years **Vessels** Maximum number of O&M vessels on site at any one time – 20 Up to 239 annual round trips to port.	**Presence of wind farm infrastructure across Offshore Development Area:** Up to 200 wind turbines Up to four offshore platforms **Maximum temporal footprint:** The operational lifetime is expected to be 30 years per Project. **Vessels** Maximum number of O&M vessels on site at any one time – 21 Up to 474 annual round trips to port	The worst case scenario represents the maximum intrusive effect of installed infrastructure and operation and maintenance activities for the longest duration. Based on simultaneous presence of jack-up vessels, service operations vessels, accommodation vessels, small CTV vessels, lift vessels, cable maintenance vessels and auxiliary vessels.
Decommissioning				
No final decision regarding the final decommissioning policy for the offshore project infrastructure including landfall, has yet been made. It is also recognised that legislation and industry best practice change over time. It is likely that offshore project infrastructure will be removed above the seabed and reused or recycled where practicable. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and will be agreed with the regulator. It is anticipated that for the worst case scenario, the impacts will be no greater than those identified for the construction phase. A decommissioning plan for the offshore works would be submitted prior to any decommissioning commencing.				

17.3.2.2 Development Scenarios

15. Following Statutory Consultation high voltage alternating current (HVAC) technology (previously assessed in PEIR) was removed from the Projects' design envelope (see **Volume 7, Chapter 4 Site Selection and Assessment of Alternatives (application ref: 7.4)** for further information). As a result, only high voltage direct current (HVDC) technology has been taken forward for assessment purposes. The ES considers the following development scenarios:

    - Either DBS East or DBS West is built In Isolation; or
    - DBS East and DBS West are both built either Sequentially or Concurrently.

16. An In Isolation scenario has been assessed within the ES on the basis that theoretically only one Project could be taken forward without the other being built. If an In Isolation project is taken forward, either DBS East or DBS West may be constructed. As such the offshore assessment will consider both DBS East and DBS West In Isolation.

17. In order to ensure that a robust assessment has been undertaken, all Development Scenarios have been considered to ensure the realistic worst-case scenario for each topic has been assessed. A summary is provided here, and further details are provided in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**.

18. The three Development Scenarios to be considered for assessment purposes are outlined in **Table 17-2**.

Table 17-2 Development Scenarios and Construction Durations

Development scenario	Description	Total Maximum Construction Duration (Years)	Maximum construction Duration Offshore (Years)	Maximum construction Duration Onshore (Years)
In Isolation	Either DBS East or DBS West is built In Isolation	Five	Five	Four
Sequential	DBS East and DBS West are both built Sequentially, either Project could commence construction first with staggered / overlapping construction	Seven	A five year period of construction for each project with a lag of up to two years in the start of construction of the second project (excluding landfall duct installation) – reflecting the maximum duration of effects of seven years.	Construction works (i.e. onshore cable civil works, including duct installation) to be completed for both Projects simultaneously in the first four years, with additional works at the Landfall Zone, Onshore Substation Zone and cable joint bays in the following two years. Maximum duration of effects of six years.
Concurrent	DBS East and DBS West are both built Concurrent reflecting the maximum peak effects	Five	Five	Four

19. The In Isolation, Concurrent and Sequential Development Scenarios all allow for flexibility to build out either or both Projects using a phased approach offshore. Under a phased approach the maximum timescales for individual elements of the construction are assessed.

20. The built-out scenarios may affect the construction programmes as detailed in Chapter 5 Project Description. However, as the infrastructure requirements for each project are the same under both scenarios (concurrent or sequential) this would have no effect on offshore archaeology and cultural heritage.

17.3.2.3 Operation Scenarios

21. Operation scenarios are described in detail in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**. The assessment considers the following scenarios:

- Only DBS East in operation;
- Only DBS West in operation; and
- DBS East and DBS West operating concurrently with or without a lag of up to two years between each Project commencing operation.

22. If the Projects are built out using a phased approach, there would also be a phased approach to starting the operational stage. The worst case scenario for the operational phases for the Projects have been assessed. See section 5.1.1 of **Volume 7, Chapter 5 Project Description (application ref: 7.5)** for further information on phasing scenarios for the Projects.

23. The operations lifetime of each Project is expected to be 30 years.

17.3.2.4 Decommissioning Scenarios

24. Decommissioning scenarios are described in **Volume 7, Chapter 5 Project Description (application ref: 7.5)**. Decommissioning arrangements will be agreed through the submission of a Decommissioning Programme prior to construction, however for the purpose of this assessment it is assumed that decommissioning of the Projects could be conducted separately, or at the same time.

17.3.3 Embedded Mitigation

25. This section outlines the embedded mitigation relevant to the offshore archaeology and cultural heritage assessment, which has been incorporated into the design of the Projects or constitutes standard mitigation measures for this topic (**Table 17-3**). Mitigation is also detailed within the **Commitments Register (application ref: 8.6)** and cross-referenced within **Table 17-3**. Where additional mitigation measures are proposed, these are detailed in the impact assessment (section 17.6).

Table 17-3 Embedded Mitigation Measures.

Parameter	Embedded Mitigation Measures	Where commitment is secured
Wrecks (Maritime and Aviation Archaeology)	A requirement to avoid historic wrecks (as far as possible) was included as a design principle for site selection in the design of the Offshore Export Cable Corridor.	**Volume 7, Chapter 4 Site Selection and Assessment of Alternatives (application ref: 7.4)**

26. Following the completion of the archaeological assessment of marine geophysical data (section 17.5.2), a total of 43 Archaeological Exclusion Zones (AEZs) have been recommended by Wessex Archaeology within the Array Areas and 13 have been recommended in the Offshore Export Cable Corridor. No development related activities would take place within an AEZ. In addition, 791 further geophysical anomalies of possible archaeological interest have been identified within the Offshore Archaeology Study Area. No AEZs are recommended for these additional anomalies at this time, although avoidance of these features by micro-siting is recommended if they are proposed to be directly impacted by development in the future. If micro-siting is not possible, then further assessment to ascertain the nature of the features may be required.

27. The avoidance of AEZs, and features of possible archaeological interest, has not been embedded in the design of the wind farm boundaries or offshore cable corridors to date (over and above the requirement to avoid historic wrecks as far as possible as a principle of site selection). However, the parameters of the Projects are sufficiently wide to accommodate micro-siting as part of the cable route refinement and wind farm design (which would be progressed post consent).

28. The Applicants' proposed approach to the delivery of mitigation post-consent, and how the outcomes of additional investigation would influence the final design of the Projects, is described in section 17.6 and has been set out in **Volume 8, Outline Written Scheme of Investigation (WSI) (Offshore) (application ref: 8.22)**, which has been prepared in accordance with industry good practice guidance on Archaeological WSIs (The Crown Estate, 2021) and which accompanies the ES and DCO application. **Volume 8, Outline WSI (Offshore) (application ref: 8.22)** would be secured within Deemed Marine Licence conditions forming part of the DCO.

17.4 Assessment Methodology

17.4.1 Policy, Legislation and Guidance

17.4.1.1 National Policy Statements

29. The assessment of potential impacts upon offshore archaeology and cultural heritage has been made with specific reference to the relevant National Policy Statements (NPS) including the Overarching NPS for Energy (EN-1) (DESNZ, 2023a), the NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023b) and the NPS for Electricity Networks Infrastructure (EN-5) (DESNZ, 2023c). These were published in November 2023 and were designated in January 2024. The specific assessment requirements for Offshore Archaeology and Cultural Heritage, as detailed in the NPS, are summarised in **Table 17-4** together with an indication of the section of this chapter where each is addressed.

Table 17-4 NPS Assessment Requirements

NPS Requirement	NPS Reference	ES Section Reference
EN-1 NPS for Energy		
As part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development, including any contribution made by their setting. The level of detail should be proportionate to the importance of the heritage assets and no more than is sufficient to understand the potential impact of the proposal on their significance.	Paragraph 5.9.10	The significance of the archaeological receptors considered in this chapter, and the contribution of setting to that significance, have been detailed in sections 17.5.1.2, 17.5.2.2 and 17.5.3.2. Issues relating to the setting of onshore heritage assets have been considered as part of **Volume 7, Chapter 22 Onshore Archaeological and Cultural Heritage (application ref: 7.22)**.

NPS Requirement	NPS Reference	ES Section Reference
Where a site on which development is proposed includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact.	Paragraph 5.9.11	Section 17.5 of this chapter provides the results of the desk-based assessment and the archaeological assessment of marine geophysical and geotechnical data (field evaluation) undertaken for Offshore Archaeology and Cultural Heritage.
The applicant should ensure that the extent of the impact of the proposed development on the significance of any heritage assets affected can be adequately understood from the application and supporting documents.	Paragraph 5.9.12	This chapter provides an account of the potential impacts of the Projects upon heritage assets and their significance (section 17.6).
The applicant is encouraged, where opportunities exist, to prepare proposals which can make a positive contribution to the historic environment, and to consider how their scheme takes account of the significance of heritage assets affected. This can include, where possible: • Enhancing, through a range of measures such as sensitive design, the significance of heritage assets or setting affected • Considering where required the development of archive capacity which could deliver significant public benefits	Paragraph 5.9.13	The potential for enhancement of the archaeological record for the North Sea is discussed in section 17.6.

NPS Requirement	NPS Reference	ES Section Reference
• Considering how visual or noise impacts can affect heritage assets, and whether there may be opportunities to enhance access to, or interpretation, understanding and appreciation of, the heritage assets affected by the scheme		
EN-3 NPS for Renewable Energy Infrastructure		
Applicants should consult with the relevant statutory consultees, such as Historic England or Cadw, on the potential impacts on the marine historic environment at an early stage of development during pre-application, taking into account any applicable guidance (e.g., offshore renewables protocol for archaeological discoveries).	Paragraph 2.8.158	Consultation has been undertaken with relevant statutory consultees, as outlined in section 17.2 and detailed in **Volume 7, Appendix 17-1 (application ref: 7.17.17.1).** Consultation will be on going throughout the development process. The guidance taken into account for the assessment of offshore archaeology and cultural heritage is listed in section 17.4.
Assessment of potential impacts upon the historic environment should be considered as part of the Environmental Impact Assessment process undertaken to inform any application for consent. Desk based studies to characterise the features of the historic environment that may be affected by a proposed development and assess any likely significant effects should be undertaken by competent archaeological experts. These studies should take into account any geotechnical or geophysical surveys that have been undertaken to aid the wind farm design.	Paragraphs 2.8.159 to 2.8.161	Section 17.5 of this document provides the results of the desk-based assessment and the archaeological assessment of marine geophysical and geotechnical data undertaken for Offshore Archaeology and Cultural Heritage.

NPS Requirement	NPS Reference	ES Section Reference
Assessment may also include the identification of any beneficial effects on the marine historic environment, for example through improved access or the contribution to new knowledge that arises from investigation.	Paragraph 2.8.166	Any beneficial effects to the offshore archaeology and cultural heritage resource resulting from the Projects have been identified in section 17.6.
Where elements of a proposed project (whether offshore or onshore) may interact with historic environment features that are located onshore, applicants should assess the effects in accordance with section 5.9 in EN-1.	Paragraph 2.8.167	Potential impacts of the Projects upon onshore heritage assets have been considered in **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**.
EN-5 NPS for Electricity Networks Infrastructure		
… applicants must take into account Schedule 9 to the Electricity Act 1989, which places a duty on all transmission and distribution licence holders, in formulating proposals for new electricity networks infrastructure, to "have regard to the desirability… of protecting sites, buildings and objects of architectural, historic or archaeological interest; and … do what [they] reasonably could to mitigate any effect which the proposals would have on the… sites, buildings or objects.	Paragraph 2.2.10	Potential impacts upon sites and objects of archaeological interest offshore are set out in section 17.6 along with a proposed approach to mitigation.

17.4.1.2 Other

30. In addition to the NPS, there a number of pieces of legislation, policy and guidance applicable to the assessment of Offshore Archaeology and Cultural Heritage. These include:

- Legislation:

- UNESCO Convention on the Protection of Underwater Cultural Heritage;
- European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (The Valletta Convention);
- Protection of Wrecks Act 1973: Sections One and Two;
- Ancient Monuments and Archaeological Areas Act 1979;
- Protection of Military Remains Act 1986; and
- Merchant Shipping Act 1995.

- Policy:
  - National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing & Communities, 2023);
  - UK Marine Policy Statement (DEFRA, 2011);
  - East Inshore and East Offshore Marine Plans (DEFRA, 2014) and the North East Inshore and Offshore Marine Plan (DEFRA, 2021); and
  - The East Riding Local Plan Policy, ENV3: Valuing our heritage (East Riding of Yorkshire Council, 2016).
- Guidance:
  - Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021);
  - Principles of Cultural Heritage Impact Assessment in the UK (Institute of Environmental Management and Assessment (IEMA), Institute of Historic Building Conservation (IHBC) and Chartered Institute of Archaeologists (CifA), 2021);
  - CifA Standard and Guidance for Historic Environment Desk-Based Assessments (2020) and Code of Conduct (2022);
  - The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition) (Historic England, 2017a);
  - Conservation Principles For The Sustainable Management Of The Historic Environment (Historic England, 2017b);
  - Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Historic England, 2013);
  - Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);

- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008);
- Historic Environment Guidance for the Offshore Renewable Energy Sector Guidance (Wessex Archaeology, 2007); and
- Code for Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC), 2006).

31. This assessment has been undertaken in a manner consistent with the NPPF and the UK Marine Policy Statement. To summarise, UK government guidance provides a framework which:

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

32. Specifically, the UK Marine Policy Statement (MPS) (DEFRA, 2011) sets out high level objectives for marine planning, which have directed development of Marine Plans at a regional level. Marine Plans must be in accordance with other relevant national policy and are intended to contribute to the achievement of sustainable development in the UK marine area. Those relevant to the Projects are the East Inshore and East Offshore Marine Plans (DEFRA, 2014) and the North East Inshore and Offshore Marine Plan (DEFRA, 2021).

33. Policy SOC2 of the East Inshore / Offshore Marine Plan (DEFRA, 2014) states that proposals that may affect heritage assets should demonstrate, in order of preference:

- That they will not compromise or harm elements which contribute to the significance of the heritage asset;
- How, if there is compromise or harm to a heritage asset, this will be minimised;
- How, where compromise or harm to a heritage asset cannot be minimised it would be mitigated against; or
- The public benefits for proceeding with the proposal if it is not possible to minimise or mitigate compromise or harm to the heritage asset.

34. Similarly, policy NE-HER-1 of the North East Inshore / Offshore Marine Plan (DEFRA, 2021) states that:

- Proposals that demonstrate they would conserve and enhance the significance of heritage assets would be supported.
- Where proposals may cause harm to the significance of heritage assets, proponents must demonstrate that they would, in order of preference:

  a) avoid

  b) minimise

  c) mitigate – any harm to the significance of heritage assets.
- If it is not possible to mitigate, then public benefits for proceeding with the proposal must outweigh the harm to the significance of heritage assets.

35. These principles underpin the approach to mitigation as set out in section 17.3.3 and section 17.6.

36. Further detail is provided in **Volume 7, Chapter 3 Policy and Legislative Context (application ref: 7.3)**.

17.4.2 Data and Information Sources

17.4.2.1 Site Specific Surveys

17.4.2.1.1 Marine Geophysical Survey and Assessment

37. In order to provide site specific and up to date information on which to base the impact assessment, marine geophysical data were acquired from the Offshore Development Area by Fugro in 2022. The data comprised sidescan sonar (SSS), magnetometer (Mag.), multibeam echosounder (MBES), multibeam backscatter (MBBS), sparker-sourced 2D ultra high resolution seismic (UHRS) and parametric sub-bottom profiler (SBP) datasets.

38. Data for the Array Areas were acquired by Fugro using the vessels *Fugro Searcher*, *Fugro Frontier* and the *Mainport Geo*. The *Mainport Geo* acquired a broad grid of data with 1km line spacing between 21st April and 15th May 2022. The *Fugro Searcher* and *Fugro Frontier* acquired data at a line spacing of 100m between 7th August and 10th September 2022, and 22nd May and 23rd October 2022, respectively.

39. Data from the Offshore Export Cable Corridor (excluding the 500m temporary construction buffer) were acquired onboard the vessel *Fugro Discovery* between 15th June and 21st July 2022 at a line spacing of approximately 100m, with some areas reduced to a line spacing of 65m due to a change in water depth to ensure complete coverage. Data from the nearshore section of the offshore export cable corridor were acquired by Fugro on board survey vessel *Valkyrie* between 22nd June and 31st July 2022 at a line spacing of between 15 – 35m depending on water depth.

40. Over some sections of the nearshore section (Block A) and a large section of the adjacent Block B, the vessels were inhibited by the presence of fishing gear from obtaining data from towed sensors (SSS and Mag.). Where there was no data from towed sensors, MBBS data were additionally assessed in order to obtain the maximum amount of information over the areas possible.

41. Further details on the survey specifications, including an assessment of the suitability of the data for archaeological assessment, are included in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)** and **Volume 7, Appendix 17-3 (application ref: 7.17.17.3)** In summary, all data were considered suitable for archaeological interpretation.

42. Due to the large size of the Offshore Development Area and the high volume of geophysical data acquired, a proportionate approach to the archaeological assessment of seabed features has been applied. Acknowledging that only a small percentage of the total Array Areas for both Projects agreed in the Agreements for Lease (989km²) would be subject to disturbance (24,924,843m² under the worst case scenario presented in **Table 17-1**) an alternative approach to assessment was discussed in consultation with Historic England through the EPP (**Volume 7, Appendix 17-1 (application ref: 7.17.17.1)**).

43. This proportionate approach allowed for the assessment of all data acquired from the Offshore Archaeology Study Area, but not all data was assessed in its 'raw' format. This approach was considered to provide greater assessment resolution than, for example, applying a selective strategy, based on reviewing only a limited subset of data, as even large anomalies can get missed if they are located between data lines. In summary the approach applied comprised the analysis of:

- MBES data, provided gridded at 1.0m and analysed using QPS Fledermaus software, which enables a 3-D visualisation of the acquired data and geo-picking of seabed anomalies;
- High frequency SSS mosaics, provided as .tifw files and assessed using ArcMap with low frequency SSS mosaics used to infill gaps in the high frequency and reviewed alongside the geophysical contractor's target listings; and
- Mag. Data processed using in-house proprietary software and gridded to produce a map of magnetic anomalies.

44. The following thresholds were also applied:

- Anomalies picked from the SSS mosaic and MBES over 5m in any one direction were included in the gazetteer; and
- Magnetic anomalies below 20 nanotesla (nT) have been excluded based on ground-truthing information from similar large scale sites which shows that smaller anomalies are less likely to represent features of archaeological interest.

45. A sub-set of anomalies tagged by Wessex Archaeology in the SSS mosaics and Mag. Data were then further investigated in the individual line SSS data files (.xtfs). These included anything thought to be:

- wreck;
- debris field;

- anything deemed unusual and warranting further investigation due to its archaeological potential during interpretation; and
- Mag. Anomalies over 1000nT (that are not known to be modern).

46. Anomalies assessed in the raw SSS data were not subject to a size threshold, as this process was designed to ensure the full extents of significant anthropogenic seabed features, including adjacent related small anomalies (e.g. a wreck ad associated small items of debris), were recorded to ensure AEZs are as comprehensive as possible.

47. In the sections of the Offshore Export Cable Corridor where SSS and Mag. Could not be acquired due to the presence of fishing gear, MBES data were assessed alongside the MBBS, both gridded at 0.5m (rather than 1m). Geotiffs were created from the MBBS and reviewed using ArcMap to identify individual features of possible archaeological potential.

48. The nearshore Offshore Export Cable Corridor (Block A) was undertaken as a full assessment of raw SSS data, MBES, MBBS and Mag. Datasets. However, where sections were not covered by towed sensors (due to the presence of fishing gear), higher resolution MBES data and MBBS data (gridded at 0.25m) were provided and assessed. The minimum thresholds for anomaly sizes applied to interpretation of the offshore datasets was not applied to the nearshore area.

49. Full details on how this approach has been applied to the archaeological assessment of seabed features are presented in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**. Further information on how this approach was considered in consultation with Historic England are provided in **Volume 7 Appendix 17-1 (application ref: 7.17.17.1)**. Consideration of the limitations of this approach is provided in section 17.4.7.

50. Once all the datasets had been individually interpreted the anomalies were grouped together, allowing one ID number to be assigned to a single object for which there may be, for example, a United Kingdom Hydrographic Office (UKHO) record, a MBES anomaly, and multiple SSS anomalies. Following grouping, Wessex Archaeology apply a discrimination flag to each feature in order to discriminate against those which are not thought to be of an archaeological concern. The criteria for each discrimination flag are set out in **Table 17-5** below. The results are presented in full in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)** and are summarised in section 17.5.2.

Table 17-5 Wessex Archaeology Criteria Discriminating Relevance of Identified Features to the Projects

Overview classification	Discrimination	Criteria	Data type
Archaeological (palaeogeographic features)	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material.	UHRS, SBP, MBES
	P2	Feature of possible archaeological interest.	
Archaeological (seabed features)	A1	Anthropogenic origin of archaeological interest.	MBES, SSS, Mag
	A2_h	Anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature.	
	A2_l	Anomaly of possible anthropogenic origin but interpretation is uncertain; may be anthropogenic or a natural feature.	
	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly.	
Non-archaeological	U1	Not of anthropogenic origin.	MBES, SSS, Mag
	U2	Known non-archaeological feature / Feature of non-archaeological interest.	MBES, SSS, Mag, SBP
	U3	Recorded loss.	MBES, SSS, Mag
Non-impact	O1	Outside horizontal footprint of study area.	MBES, SSS, Mag, SBP

Overview classification	Discrimination	Criteria	Data type
	O2	Outside vertical footprint of proposed impact.	SBP
	O3	Area subsequently cleared after data acquired, anomaly / object recovered.	MBES, SSS, Mag, SBP

51. In addition, the interpretation of UHRS, SBP and MBES has been undertaken to inform the palaeolandscape assessment. In the Array Areas, a 3km x 3km grid of UHRS data were assessed using Kingdom software (2022). Features were interpreted to approximately 70m below seabed to account for potential monopile depths.

52. In the Offshore Export Cable Corridor SBP data were processed using CodaOctopus Survey Engine Seismic+ software. An initial centre line of data was assessed, with additional infill lines assessed across the width of the corridor (including both main lines and cross lines) where features of archaeological potential were identified. The data interpretation was particularly focussed on the upper 5m of sediment along the offshore expert cable corridor, selected as a standard maximum depth of sediment disturbance during cable laying. In addition to the SBP data, the MBES data were visually assessed in ArcGIS and QPS Fledermaus for any exposed and / or underfilled palaeolandscape features in the nearshore area where some features of palaeogeographic interest were visible at seabed.

53. After initial observation and geophysical interpretation of the UHRS and SBP data, palaeolandscape features were interpreted in a geological and stratigraphic context in order to be assigned an archaeological discrimination in line with the definitions in **Table 17-5.**

54. The results of the assessment are presented in full in **Volume 7, Appendix 17-3 (application ref: 7.17.17.3)** and summarised in section 17.5.1.

17.4.2.1.2 Marine Geotechnical Survey and Assessment

55. A total of 122 vibrocores were acquired by Fugro within the Offshore Export Cable Corridor, five boreholes within the nearshore part of the Offshore Export Cable Corridor and five boreholes within the Array Areas during geotechnical surveys undertaken between 2022 and 2023. One vibrocore was acquired for dedicated geoarchaeological purposes following an archaeological review of the draft DBS Seafloor and Shallow Geological Results Report (Fugro 2023).

56. Geoarchaeological review of vibrocores and boreholes was undertaken in two stages. The first stage included a review of preliminary vibrocore logs that were drafted on the vessel and sent to the geoarchaeologist (direct from the vessel). These preliminary logs were used to flag vibrocores with the potential to contain deposits of archaeological interest, prior to scheduling engineering testing.

57. A second stage of geoarchaeological review was undertaken using the detailed geotechnical core logs and photographs after cores / samples were split in the laboratory.

58. The results of this review are presented in **Volume 7, Appendix 17-4 (application ref: 7.17.17.4)** and summarised in section 17.5.1.

17.4.2.2 Other Available Sources

59. Other sources that have been used to inform the assessment are listed in **Table 17-6**.

Table 17-6 Other Available Data and Information Sources

Data Set	Spatial Coverage	Year	Notes
Global Wrecks and Obstructions	Global	2022	Data set containing details of charted, uncharted, live and dead wrecks and obstructions and shared on the Admiralty Marine data Portal by the UKHO.

Data Set	Spatial Coverage	Year	Notes
The National Heritage List for England (NHLE) maintained by Historic England	England	2022	Official, up to date, register of all nationally protected historic buildings and sites in England – listed buildings, scheduled monuments, protected wrecks, registered parks and gardens, and battlefields. (including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973).
Records held by Historic England, formally part of the National Record of the Historic Environment (NRHE) dataset	England	2022	Records of heritage assets and documented losses of wrecks and aircraft.
Humber Historic Environment Record (HER)	East Riding of Yorkshire and Hull	2022	HERs are information services that provide access to comprehensive and dynamic resources relating to the archaeology and historic built environment of a defined geographic area. HERs contain details of local archaeological sites and finds, historic buildings and historic landscapes and are regularly updated.
The Coastal and Intertidal Zone Archaeology Network (CITiZAN)	UK	2022	CITiZAN highlights the threat of coastal erosion to a wealth of foreshore and intertidal sites. These archaeological features encompass a huge time span, many are of considerable local or national significance.
Relevant documentary sources and grey literature	UK	Various	Includes reports and survey data gathered from previous offshore wind farm projects in the wider Dogger Bank area, e.g. Dogger Bank A, B, C and Sofia.

17.4.3 Impact Assessment Methodology

60. The impact assessment methodology adopted for offshore archaeology and cultural heritage will define heritage assets, and their settings, likely to be impacted by the Projects and assess the level of any resulting benefit, harm or loss to their significance. The assessment is not limited to direct (physical) impacts, but also assesses possible indirect (physical) impacts upon heritage assets which may arise as a result of changes to hydrodynamic and sedimentary processes and changes to the setting of heritage assets, whether visually, or in the form of noise, dust and vibration, spatial associations and a consideration of historic relationships between places which may impact their significance.

61. **Volume 7 Chapter 6 EIA Methodology (application ref: 7.6)** provides a summary of the general impact assessment methodology applied. The following sections describe the specific methods used to assess the likely significant effects on Offshore Archaeology and Cultural Heritage.

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

- A. understanding cultural heritage assets; and
- B. evaluating the consequences of change.

63. Understanding cultural heritage assets distinguishes between:

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

64. Evaluating the consequences of change additionally distinguishes between three separate analytical stages:

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

65. The three stages of 'understanding cultural heritage assets' (a description of the assets and their cultural significance, including the contribution of setting to that significance, and attributing importance) are described in section 17.5 (Existing Environment). An evaluation of the consequences of change is presented in section 17.6 (Assessment of Significance) as set out below.

66. **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)** sets out the following steps in assessing significant effects:

- Identifying the source of potential impacts and establishing if a pathway exists between the source of the impact and the identified receptors;
- Identifying the sensitivity of each receptor to the relevant impacts;
- Identifying the magnitude of the impact predicted; and
- Considering the receptor sensitivity and likely impact magnitude, in order to assess the likely significance of effect for the potential impact.

67. The relationship between the CHIA stages and the general impact assessment methodology, as set out in **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)**, is as follows:

68. In CHIA, *identifying the source of potential impacts* is represented by a factual statement of how a proposal would change a cultural heritage asset or its setting (understanding change). It is important to note that change may or may not lead to an impact on cultural significance. If there is a pathway for an impact on cultural significance, this will be articulated for each impact.

69. *Identify the sensitivity* of a receptor equates to the measure of importance ascribed to an asset (or group of assets).

70. The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is affected. However, while impacts to a heritage asset's setting or character can be temporary, impacts which result in damage or destruction of the assets themselves, or their relationship with their wider environment and context, are permanent. Once destroyed an asset cannot recover. On this basis, it is the importance of a heritage asset (as a scaled measure of the degree to which we seek to protect and preserve the cultural significance of that asset through, for example, legislation and planning policy) rather than the sensitivity which forms the basis for assessment.

71. For the purposes of this ES, the criteria for determining the heritage importance of any relevant heritage assets are described in **Table 17-7**.

Table 17-7 Definition of Importance for Cultural Heritage Assets

Importance	Definition
High	Assets perceived of being of international / national importance including: • World Heritage Sites; • Scheduled Monuments; • Listed Buildings or structures; • Protected wrecks; • Designated historic landscapes of outstanding interest; • Conservation Areas containing buildings or structures with high heritage importance, or high concentrations of listed buildings; • Non-designated assets of acknowledged international / national importance; and • Assets that can contribute significantly to acknowledged international / national research objectives. Assets where the importance / existence / level of survival of the asset has not been ascertained (or fully ascertained / understood) from available evidence and is therefore considered of high importance as a precautionary measure.
Medium	Assets perceived of being of regional importance including: • Designated special historic landscapes; • Other types and character of Conservation Areas (i.e. not containing buildings or structures with high heritage importance, or high concentrations of listed buildings); • Assets that contribute to regional research objectives; and • Assets with regional value, educational interest or cultural appreciation.
Low	Assets perceived of being of local importance including: • 'Locally Listed' buildings or structures; • Assets that contribute to local research objectives; and • Assets with local value, educational interest or cultural appreciation. Assets compromised by poor preservation and / or poor contextual associations.
Negligible	Assets with no significant value or archaeological / historical interest.

72. *Identify the magnitude* of the impact equates to the degree to which cultural significance is positively or negatively changed by the proposal.

73. The magnitude of adverse impact with respect to offshore archaeology and cultural heritage directly relates to the extent of harm to, or loss of, key elements of the asset's cultural significance, which may include its setting. The magnitude of beneficial impact directly relates to the level of public benefit associated with an individual impact. Benefits may correspond directly to the project itself where a project will enhance the historic environment (e.g. through measures which will improve the setting of a heritage asset or public access to it). Alternatively, benefits may occur on the basis of data gathering exercises undertaken for the purpose of a project which will enhance public understanding by adding to the archaeological record (e.g. through the accumulation of publicly available information and data).

74. The criteria used for assessing the magnitude of impact with regard to offshore archaeology and cultural heritage are presented in **Table 17-8**.

Table 17-8 Definition of Magnitude of Impacts

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

Magnitude	Definition
Medium Beneficial	Elements of the asset's physical fabric which would otherwise be lost, leading to an appreciable but partial loss of cultural significance, are preserved *in situ*; or Elements of the asset's setting are considerably improved, appreciably enhancing its cultural significance; or Research and recording leads to a considerable enhancement to the archaeological or historical interest of the asset. This only applies in situations where the asset would not be otherwise harmed i.e. it is not recording in advance of loss.
High Beneficial	Elements of the asset's physical fabric which would otherwise be lost, severely compromising its cultural significance, are preserved *in situ*; or Elements of the asset's setting, which were previously lost or unintelligible, are restored, greatly enhancing its cultural significance.
No impact	No change to the assets fabric or setting which affects its cultural significance.

75. The *likely significant effect* is the measure that brings together the magnitude of the impact and the cultural heritage asset's importance to assess the degree to which any change would impact on cultural significance. This measure is indicative of the weight that should be given to the matter in influencing the design of the proposal or, ultimately, in influencing whether the proposal will be acceptable and permitted.

76. The determination of significance is guided by the use of an impact significance matrix presented in **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)**. Definitions for this weighted measure of significance of effect (in EIA terms) are provided in **Table 17-9**. For the purposes of this assessment, any effect that is of major or moderate significance is considered to be significant in EIA terms, whether this be adverse or beneficial. Any effect of minor or negligible significance is deemed not significant.

Table 17-9 Definition of Effect Significance

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

17.4.4 Historic Seascape Character Assessment Methodology

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

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

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

80. Changes to the historic seascape character and the extent to which these changes can be accommodated are discussed in section 17.5.4.

17.4.5 Cumulative Effects Assessment Methodology

81. The Cumulative Effects Assessment (CEA) considers other schemes, plans, projects and activities that may result in significant effects in cumulation with the Projects. **Volume 7 Chapter 6 EIA Methodology (application ref: 7.6)** (and accompanying **Volume 7, Appendix 6-2 Offshore Cumulative Effects Assessment (CEA) Methodology (application ref: 7.6.6.2)**) provides further details of the general framework and approach to the CEA.

82. For Offshore Archaeology and Cultural Heritage, cumulative effects may occur where archaeological receptors also have the potential to be impacted by other existing, consented and / or proposed developments or activities. This includes consideration of the extent of influence of changes to marine physical processes (see **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**) arising from the Projects alone and those arising from the Projects cumulatively with other developments.

83. Cumulative effects are considered in section 17.8.

17.4.6 Transboundary Effect Assessment Methodology

84. The transboundary assessment considers the potential for transboundary effects to occur on offshore archaeology and cultural heritage receptors as a result of the Projects; either those that might arise within the Exclusive Economic Zone (EEZ) of European Economic Area (EEA) states or arising on the interests of EEA states e.g. a non UK fishing vessel. **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)** provides further details of the general framework and approach to the assessment of the transboundary effects.

85. For Offshore Archaeology and Cultural Heritage, the potential for transboundary effects has been identified in relation to wrecks or aircraft of non-British nationality which could be subject to impact from development. Such wrecks may fall within the jurisdiction of another country, and may include, for example, foreign warships lost in UK waters.

86. In addition, there is potential for developments, individually and cumulatively, to affect larger-scale archaeological features such as palaeolandscapes and to affect the setting of heritage assets and historic landscapes / seascapes which may also extend across these boundaries. This may also include sensitivities in conjunction with local community groups and interests.

87. These potential transboundary effects are considered in section 17.9.

88. Indirect transboundary impacts, associated with changes to marine physical processes, where those changes cross an international boundary, are not expected to occur. The potential for transboundary effects were considered in the Scoping Report and it was concluded that, given that the likely marine physical processes impacts of the Projects would be restricted to near-field change, coupled with the Array Areas location 40.82km from the EEZ boundary at their closest point, there would be no pathway for transboundary impacts. The conclusion of the Scoping Report was accepted in the Scoping Opinion, and therefore, indirect transboundary impacts are scoped out and are not considered further in this chapter.

17.4.7 Assumptions and Limitations

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

90. In addition, as outlined in section 17.4.2.1.1, a proportionate approach to the archaeological assessment of marine geophysical data has been applied to provide a characterisation of the Offshore Archaeology Study Area for the purposes of EIA. This approach has included the application of size thresholds in picking anomalies and, whilst all geophysical data have been reviewed, not all data was reviewed in its 'raw' format.

91. Line-by-line review of 'raw' (pre-processed data that have been quality controlled, with navigational / tidal corrections applied and removal of system and environmental noise), un-mosaicked SSS data by an archaeological specialist is generally preferred over the review of processed SSS Data. However, it is also accepted that other methodologies may be considered where appropriate steps are taken to ensure a comprehensive review is able to be undertaken (The Crown Estate, 2021).

92. The Applicants acknowledge that, with this approach to characterisation assessment, there is a risk that smaller seabed features might not have been captured, or fully defined. However, to mitigate such risks measures have been taken to ensure that the review is comprehensive and that all data have been considered. For example, the assessment of 'raw' data at selected locations, identified by Wessex Archaeology as warranting additional review, has provided greater clarity where required (e.g. to ensure the appropriate nature and extent of AEZs).

93. As described in The Crown Estate guidance on archaeological WSIs, the level or volume of data assessment will vary depending upon the objectives of the survey and often also according to the phase of a project. For example, high-level characterisation surveys, which provide context for EIA, are contrasted with detailed assessments undertaken prior to the construction phase where impacts associated with the intended engineering design of the development are better known (The Crown Estate, 2021).

94. Similarly, for the Projects, further investigation and data gathering will be progressed post-consent which will include high resolution surveys, alongside additional mitigation requirements. This commitment is captured in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)** with the understanding that the Offshore Development Area, and the parameters of the Projects are considered sufficiently wide to accommodate micro-siting as part of an iterative approach to wind farm design (which will be progressed post consent). This approach, therefore, which has been discussed in consultation with Historic England as part of the EPP (**Volume 7, Appendix 17-1 (application ref: 7.17.17.1)**), is, considered by the Applicants to provide a characterisation appropriate for EIA, whilst also being proportionate to the large size of the Offshore Archaeology Study Area (on which only a small percentage will actually be built on, and the high volume of data acquired).

95. Following the pre-submission ETG meeting on 14th December 2023 and Historic England's review of the assessment report (**Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**) written advice was received by Historic England which confirmed they had no particular concerns on the methodological assessment approach taken by the Applicants. It is acknowledged, however, that (as advised by Historic England in their response) a full understanding of the benefits or limitations of this approach may only become clear as the design plan develops, subsequent ground truthing takes place and construction commences.

17.5 Existing Environment

96. The existing environment within the Offshore Archaeology Study Area is defined as the known archaeological and cultural heritage resource and the potential for previously unrecorded heritage assets and finds to be present within the Offshore Development Area with respect to

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

17.5.1 Seabed Prehistory

17.5.1.1 Description of Heritage Assets

97. The recent geological history of the southern North Sea is directly linked to glacial / interglacial cycles experienced by the area during the Pleistocene (2.5 million to 10,000 years ago), which resulted in large areas of the southern North Sea being periodically exposed as a terrestrial environment. These glacial cycles, and accompanying changes in sea level, are recorded as Marine Isotope Stages (MIS).

98. The potential for prehistoric sites to be present within the Offshore Archaeology Study Area, either exposed on or buried below the seabed, is primarily associated with surviving terrestrial features and deposits corresponding to times when sea levels were lower and prehistoric hominin populations may have inhabited what is now the seabed.

99. Archaeological material may also be present within secondary contexts, as isolated finds within deposits that may have been reworked by marine or glacial processes. While these deposits formed during periods when the North Sea was inhabitable, they have some potential to contain reworked archaeological material.

100. There are no known *in situ* prehistory sites within the Offshore Archaeology Study Area. However, late Mid- and Late-Pleistocene fauna have been recovered from the wider region by trawlers and a mammoth tusk reported from Marine Aggregate Licence Area 408 (located 50km south-west of the Projects) has produced a date of approximately 44,000 years Before Present (BP) (Allen *et al.*, 2008). This indicates there is some potential for prehistoric faunal remains to be present in the Offshore Archaeology Study Area.

101. Where discoveries of archaeological and faunal material are rare, submerged palaeolandscape features and deposits provide the environmental context to understand prehistory. The Dogger Bank region has long been known to preserve prehistoric landscapes and deposits (Reid, 1913; Coles, 1998). From as early as 1883, maps showing the distribution of 'moorlog' (peat / submerged forest) across Dogger Bank were produced (see Wessex Archaeology 2014 for a review). Many decades later, the North Sea Palaeolandscapes Project (Fitch *et al.*, 2005; Gaffney *et al.*, 2007) produced a regional-scale map showing the nature and distribution of prehistoric landscapes across Dogger Bank showing a complex network of palaeochannels that flooded during post glacial sea-level rise.

102. The formation of Dogger Bank is a product of the interplay between climate change, ice dynamics and sea-level change associated with the growth and demise of the British Irish Ice Sheet and Fennoscandian Ice Sheet during the last glacial period. Recent investigations have demonstrated large-scale glaciotectonic deformation across the western parts of Dogger Bank (adjacent to the Projects) which has created a highly complex stratigraphic record that is not a simple "*layer cake*" (Phillips *et al.*, 2018; Emery *et al.*, 2019). Interpretation of seismic data as horizon maps showing the palaeo-topography of the glacial landscape reveal a series of elongate arcuate ridges separated by low lying basins that ponded water creating proglacial lakes or kettle holes. As the climate warmed, these waterlogged environments would have attracted fauna and people and have high potential to preserve organic deposits or palaeoenvironmental material.

103. The baseline understanding of submerged prehistory at Dogger Bank was improved following a series of geophysical and geoarchaeological investigations undertaken in support of the Environmental Statements for the Dogger Bank Creyke Beck A & B and Teesside A & B projects, now known as Dogger Bank A, B and C and Sofia, respectively. A series of palaeolandscape features were identified including a network of palaeochannels, a possible pingo lake (depression caused by melting ice) and peat deposits (Wessex Archaeology, 2013a; 2013b). Further evidence of submerged palaeolandscapes was reported through the Offshore Protocol for Archaeological Discoveries (ORPAD) in 2012 when peat was recovered from the seabed during a benthic ecological survey (Russell and Stevens, 2014). Palaeoenvironmental assessment of peat deposits indicated remnants of Upper Palaeolithic to Mesolithic landscapes were preserved.

104. A series of ongoing geoarchaeological and marine geophysical assessments are being undertaken for the consented Dogger Bank A, Dogger Bank B, Dogger Bank C and Sofia offshore wind farms. These are providing high resolution maps of the extensive prehistoric landscape (Wessex Archaeology, 2020a) and palaeoenvironmental assessment and dating of deposits from wetland, riverine, lake and coastal environments is ongoing (Wessex Archaeology, 2022).

105. A geotechnical survey undertaken within the Array Areas in 2022 acquired five boreholes to depths of 55m. The borehole logs were reviewed by a geoarchaeologist to gain an initial understanding of the nature of the shallow geology of the Offshore Archaeology Study Area (**Table 17-10**) (**Volume 7, Appendix 17-4 (application ref: 7.17.17.4)**). The results suggest the shallow stratigraphy is broadly the same as in the adjacent Dogger Bank A and Dogger Bank B sites (Wessex Archaeology, 2022). However, this is subject to change pending further geotechnical surveys.

Table 17-10 Shallow Geology of the Offshore Archaeology Study Area

Unit Name	Lithology	Epoch	BGS Formation	Archaeological potential
Gravel Lag	Sandy gravel with shell	Early to mid-Holocene	Indefatigable Grounds	Considered of low potential in itself, but possibly contains re-worked artefacts and can cover wreck sites and other cultural heritage.
Shallow Marine Sand	Slightly gravelly sand with shell fragments	Middle to Late-Holocene	Nieuw Zeeland Gronden Terschellinger	

Unit Name	Lithology	Epoch	BGS Formation	Archaeological potential
			Bank or Well Hole	
Alluvium	Slightly gravelly sand with rare organic matter, organic laminations and shell fragments	Early Holocene	Elbow	Potential to contain *in situ* and derived archaeological material, and palaeoenvironmental material.
Alluvium and Peat	Low to medium strength clay with fibrous wood fragments and rare organic matter	Early Holocene	Elbow	
Proglacial	Not recorded	Late Weichselian	Botney Cut	Glaciomarine deposits considered to have low potential. Glaciolacustrine deposits have potential to contain *in situ* and derived archaeological material, and palaeoenvironmental material.
Diamict and Glacial Sand	Stiff high strength gravelly clay with occasional beds of clayey sand	Weichselian	Bolders Bank or Dogger Bank	Considered low but has potential to bury deposits of interest or to contain reworked material.
Pre-Glacial Sand	Fine sand with rare lamina of clay or organic matter, fragments of organic matter, wood and shell	Holstenian to Eemian	Egmond Ground, Cleaver Bank, Tea Kettle Hole or Eem	Potential to contain *in situ* and derived archaeological material, and palaeoenvironmental material.

106. Of the six units anticipated to be present within the Offshore Archaeology Study Area, five were recorded in the boreholes.

107. Deposits of archaeological interest include Alluvium and Peat which have potential to contain *in situ* and derived archaeological material, and palaeoenvironmental material. The geoarchaeological review of DBS boreholes identified a sequence of silt and clay (alluvium) interbedded with a thin (0.28m) peat deposit at a depth of 18m below seafloor in borehole BBSW-005-BH-A. Core sample photographs suggest a large (up to 10cm) piece of wood is preserved within the peat and a sample has been retained for future palaeoenvironmental assessment. These deposits indicate there is high potential for remnants of prehistoric landscapes to be present in the Offshore Archaeology Study Area, although these may be buried below significant thicknesses (>10m) of recent Shallow Marine Sand.

108. Proglacial deposits were not recorded, but this may reflect low data resolution and there is potential for these deposits to be present in the Offshore Archaeology Study Area. The archaeological potential of Proglacial deposits depends on their depositional history and relative sea-level history. If laid down in warming periglacial landscape, these deposits have the potential to preserve palaeoenvironmental records and as such, understanding their formation history is of geoarchaeological interest.

109. The lowermost deposits across the Dogger Bank are characterised by sand-rich formations representing deposition in marine, terrestrial, periglacial and intertidal environments (Egmond Ground Formation, Cleaver Bank Formation, Tea Kettle Hole Formation and Eem Formation). Of these, Cleaver Bank Formation and Tea Kettle Hole Formation are of archaeological interest as they were deposited during the Saalian period (MIS 6) when sea levels were lower, and the southern North Sea was sub-aerially exposed. These formations represent deposition in a periglacial or aeolian environment during the Middle Palaeolithic, a period of known hominin occupation in Britain and the southern North Sea (e.g. Bicket and Tizzard, 2015). Understanding the formation history of the Pre-Glacial Sand unit is, therefore, important for defining archaeological potential.

110. Three units have low archaeological potential. Shallow Marine Sand and Gravel Lag are the youngest deposits and reflect deposition in a marine environment during and after rising sea levels flooded Dogger Bank in the early to middle Holocene. These deposits have the potential to contain reworked archaeological material, or to bury other cultural heritage such as wrecks. The Diamict and Glacial Sand unit represents processes occurring at or below an ice sheet during the last glacial period when the Dogger Bank was unsuitable for hominin occupation and as such, these deposits have low archaeological potential, although they may bury or seal older deposits of interest.

111. In 2023, a geotechnical survey comprising 122 vibrocores to depths of up to 6m below seafloor was undertaken along the export cable corridor. A geoarchaeological review of core logs provided information on the nature, stratigraphy and extent of deposits in the shallow subsurface (**Volume 7, Appendix 17-4 (application ref: 7.17.17.4)**). Bedrock of chalk and mudstone was recovered at four locations indicating a relatively thin cover of Quaternary deposits in places. The shallow Quaternary stratigraphy of the export cable corridor is dominated by seabed sediments and shallow marine sands overlying glacial clays interbedded with glacial sands. These deposits have low archaeological potential.

112. In four vibrocores, low strength clay and sandy silts were recovered which are initially interpreted as alluvium and may have formed in and along the margins of river or tidal channels before the area was submerged. These deposits are of archaeological interest as they preserve inorganic palaeoenvironmental material. No peat or organic deposits were identified in the vibrocores.

113. A geotechnical survey comprising five cable percussion boreholes was also undertaken in the nearshore part of the export cable route in water depths between 2m and 9m below Lowest Astronomical Tide (LAT). These recovered a sequence of seabed sediments overlying glacial clay resting on chalk bedrock (**Volume 7, Appendix 17-4 (application ref: 7.17.17.4)**). No deposits of archaeological interest were recovered in these nearshore boreholes.

114. The archaeological assessment of UHRS and SBP data undertaken by Wessex Archaeology (**Volume 7, Appendix 17-3 (application ref: 7.17.17.3)**) identified a total of 171 palaeolandscape features of archaeological interest, with 155 located within the Array Areas and 16 in the offshore export cable corridor. These features include geomorphological features such as channels, basins, mounds and sediment wedges. They also include seismic anomalies such as bright reflectors and acoustic blanking that may indicate the presence of organic material.

115. These features, summarised below, are described further in **Volume 7, Appendix 17-3 (application ref: 7.17.17.3)** and are listed in full in the gazetteer of palaeolandscape features included as **Appendix I** to **Volume 7, Appendix 17-3 (application ref: 7.17.17.3)**. The distribution of the features is shown on Figures 3 to 9 (Array Areas) and Figures 11.1 to 11.6 (Offshore Export Cable Corridor) in **Volume 7, Appendix 17-3 (application ref: 7.17.17.3)**.

116. The interpretation reveals a complex sequence of channels that has evolved during multiple glacial / interglacial cycles. The oldest of these channel features are interpreted as tunnel valleys that formed at the margins of ice sheets that were present in the Dogger Bank region during the Elsterian and Saalian glacial periods. Whilst these features formed during a cold environment that would have been unsuitable for human occupation, they may have infilled at a later date, potentially in warmer climates and therefore have potential to preserve palaeoenvironmental material.

117. During the Eemian interglacial period, the southern North Sea would have been submerged but there is evidence of a delta forming in the region of Dogger Bank at this time and the assessment of geophysical data indicates the upper part of the Eemian sequence is incised by multiple channels. These channel features have not been studied previously so their age and formation history is unknown, but they likely formed in a subaerial environment. Furthermore, humans were absent from Britain (but not Europe) during this time so the archaeological potential of these channels is poorly understood.

118. The uppermost channels incise into glacial deposits that formed during the last glacial period (Weichselian) when the Dogger Bank region was overridden by ice sheets. These channel features have variable fill and form, and are interpreted to have formed initially in a proglacial environment during deglaciation, with a later stage of channel formation representing a shift to temperate conditions during the early Holocene. Bright reflectors, potentially indicating the presence of organic material, are identified in these upper channels and there is high potential for the preservation of palaeoenvironmental material.

119. At the interface between the Holocene palaeo-land surface and overlying marine sediments a series of mound and wedge features were identified. Their archaeological potential is unknown but they may be remnants of former coastal barrier islands that would have formed due to rising sea levels during the early Holocene. Alternatively, these features could be marine bedforms that formed in shallow water when Dogger Bank was initially submerged.

120. Fewer palaeolandscape features of archaeological interest were identified along the Offshore Export Cable Corridor. Two cut and fill features were identified below sand waves immediately to the west of Dogger Bank. The acoustically transparent nature of the infill suggests deposition in quiet water and these features could be part of wider channel forms whose form is unknown beyond the limits of the data in the export cable corridor.

121. In the nearshore, a series of channel and cut and fill features have been identified incised into underlying glacial deposits. These are interpreted as potential remnants of fluvial or other terrestrial features that would have formed before the area was submerged. A series of asymmetric mounds are also present in the sub-surface, but these are visible on the seabed surface as the offshore export cable corridor approaches the coast. They are interpreted as possible sand waves or coastal dunes but may also be relict glacial features. One feature described as a curvilinear mound, observed in MBES data in the nearshore, has been interpreted as remains of a channel feature, potentially comprising stiff glacial material or fibrous peat. This is of archaeological interest and it may be related to the peat deposits at the Skipsea Withow Mere Site of Special Scientific Interest (SSSI).

122. Considering the location of the Projects at the western margin edge of the Dogger Bank, which is known to preserve palaeolandscape features and deposits of archaeological interest, and the recovery of organic and palaeoenvironmental material in a borehole located in the Offshore Archaeology Study Area, there is high potential for submerged prehistoric landscape features and deposits to be present within the Array Areas. This is confirmed by the archaeological assessment of geophysical data which has identified a multi-age sequence of channel features that could represent periodic sub-aerial exposure of the Dogger Bank from the Eemian interglacial to the early Holocene. The palaeolandscape potential of the Offshore Export Cable Corridor is lower in comparison, but localised pockets of alluvium are preserved, potentially associated with palaeochannel features. The nearshore part of the Offshore Export Cable Corridor shows evidence of relict channels and other potentially terrestrial features that could correlate to the extensive wetland environments at Skipsea Withow Mere. These are of archaeological interest and may support correlation of palaeoenvironmental records across the land-sea interface.

17.5.1.2 Cultural Significance of Heritage Assets

123. There are no known seabed prehistory sites within the Offshore Archaeology Study Area for which significance can be described. As such, the significance of these palaeolandscapes lies primarily in their archaeological interest or research value, particularly when considered alongside survey data and interpretations produced for other seabed development projects on the Dogger Bank.

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

125. For offshore assets, for the most part, submerged archaeological sites are not 'readily appreciated by a casual observer'. With respect to former prehistoric landscapes in the southern North Sea, these are largely experienced conceptually in terms of interpreted data and research. As such, the setting of these assets (in terms of the surroundings in which they are experienced) does not form a key part of their cultural significance. However, changes within the physical setting will occur (i.e., the introduction of the Projects into the seascape) and the capacity of these palaeolandscapes to accommodate this change is discussed alongside historic seascape character in section 17.5.4.

17.5.1.3 Importance of Heritage Assets

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

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

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

129. The heritage importance of the potential heritage assets outlined above are presented in **Table 17-11**.

Table 17-11 Heritage Importance (Seabed Prehistory)

Asset Type	Definition	Importance
Potential *in situ* prehistoric sites	Primary context features and associated artefacts and their physical setting (if / where present).	High

Asset Type	Definition	Importance
	Known submerged prehistoric sites and landscape features with the demonstrable potential to include artefactual material.	High
Potential submerged landscape features	Other known submerged palaeolandscape features and deposits likely to date to periods of prehistoric archaeological interest with the potential to contain *in situ* material.	High
Potential derived prehistoric finds	Isolated discoveries of prehistoric archaeological material discovered within secondary contexts.	Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material.	Low
	Palaeoenvironmental material associated with specific palaeolandscape features or archaeological material.	High

17.5.2 Maritime and Aviation Archaeology

17.5.2.1 Description of Heritage Assets

130. There are no designated wrecks or other types of protected sites within the Offshore Archaeology Study Area. There is, however, one record from the UKHO which describes the recovery of material from a crashed Tornado (UKHO ID 6586). Should any material from a crashed military aircraft be encountered located within the Offshore Archaeology Study Area, these would automatically be protected under the Protection of Military Remains Act 1986.

131. SSS, MBES, MBBS and Mag. data interpreted by Wessex Archaeology have demonstrated the presence of 847 seabed features which have been identified as being of archaeological interest (A1) or potential archaeological interest (A2 and A3) in accordance with the definitions set out in **Table 17-5**. A full list of seabed features interpreted from the data by Wessex Archaeology for the Projects is included in the gazetteer in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**. The locations of seabed features within the Array Areas are illustrated on Figures 2.01 to 2.24 and within the offshore export cable corridor on Figures 2.10, 2.22 and 2.25 to 2.41 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**.

132. A total of 495 features have been identified within the Array Areas and 352 within the Offshore Export Cable Corridor, as shown in **Table 17-12**.

Table 17-12 Anomalies of Archaeological Potential Within the Offshore Archaeology Study Area

Archaeological discrimination	Array Areas	Offshore Export Cable Corridor	Total	Interpretation
A1	18	8	26	Anthropogenic origin of archaeological interest
A2_h	60	63	123	Anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature
A2_l	392	276	668	Anomaly of possible anthropogenic origin but the interpretation is uncertain; may be anthropogenic or a natural feature
A3	25	5	30	Historic record of possible archaeological interest with no corresponding geophysical anomaly
Total	495	352	**847**	

133. Furthermore, these anomalies can be classified by probable type, which can further aid in assigning archaeological potential and importance as shown in **Table 17-13**.

Table 17-13 Types of Anomaly Identified

Anomaly classification	Array Areas	Offshore Export Cable Corridor	Total
Wreck Areas of coherent structure including wrecks of ships, submarines and some aircraft (where coherent structure survives).	6	3	9
Debris field A discrete area containing numerous individual debris items that are potentially anthropogenic, and can include dispersed wreck sites for which no coherent structure remains.	13	9	22
Debris Distinct objects on the seabed, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin.	9	11	20
Linear debris Distinct linear objects on the seabed, either straight or curved, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin. May represent linear anthropogenic debris which can include, for example, lengths of rope or chain or abandoned fishing gear.	12	31	43
Seabed disturbance An area of disturbance, occasionally containing objects of uncertain origin. May indicate wreck debris or other anthropogenic features, or items buried just below the seabed, but lacking any definite anthropogenic structures. Precise nature is uncertain.	41	19	60
Bright reflector Individual objects or areas of low reflectivity, characteristic of materials that absorb acoustic energy, such as waterlogged wood or synthetic materials. Precise nature is uncertain.	7	1	8

Anomaly classification	Array Areas	Offshore Export Cable Corridor	Total
Dark reflector Individual objects or areas of high reflectivity, displaying some anthropogenic characteristics. Precise nature is uncertain.	57	53	110
Mound A mounded feature with height not considered to be natural. Mounds may form over wreck sites or other debris.	3	25	28
Magnetic No associated seabed surface expression, and have the potential to represent possible buried ferrous debris or buried wreck sites.	322	195	517
Recorded Wreck Position of a recorded wreck at which previous surveys have identified definite seabed anomalies, but for which no associated feature has been identified within the current data set.	24	4	28
Recorded obstruction Position of a recorded obstruction (e.g. foul ground, fishermen's fastener recorded by the UKHO), but for which no associated feature has been identified within the current data set.	1	1	2
Total	**495**	**352**	**847**

134. The A1 anomalies, including identified wrecks, are summarised by area in **Table 17-14**. Further details on each wreck are provided in Sheet 1 to Sheet 9 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**.

Table 17-14 Known Wrecks and Unidentified A1 Anomalies Within the Offshore Archaeology Study Area

WA ID	UKHO ID	Description
Array Areas		
70006	N/A	Unidentified and previously unrecorded wreck, isolated and mostly coherent, seen as an ovoid shape with what appears to be an upright and fairly intact hull measuring 23.3 x 12.6 x 0.9m (Sheet 1 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). There is some indication of surviving deck structure. The north-eastern end is disjointed with some evidence of collapse with small angular dark reflectors visible outside the interpreted hull. Associated with a 42nT anomaly on the closest Mag. line located 60m to the east.
70019	6900	Unidentified wreck, highly degraded and somewhat dispersed, seen across an area measuring 40.7 x 21.9m (Sheet 2 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). Despite being broken up, significant height can still be seen at 3.1m and some possible superstructure survives. The wreck site is associated with a 699nT Mag. anomaly seen on one profile line located around 30m away. The UKHO record describes a steam ship recorded on a Danish fishing chart and identified during diving in 1989 as a merchant vessel with lead pipe scattered on the seabed, hence it is known as the 'Lead Wreck'. This wreck was swept clear in 1960 and was recorded as being well dispersed in 1989. In 2020 the most prominent feature of the wreck was recorded as being a round cylinder.
70018		Debris field (5.2 x 4.7 x 0.2m) located to the south of wreck 70019. A further three A2_h anomalies were also considered possibly related to the wreck (debris 70020, debris 70021 and debris field 70022).
70128	97864	Unidentified wreck, coherent and upstanding with a well-defined structure which measures 32.8 x 10.9 x 2.0m (Sheet 3 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). The vessel is internally indistinct and some associated debris is seen to the north and east (A2_h anomalies, linear debris 70127, linear debris 70129, and debris 70130). It is associated with a very large anomaly of 649nT in the Mag. data. The UKHO record describes an unknown wreck, being intact and sinking into the sand on one side, having been first identified in 2021.

WA ID	UKHO ID	Description
70252	97582	Unidentified wreck, visible as a distinct angular structure measuring 59.6 x 11.8 x 3.1m (Sheet 4 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). The hull appears to be broken up, particularly along the western extents. Two large angular objects are present within the northern end. This is associated with a very large Mag. anomaly of 1001nT. The UKHO record describes a wreck first identified in 2021 and reported as being visibly decaying and broken up, with a small debris field at the south-southwest end.
70249		Debris field (6.3 x 3.5 x 0.3m) located west of wreck 70252
70251		Debris field (9.1 x 5.2 x 0.1m) located east of wreck 70252
70349	N/A	Unidentified and previously unrecorded wreck, seen as a coherent vessel measuring 31.0 x 7.0 x 2.8m (Sheet 5 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). The wreck appears upright and is situated within sand ripples so its full extent may be buried. Some probable internal structure is indicated, the southern end slopes into the seabed and may be settled or partially buried. This is associated with a very large Mag. anomaly of 8797nT.
70348		Angular object measuring 7.2 x 2.1 x 0.3m and located west of the southern end of wreck 70349.
70350		Elongate dark reflector measuring 3.4 x 1.0 x 0.2m and located west of the north-east end of wreck 70349.
70448	N/A (70444)	Unidentified wreck, seen as a distinct vessel and measuring 29.6 x 7.8 x 2.5m (Sheet 6 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). This contains a large internal feature, possibly a boiler. The hull appears fairly coherent, with the suggestion of some disintegration. This wreck is located 330m north-west of UKHO record 6824 (70444) and is likely the wreck to which the record refers. However, due to the large distance between the wreck and the recorded location, 70444 has been recorded separately as an A3.
70449		Debris (2.7 x 2.3 x 0.2m) located on the south-west side of the vessel which may be hollow in the centre.

WA ID	UKHO ID	Description
70030	N/A	Isolated debris field comprising three groups of possible debris that are potentially related and are associated with a very large Mag. anomaly of 2649 nT. The area measures 96.2 x 30.1 x 0.2m in total. Interpreted as an area of slightly dispersed ferrous debris.
70264	N/A	Isolated item of debris (5.1 x 3.6 x 1.7m) interpreted as a sub-rounded object which casts a bright shadow in the SSS data and has a very large associated Mag. anomaly of 4747nT. This has been interpreted as ferrous debris.
70051	N/A	Magnetic only anomaly (1815nT) possibly representing significant ferrous debris that is either buried or without surface expression.
70118	N/A	Magnetic only anomaly (8377nT) possibly representing significant ferrous debris that is either buried or without surface expression.
70267	N/A	Magnetic only anomaly (2865nT) possibly representing significant ferrous debris that is either buried or without surface expression.
70299	N/A	Magnetic only anomaly (1501nT) possibly representing significant ferrous debris that is either buried or without surface expression.
Offshore Export Cable Corridor		
70572	6617	Unidentified wreck, seen as a distinct curved dark reflector with complex internal dark reflectors indicating internal structure (Sheet 7 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). It appears partially covered by sandwaves and the visible remains measure 31.0 x 10.0 x 1.0m. There is an associated Mag. anomaly measuring 164nT indicating ferrous material present.
70571		Debris field (25.4 x 13.8 x 0.2m) located to the north of wreck 70572.
70573		Debris field (10.2 x 3.1 x 0.1m) located to the south of wreck 70572.

WA ID	UKHO ID	Description
70574		Debris (4.6 x 1.1 x 0.1 m) located to the west-northwest of wreck 70572.
70628	6596	Unidentified wreck, seen as a distinct elongate dark reflector with some complex internal reflectivity likely indicating structure. It measured at least 35.4 x 14.0 x 2.1m (Sheet 8 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). The wreck is situated in an area of sandwaves which may periodically cover the wreck. Possibly in three segments.
70627		Debris (4.1 x 1.5m) identified approximately 8m to the east of wreck 70628.
70774	97497	Unidentified wreck, seen as a series of dark reflectors across an area measuring 12.5 x 2.5 x 0.4m, with one larger and more distinct dark reflector measuring 1.7 x 0.8 x 0.3m (Sheet 9 in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). It was also associated with a very large Mag. anomaly measuring 904nT. The UKHO records describes an unknown wreck that is heavily degraded and reported to have part of the bow and boiler visible.
70599	N/A	Magnetic only anomaly (1575nT) possibly representing significant ferrous debris that is either buried or without surface expression.

135. In addition to the A1 anomalies (including wrecks) listed in **Table 17-14**, there are 30 A3 historic records of possible archaeological interest with no corresponding geophysical anomaly. These are all recorded locations of UKHO wrecks or obstructions for which no remains were visible in the geophysical data assessed by Wessex Archaeology (**Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**). Of these 30, ten have descriptions within the UKHO record which suggest material has previously been recorded on the seabed (**Table 17-15**). Two of the A3 records (70534 and 70659) are located within the construction buffer which has not been covered by the 2022 geophysical dataset, and no comment can be made on the wreck's current condition. For the remining eight A3 records in **Table 17-15** it is possible that, although they were not seen in the current geophysical dataset, wrecks may still be present, either well dispersed and / or buried at the recorded location, or that the record may be inaccurately positioned, and the wreck is located elsewhere.

Table 17-15 A3 Historic Records Within the Offshore Archaeology Study Area

WA ID	UKHO ID	Description
Array Areas		
70035	6896	An unknown wreck recorded on a Danish fishing chart in 1965. This was reported as having been visually located in 1989, but has since been amended to dead in 2002.
70076	6898	An unknown dangerous wreck. This was first reported in 1915 and last updated in 1972 from a Danish fishing chart.
70146	6870	A small unknown wreck recorded as dangerous. This was first located and dived in 1989, a survey in 1990 failed to identify it in bathymetric data and the record was amended to dead
70220	6838	An unknown wreck. This was identified in 1982, but has since been amended to dead.
70271	6815	An unknown dangerous wreck. This was first reported in 1960, and was recorded as being present on a 1965 edition Danish fishing chart in 1972.
70286	6808	An unknown dangerous wreck. This was first noted in 1959, was shown on a Danish fishing chart and last recorded in 1978. No information is provided in the record of its dimensions or condition.
70444	6824	An unknown wreck. This was present on a Danish fishing chart and was visually observed as present in 1982. This position is 330m south-east of observed wreck 70448 and may represent this wreck, although this is uncertain.
Offshore Export Cable Corridor		
70534	6849	An unknown wreck last surveyed in 1986, observed to be lying between sandwaves and measuring 25m in length and 1.9m in height. Located within the construction buffer and not covered by the 2022 geophysical data.

WA ID	UKHO ID	Description
70653	6586	The recorded position of the wreck *Resercho*, a British vessel lost in 1939 after hitting a mine. The position was originally recorded as an obstruction by fishermen but, in 1986, large pieces of wreck were located by the fishing vessel *Alatna* during a search for aircraft wreckage, believed to be from a crashed Tornado. Nothing was found at this location in 2016 and the record was amended to 'dead'. No anomalous features were identified in the 2022 data at this location during this assessment. This may be due to the fact the some of the wreckage has been recovered, although there is still the possibility of material being present on, or below, the seabed.
70659	6470	*Feltre*, originally the *Rhenania*, a steamship built in Germany in 1904 as a passenger ship for the Hamburg-Amerika Line. At the outbreak of WWI the ship was requisitioned and renamed Feltre by the Italian government and put to use as a cargo ship. Feltre was on route to the Tyne with a cargo of iron ore when the vessel was torpedoed and sunk by the German submarine UB-32 on 26th August 1917. The wreck was positively identified in 1986, from the original name on the ships bell found by divers. The site is known locally as Cap Morel, or Cattermole. The wreck was last recorded in2016 with dimensions of 135.4 x 34.2 x 11.3m, broken up with a strong magnetic anomaly. Located within the construction buffer and not covered by the 2022 geophysical data.

136. The remining 20 A3 records correspond to fishermen's fasteners, wrecks or obstructions that are recorded by the UKHO, but which have descriptions which suggest that no material has actually ever been observed at the recorded location. All have been retained within the gazetteer as a precaution for recording purposes and are described further in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**.

137. Five further UKHO records related to modern losses of vessels which were the:

- *Annemarie Palm 2* (UKHO ID 97394 and 6772) lost in 1977 (fishing vessel);
- *Storm Drift* (UKHO ID 6485) lost in 1980 (fishing vessel);
- *Our Lorraine* (UKHO ID: 6486) lost in 1975 (fishing vessel); and
- *Emmalies Funk* (UKHO ID: 6782) lost in 1973 (German cargo ship).

138. As 'modern' vessels lost post-1970 these wrecks are not of archaeological significance. *Emmalies Funk* (UKHO ID: 6782) is considered a 'dead' wreck by the UKHO and appears to present a recorded location of loss only, remains of the vessels itself having not been found.

139. Of the total 847 seabed features, 791 are discriminated as A2 anomalies of possible archaeological interest, comprising 123 discriminated at A2_h (anomaly of likely anthropogenic origin but of unknown date, may be of archaeological interest or a modern feature) and 668 as A2-l (anomaly of possible anthropogenic origin but interpretation is uncertain, may be anthropogenic or a natural feature). These anomalies may be of no archaeological interest (i.e. modern debris or potentially a natural feature), may represent isolated finds lost from a vessel or aircraft boat (e.g. ordnance, anchors, items of deck machinery, or broken super structure) or may represent buried or dispersed wreckage, which could be previously unrecorded, or could be associated with recorded losses that have not yet been located, as described below. Full details are provided in **Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**.

140. In addition to the seabed features summarised above there is potential for the presence of previously unrecorded maritime archaeological material to be present, dating from the Mesolithic period up to the present day. Similarly, there is potential for the discovery of previously unknown aircraft material.

141. The maritime records maintained by Historic England (and part of the former NRHE) group recorded losses at arbitrary points on the seabed called Named Locations, these represent general loss locations and do not (unless by chance) relate to actual seabed remains. As stated above, the UKHO dataset also includes five recorded loss locations which do not correspond to actual remains.

142. There are two named locations within 5km of the Offshore Archaeology Study Area, as shown on **Volume 7, Figure 17-1 (application ref: 7.17.1)**: 'Hornsea Humberside' at NGR TA2094048320 and 'Filey Bay North Yorkshire' at NGR TA4675080610. The are 26 reported losses grouped at Hornsea and only one at the off 'Filey Bay' location.

143. Twenty-four of the records correspond to 19th century losses of fishing or cargo vessels. Only one record relates to an earlier loss, corresponding to the 1327 wreck of a Flemish cargo vessel which stranded, laden with herrings, at Hornsea after being driven ashore "*by the tempest*" (NRHE ID 1450776).

144. The remaining three records correspond to WWII military aircraft losses, all British aircraft lost in 1940 (NRHE ID 1321326 Whitley MK V P5002), 1943 (NRHE ID 1352689 Bristol Beaufighter MK VI T5316) and 1944 (NRHE ID 1340795 Lancaster MK I ME747).

145. Two of the UKHO losses are recent losses in 1971 (UKHO ID 8559, the cargo vessel *Welfare*) and 1990 (UKHO ID 6400, fishing vessel *Mateley B*). The vessel *Rubico* (UKHO ID 6517) was lost in 1904 following a collision, but has not been found, and the wrecks *Nitedal* (UKHO ID 5804; NRHE ID 978621) and *Leka* (UKHO ID 57495; NRHE ID 1454594) were both lost after being torpedoed by a German submarine in 1917. The NRHE record confirms that the wreck of the *Nitedal* has since been confirmed at another location outside the Offshore Archaeology Study Area. The UKHO description for *Leka* describes how the site had been suggested to be the remains of either the *Nitedal*, *Leka* or both although the site was no longer considered to be a danger to navigation in 1918 and nothing was found at this location in 1931 or 1980.

146. Further details of these losses are provided in **Volume 7, Appendix 17-5 (application ref: 7.17.17.5)**.

17.5.2.2 Cultural Significance of Heritage Assets

147. The cultural significance of unidentified wrecks and debris and potential wrecks, aircraft and isolated finds (which are yet to be discovered) is currently unknown. The archaeological interest (or otherwise) of features located within the construction footprint, and which may be impacted by the Projects, will be further examined post-consent (e.g. investigation of individual anomalies (ground-truthing) through Remotely Operated Vehicles (ROV) and / or diver survey). Once the character, nature and extent of selected features are more fully understood, their cultural significance can be described to inform any requirements for further work on a case by case basis.

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

149. There is currently only one identified wreck of archaeological interest known to exist with the Offshore Archaeology Study Area, the *Feltre* (A3 historic record ID 70659). Previously named *Rhenania*, this steam ship was built in Germany in 1904, with a quadruple expansion engine of 387hp and screw propulsion, by Bremer Vulkan in Vegesack. The vessel was designed for the Hamburg-Amerika Line to carry over 260 passengers. The dimensions of the vessel are recorded as 124.7m (length) x 16.2m (width) x 8.5m (draught) with a tonnage of 6455. The ship had two decks, a poop deck of 255 feet and forecastle of 46 feet.

150. At the outbreak of WWI the *Rhenania* was laid up in Naples and was requisitioned and renamed *Feltre* by the Italian Government and put to use as a cargo ship. *Feltre* was on route to the Tyne with a cargo of iron ore when the vessel was torpedoed and sunk by the German submarine UB-32 on 26th August 1917.

151. The loss of this vessel during WWI in 1917 after being torpedoed is of particular cultural significance. It is noted that two further cargo vessels, *Nitedal* (UKHO ID 5804 / NRHE ID 978621) and *Leka* (UKHO ID 57495 / NRHE ID 1454594), are reported to have been torpedoed in 1917, although the remains are not known to be present within the Offshore Archaeology Study Area itself.

152. The study East Coast War Channels in the First and Second World War (Firth, 2014) examines the spatial extent of navigation channels and minefields between the Thames and the Scottish border during both wars and the heritage assets that are associated with these channels. Together with the presence of military installations at the landfall (see section 17.5.3) the context of the East Coast war channels represents the wider setting of 20th century military activity within which the Offshore Archaeology Study Area is located. The use and loss of the wrecks against the wider backdrop of hostile military action along the east coast means that their setting should be considered to contribute to their significance, although this corresponds more broadly to their cumulative research value.

153. Similarly, although there are no known aircraft crash sites within the Offshore Archaeology Study Area (with the exception of a possible modern Tornado crash site) the aircraft losses reported during WWII further demonstrate this military setting.

154. However, it is also notable that the largest number of reported losses represent 19th century losses of fishing and cargo vessels of local, vernacular types (e.g. brigs, snows, dandys, luggers and schooners) rather than larger sailing ships and steamships. This is indicative of the importance of coastal trade and fishing to the region and should any of these vessels be identified these would likely have particular local / regional cultural significance.

17.5.2.3 Importance of Heritage Assets

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

156. As a broken up wreck, the *Feltre* is not considered to represent an example which could be considered of national importance warranting protection at a national level. On the basis the wreck may be considered an asset of regional interest, due to its association with the military activities of WWI, *Feltre* is assessed as being of medium importance for the purposes of the ES.

157. As the vessel is located within the construction buffer and not covered by the 2022 geophysical data, it is not possible to comment further on the current extent of the remains. However, should further information become available, as part of pre-construction investigations, for example, the importance of *Feltre* (and other wrecks which may yet be identified) could be enhanced by additional contextual information. For example, importance may be strengthened by an association with other vessels of a similar type, or with recognition of a wider spatial context which reflects their use within a specific seascape or for a specific purpose (e.g. maritime trade networks or a military activity). This is considered further as part of the CEA in section 17.8.

158. Isolated finds of maritime or aviation origin within secondary contexts will have evidential value for patterns of activities offshore, and are assessed as being of medium importance.

159. The heritage importance of the heritage assets outlined above are presented in **Table 17-16**.

Table 17-16 Heritage Importance (Maritime and Aviation Archaeology)

Asset type	Definition	Importance
Known maritime heritage assets	*Feltre* (70659)	Medium
	Unidentified wrecks and associated debris	High
Potential wrecks	Wrecks within the Offshore Archaeology Study Area that are yet to be discovered	High
Potential derived maritime finds	Isolated artefacts lost from a boat or ship or moved from a wreck site	Medium
Potential aircraft	Aircraft within the Offshore Archaeology Study Area that are yet to be discovered	High
Potential derived aviation finds	Isolated artefacts lost from an aircraft or moved from a crash site	Medium

17.5.3 Intertidal Archaeology

17.5.3.1 Description of Heritage Assets

160. There are no designated heritage assets below MHWS at the landfall.

161. Records of non-designated heritage assets within the intertidal zone have been compiled from searches of the Humber HER and records held by Historic England which were formally part of the NRHE dataset. Records of heritage assets which were once located on land, but which have been lost due to coastal erosion, have also been included as relevant to the potential for fragmentary remains to survive within the Offshore Archaeology Study Area. Intertidal heritage assets located within the Offshore Development Area, and the onshore Non-Designated Heritage Assets Study Area, are illustrated on **Volume 7, Figure 22-2-3a (application ref: 7.22.1)** and listed in the gazetteer provided in **Volume 7, Appendix 22-2 Annex 22.2.2 (application ref: 7.22.22.2)**.

162. The assessment of the intertidal baseline was further supported by a heritage walkover survey which took place over four days from 5th to 8th December 2022. The full results of the walkover survey are presented in **Volume 7, Appendix 22-4 (application ref: 7.22.22.4)**.

163. Reference is also made in the summary below to the interim results of archaeological trial trenching undertaken by AOC Archaeology Group between August and December 2023 at the landfall, above MHWS, as relevant to adjacent archaeology within the intertidal zone **Volume 7, Appendix 22-8 (application ref: 7.22.22.8)**. The Landfall Evaluation Area consists of four fields adjacent to the cliff top where evidence of Iron Age and Roman activity, a medieval settlement (possibly the lost village of Cleeton), and further undated and post-medieval features have been excavated.

164. The records of non-designated heritage assets, walkover survey, and trial trench evaluation suggest a high potential for archaeological remains within the intertidal zone, including buried archaeology, corresponding to four main areas of potential:

- Prehistoric archaeology including the potential for buried features and paleoenvironmental remains;
- Iron Age and Roman archaeology comprising isolated finds and relating to former sites and features which have been lost / impacted through coastal erosion;
- Medieval and post-medieval archaeology comprising isolated finds and relating to former settlements which have been lost / impacted through coastal erosion; and
- 20th century military installations and coastal defences, many of which have also been lost or have fallen onto the beach due to coastal erosion.

17.5.3.1.1 Prehistoric

165. Earlier Prehistoric activity is demonstrated through the presence of findspots of faunal remains (Humber HER 16379, 18037, 15531) and flint and bone implements (Humber HER 21182, 20667, 8835). A number of undated pits, ditches and buried deposits observed in the eroding cliff face may also represent early Prehistoric features (Humber HER 21228, 21231, 21232, 18037), although these may also be related to the Iron Age and Roman activity described in section 17.5.3.1.2 below.

166. During the heritage walkover survey an organic / peat deposit was observed in the cliff face at the northern point of the Seaside Caravan Park at the recorded location of Humber HER 18037 (a Prehistoric animal bone recovered from organic deposit at Ulrome cliffs) (see **Volume 7, Appendix 22-4 (application ref: 7.22.22.4)**). Peat sequences at the Holderness Coast have been dated to the Mesolithic, c. 11.6ka (Evans and Thompson, 2010). This deposit, therefore, likely represents a prehistoric buried deposit, although the precise date is unknown. Other recorded features visited during the walkover survey were not observed (Humber HER 21228, 21231, 21232) and have likely been lost due to coastal erosion.

167. An 'alleged lake dwelling' of possible Neolithic to Iron Age date is reported to have been discovered in 1894, recorded near the northern end of the Skipsea lacustrine deposit, exposed in the cliffs and comprising a dense mass of twigs and brushwood on top of a pointed stake (Humber HER 8849). Similarly, a further possible 'lake dwelling' comprising carved wooden rods and stakes of early Neolithic age are reported from the carr peats exposed at Withow Mere (Humber HER 9001). Other finds of later Prehistoric material include a bronze spearhead from Ulrome beach (Humber HER 4409).

168. The potential for Prehistoric finds should, therefore, be considered high. Due to coastal erosion, *in situ* sites within the intertidal zone are unlikely to survive, although isolated finds may be encountered. Features, such as the organic deposit at Ulrome Cliffs (Humber HER 18037), however, may survive *in situ* exposed in the cliff face and there is potential for further buried deposits and pits or ditches to be exposed with ongoing coastal erosion.

17.5.3.1.2 Iron Age and Roman

169. Iron Age and Roman findspots include coins (Humber HER 13459, 4523) and a sherd of Romano-British pottery (Humber HER 21182) found on the beach, or within the eroding cliffs. Further recorded features include an Iron Age ditch, drain, pottery and animal bone (Humber HER 15807), a double ditch (Humber HER 15809) and a probable Roman-British pit and contemporary pottery (Humber HER 15808) found during a watching brief at Ulrome caravan park, now destroyed by erosion. A former Roman settlement site is also recorded at a location now in the intertidal zone (Humber HER 3759). The site, found in 1950 and 1952, comprised Romano-British calcite gritted ware, Samian ware, an Iron Age / Romano-British storage jar and hard grey fabrics. The site had been exposed by coastal erosion and most likely represented a small village site, now presumed destroyed by further erosion. Further Iron Age and Roman features and pottery are also recorded in the vicinity (Humber HER 21199, 18396 and 6668).

170. Although these features are all recorded to the north of the Onshore Development Area, evaluation trenches excavated for the Projects have also revealed significant evidence for Iron Age and Roman activity within the Onshore Development Area, above MHWS (**Volume 7, Appendix 22-8 (application ref: 7.22.22.8)**). A double-ditched trackway and settlement evidence have been revealed in evaluation trenches in the southeast corner of the Landfall Evaluation Area. The area immediately around the trackway ditches contain a significant concentration of archaeological features with a high incidence of finds, indicating a rubbish dump and proximity to settlement activity. A small number of features were encountered in the northwest corner of the Landfall Evaluation Area, which have blackened fills containing fired stones, indicative of burning. A concentration of ditches in the northwest corner also indicate a zone of possible Iron Age activity.

171. The potential for Iron Age and Roman finds within the intertidal and nearshore area should, therefore, be considered high. Due to coastal erosion, *in situ* sites within the intertidal zone are unlikely to survive, although isolated finds may be encountered. Further features may also be revealed within the eroding cliff face, as indicated by the adjacent undated ditch (Humber HER 21231) and pit (Humber HER 21232) which are likely associated with the settlement activity recorded during the evaluation.

17.5.3.1.3 Medieval and Post-medieval

172. There are a number of towns and villages know to have been lost due to coastal erosion along the Holderness Coast. Within, and adjacent to, the Offshore Archaeology Study Area the former locations of Cleeton (Humber HER 3412), Withow (Humber HER 8838) and Hyde (Humber HER 8845) are recorded, although no known archaeological remains are associated with these locations. Similarly, a 19th century farmhouse was recorded on the cliff edge in a derelict condition in 2009, presumably now lost, (Humber HER 15032). No evidence of these former structures was observed during the heritage walkover (**Volume 7, Appendix 22-4 (application ref: 7.22.22.4)**). A further former asset includes the site of a fish weir (Humber HER 15051) shown on the O.S. 6" first edition map from 1855.

173. There is a single Medieval findspot recorded within the intertidal area, a heart-shaped gold brooch from Skipsea Beach found in 2001 (Humber HER 19770) and two features previously observed in the cliff face are recorded as being of likely Medieval or Post-medieval date (Humber HER 21226, 21227).

174. The highest concentration of archaeological features encountered during the evaluation at the landfall are located in the northwest corner of the Landfall Evaluation Area, representing medieval settlements over more than one phase (**Volume 7, Appendix 22-8 (application ref: 7.22.22.8)**). Finds include pottery of mixed medieval fabrics, with smaller quantities of animal bone, some shell, several iron or copper allow objects and quantities of daub or fired clay. It is suggested that this could be the lost village of Cleeton, located in a different location to that recorded by the HER (Humber HER 3412).

175. A series of updated and post-medieval features have also been located in the southwest corner of the Landfall Evaluation Area including a board natural hollow or pond and a spread of cobble stones which may have been dumped in order to consolidate the ground, rather than representing an ordered surface or trackway.

176. The potential for medieval and post-medieval finds within the intertidal and nearshore area should, therefore, be considered high, although *in situ* sites within the intertidal zone are unlikely to survive.

17.5.3.1.4 20th Century Military Activity

177. The majority of the records recorded from within, and adjacent to, the Offshore Archaeology Study Area correspond to WWII activity although many of these features are no longer extant.

178. In summary, the records primarily correspond to former coastal defence structures, many recorded from aerial photographs, including a large number of pillboxes, anti-tank obstacles, beach lights, gun emplacements, observation posts, beach scaffolding and anti-aircraft obstacles and other features including weapons pits, trackways, barbed wire obstructions and military buildings. Two records correspond to the former locations of military training camps observed on aerial photographs, both since lost due to coastal erosion (Humber HER 21192 and 21221).

179. During the heritage walkover survey a number of these previously recorded locations were visited (**Volume 7, Appendix 22-4 (application ref: 7.22.22.4)**). Most were not observed to survive extant, although remains which were observed on the beach comprised:

- Pillbox 21224: observed on the beach, heavily eroded with only a small corner of the pillbox surviving;
- Pillbox 21233: largely broken up with only fragments remaining;
- Pillbox 21237: now on the beach with the remains only partially visible in the sand;
- Pillbox 21242: the Humber HER records a pillbox roof at his location however only widely distributed remains were observed, partially within the sea at low tide; and
- Beach Obstacles 21244: the Humber HER records WWII beach obstacles consisting of a concrete block with steel pipes, the beach was seen to be littered with concrete and metal debris, particularly along this stretch of the beach although this is also in proximity to the location where previous makeshift seaside huts (MHU21797) once stood on the cliff.

180. Notably, none of the previously recorded anti-tank cubes were seen to survive on the beach.

181. The potential for WWII remains should be considered high. However, due to the action of coastal erosion these would be fragmentary and most likely to comprise the remains of structures which once would have stood on the cliff top. In situ remains such as beach scaffold poles and anti-tank cubes may survive, potentially buried, although these may now be located further offshore.

17.5.3.2 Cultural Significance of Heritage Assets

182. The majority of the Humber HER records relate to previously recorded assets and findspots which are no longer present, although there is high potential for the presence of isolated finds, and potentially *in situ* features in the cliff face, and for the fragmentary remains of WWII defensive structures on the beach. Their cultural significance, therefore, is currently unknown although the archaeological interest (or otherwise) of any remains which come to light during the course of the Projects will be described to inform any requirements for further work on a case by case basis.

183. Previously recorded assets and findspots are no longer present within their 'setting' and setting does not, therefore, contribute to their significance. However, whilst buried archaeological sites may not be 'readily appreciated by a casual observer' the presence of any WWII defensive structures which may be present would be encountered within their intended coastal setting, a contextual setting which was fundamental to their use in the defence of Britain during WWII. In this respect, should such remains be present, their setting would contribute to their significance. However, this contribution is limited through their survival as fragmentary, buried remains as opposed to *in situ* extant structures.

17.5.3.3 Importance of Heritage Assets

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

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

186. Isolated finds of prehistoric archaeological material within secondary contexts, also have evidential value for understanding patterns of population and exploitation of former landscapes, for example. However, as these finds are derived, and out of context, they are regarded as being of medium rather than high importance. Similarly, isolated finds associated with the former Iron Age / Roman, medieval and post-medieval settlements on the cliff top, which may be present within the intertidal zone due to erosion, are considered to be of medium importance.

187. The fragmentary and buried remains of WW2 coastal defences and isolated finds relating to WW2 activities are also assessed as being of medium importance.

188. The heritage importance of the potential intertidal heritage assets outlined above is presented in **Table 17-17**.

Table 17-17 Heritage Importance (Intertidal Archaeology)

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

17.5.4 Historic Seascape Character

189. The historic seascape character of coastal and marine areas around England has been mapped through a series of eight separate Historic Seascape Characterisation (HSC) projects funded by Historic England and undertaken between 2008 to 2014. This has since been followed by an initiative to consolidate the existing projects into a single national database (LUC, 2017a, 2017b, 2017c). The programme uses GIS to map data that can be queried to identify the key cultural processes that have shaped the historic seascape within a given area.

190. The consolidated national GIS dataset was mapped against the Offshore Archaeology Study Area to identify the primary cultural processes which have shaped the historic seascape of this area. This includes both the current character types (**Volume 7, Figure 17-1 (application ref: 7.17.1)**) and the previous (prehistoric and historic) (**Volume 7, Figure 17-2 (application ref: 7.17.1)**) character types for which information is available. The accompanying character texts were used to identify the primary values and perceptions for each character type summarised in **Table 17-18**.

191. A qualification of change since production of the HSC baseline as well as potential changes to the character should the DCO application for DBS East and West be successful is also included in **Table 17-18**.

Table 17-18 Summary of Historic Seascape Character Types

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
Communications	Submarine telecommunications cable	Mapped as a minor character type within the Offshore Archaeology Study Area, crossing the northern corner of DBS West. Submarine telecommunications cables are mostly undetected in the marine environment. However, they are a highly reliable form of transferring information and are critical to our present-day life. They can be perceived as obstacles to certain sea users such as fishermen and dredgers.	No identified change.	As submarine telecommunications cables are mostly undetected in the marine environment it is unlikely that perceptions of this character type would be altered by construction activities or by the presence of installed infrastructure.
Cultural topography	Cultural topography (marine): Coarse sediment plains Fine sediment plains Mixed sediment plains Palaeochannel	These marine cultural topographies overall are highly valued due to their biodiversity and habitat range and have high archaeological potential and can contribute to our understanding of past landscape use. These types of seabed sediments each provide distinct preservation conditions for wrecks and implications for the potential form and survival of underlying palaeolandscapes.	New plans and projects (as described below for the industry character type) have further restricted access to these deposits and the underlying palaeolandscapes (through the physical presence of cables and foundations, for example) or reduced the extent of deposits, through dredging for example. However, a beneficial impact is the ongoing accumulation of publicly available data acquired as part of the consenting process prior to activities which is considered to be of public value.	The primary perceptions which associate marine cultural topography with high archaeological potential could be further enhanced through the accumulation of publicly available data, including discoveries reported through the protocol for archaeological discoveries during construction activities. As the final design of layouts will take the locations of heritage assets and palaeolandscape features into account, change can potentially be offset by professionally executed and published archaeological studies.
Fishing	Bottom trawling Fishing ground Fixed netting Longlining Pelagic trawling Potting Seine netting	Commercial fishing is a primary cultural and historic character of the Dogger Bank area. Bottom trawling, pelagic trawling and seine netting are characterised within constrained areas within DBS East (and partially into DBS West) and the adjacent offshore export cable corridor in the West Shoal and Dogger Bank sea areas. Mapped fishing grounds are concentrated in the western most section of DBS West. Longlining is mapped within the central area of the offshore export cable corridor, fixed netting in the nearshore section and potting mapped adjacent to the landfall only.	Bottom trawling was banned within the Dogger Bank Special Area of Conservation (SAC) in June 2022.	Although there would be areas where fishing activities are temporarily displaced as a result of construction works, fishing activities will still be permitted in areas of the offshore development not undergoing construction activities. Similarly, fishing activities will not be prohibited during the operation phase of DBS, although temporary restrictions may apply during construction and around major maintenance activities.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
Industry	Hydrocarbon field (gas) Hydrocarbon installation Hydrocarbon pipeline	The North Sea as a whole has always been important to the energy industry, most notably for its natural oil and gas resources which have been heavily exploited since the 1960s. Gas fields, hydrocarbon installations and pipelines are present within both Projects. More recently nuclear power and renewable energy sources have become viewed as more important as a result of increasing concerns about CO_2 emissions from energy generation using fossil fuels.	The most significant change since compilation of the HSC dataset is the introduction of new offshore wind farms to the north and south of DBS. The Dogger Bank A and Sofa wind farms to the north of DBS are currently under construction with construction of Dogger Bank B due to commence in 2023, followed by Dogger Bank C in 2024. Similarly, to the south, Hornsea Project 1 became fully operational in 2019 and Project 2 in 2022 with Hornsea 3 consented in 2020 and Hornsea 4 having completed examination.	Overall, perceptions of the North Sea energy industry place greater emphasis upon nuclear power and renewable energy. The HSC states that Britain has the best offshore wind resource in Europe and changing perceptions associated with the construction of DBS are therefore likely to be seen as part of this natural progression for energy generation and as a positive change from fossil fuels to renewable energy. This is further qualified by UK climate change policies. Overall, wind turbines are becoming larger and more dispersed representing fewer discrete locations for avoidance in determining the final layouts and maintaining broader access to the seabed within the wind farms themselves, once constructed. This change will be further understood following the acquisition of additional information to inform detailed design post-consent.
Military	Military practice area	Military practice areas are used by the armed forces for training and military exercises and this character type is mapped across DBS West and sections of the offshore export cable corridor. In UK waters there are several designated military practice areas, formally entitled 'Practice and Exercise Areas' (PEXAs), which are in use or available for use by the Ministry of Defence (MoD) for practice and exercises. These include Royal Air Force (RAF) practice areas, submarine exercise areas and firing danger areas. Public access across these areas is only restricted during active exercises.	No identified change.	It is anticipated that the Projects would not impact on any military activities and there would be no change to the current character of these areas.
Navigation	Navigation activity: Navigation route	Although the region's coastal economy is more strongly perceived for its fishing character, navigation activity is also an important element of the offshore region, with the main port of Hull to the South. For centuries communities have made their living from their proximity to the North Sea and its connecting routes, linking the region to other parts of Britain and to the continent.	No identified change.	Construction and maintenance activities and additional vessel traffic would occur within the context of existing navigation routes in to, and out of, Hull for example. However, this additional traffic is unlikely to be perceived as a material change. It is anticipated that no change to the perception of this character type would occur as a result of construction activities.

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
	Navigation hazard: Hazardous water Maritime debris Wreck hazard	Historically, the sea has been perceived as a dangerous place which often behaves in unexpected and unpredictable ways. Wrecks have most relevance from their roles as hazards to navigational activity or as indicators of areas and routes of past navigational, naval or trading activity. For example, the study East Coast War Channels in the First and Second World War (Firth, 2014), examines the spatial extent of navigation channels and minefields between the Thames and the Scottish border during both wars and the heritage assets that are associated with these channels. Hazardous water includes wrecks and other hazards such as submerged rocks, shoal or flats. Navigational hazards have always been a preoccupation for sailors, but they became prominent in people's consciousness, including in tales and myths, evoking rhymes and songs, due to the danger associated within them. Wrecks, although fatal for many, added to the local heritage of stories about dangers on the high seas. They are also now perceived as recreational opportunities, with many wrecks dived by both amateur dive groups and professional organisations. Many wrecks are also valued for their strong contribution to habitat diversity and by the fishing community as they attract certain prey specifies. See section 17.5.2 for detail on wrecks within the Offshore Archaeology Study Area.	Survey and evaluation for new plans and projects have extended public understanding of these hazards and, in particular, new wrecks and finds have been identified as a direct results of activities. This ongoing accumulation of publicly available data acquired as part of the consenting process is considered to be of public value.	The primary perceptions which associate hazardous water, debris and wrecks with local heritage and stories relating to dangers of the high seas, to recreational diving and to wrecks as habitats could be enhanced through the provision of publicly available data on seabed features identified during geophysical survey, and in the event of unexpected discoveries reported through the protocol for archaeological discoveries during construction activities. During operation, the Projects may result in a change to the perception of navigational hazards on the basis that the introduction of wind turbines represents additional navigation hazards. They are, however, equipped with navigational features such as warning lights. On this basis, this character sub-types are considered to have the capacity to accommodate this level of change.
Recreation	Leisure sailing	The nearshore export cable corridor is mapped as an area characterised by Leisure Sailing. As described in **Chapter 29 Tourism and recreation**, for most of the northeast coast, there is very little recreational boating within the coastal area around Creyke Beck. Recreational vessel usage is generally low in the region, and offshore recreational vessel usage is very low, almost absent.	No identified change.	Short term construction activities in the nearshore export cable corridor, and the presence of landfall infrastructure and Offshore Export Cables, which would be undetectable once installed and therefore not perceived by the public, are considered unlikely to result in a meaningful change to the perceived character of leisure sailing.
	Palaeolandscape component -	Within the Offshore Archaeology Study Area, the HSC maps areas of high, medium and low potential for the	As stated for the cultural topography character type above, new plans and	There is the potential for positive enhancement of primary perceptions associated with a growing

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
Previous character types	Mesolithic (10,000BC – 4000BC)	existence and survival of archaeological evidence for Mesolithic human habitation based on documentary research and available models (**Figure 17-2**). In England, growing interest in submerged landscapes fuelled by the media and popular culture is increasing the value placed on these offshore palaeolandscapes. In particular there is a developing interest within certain sectors of society who come into contact with the resource (e.g. fishermen and aggregate dredgers). Submerged landscapes are becoming ever more recognised and valued within the archaeological community. See section 17.5.1 for detail on submerged prehistoric landscapes within the Offshore Archaeology Study Area.	projects have further restricted access to these deposits and the underlying palaeolandscapes (through the physical presence of cables and foundations, for example) or reduced the extent of deposits, through dredging for example. However, a beneficial impact is the ongoing accumulation of publicly available data acquired as part of the consenting process which is considered to be of public value.	interest in submerged landscapes through the provision of publicly available data on palaeolandscapes following the further archaeological and geoarchaeological assessment of survey data. As the final design of layouts will take palaeolandscapes into account, this change can be offset by the accumulation of publicly available data acquired by the Projects prior to construction which is considered to be of public value.
	Bottom trawling - Early Modern (AD1750 – 1900) Fishing ground - Medieval (AD1066 – 1540) Fixed netting - Early Modern (AD1750 – 1900) Longlining - Post Medieval (AD1540 – 1750) Pelagic trawling -Early Modern (AD1750 – 1900) Seine netting - Post Medieval (AD1540 – 1750)	Historic character types associated with the commercial fishing activities described above are mapped throughout the Offshore Archaeology Study Area (**Volume 7, Figure 17-1 (application ref: 7.17.1)**). The HSC makes specific reference within the Offshore Archaeology Study Area to: Cod fished around Dogger Bank during the 14th century. Documentary sources suggest longlining activities took place off the Dogger Bank during the 18th century. Historically, longlining for white fish from cobles was the most common fishing activity in the North East. Inshore vessels are mainly cobbles. Set Netting and lining. Haddock, Whiting, Coalfish, Pollack, Wrasse, and Cod Beam trawlers worked the Yorkshire coast in the 19th century	Bottom trawling was banned within the Dogger Bank Special Area of Conservation (SAC) in June 2022.	As stated for the fishing character types above, the presence of the wind farm infrastructures is not anticipated to fundamentally alter perceptions of the historic fishing industry. The distance of the Projects Array Areas from the coast, and the minimal above ground infrastructure at the coast, means that the Projects would be largely undetectable by the public and historic perceptions of the traditional fishing industry, which the HSC described as having taken on a 'quaint' character, a memory of better days, will remain largely unchanged.
	Naval battlefield - Medieval (AD1066 – 1540)	Within the Offshore Archaeology Study Area, the HSC maps the site of several naval actions including the Battle of Dogger Bank in 1781, the Russo-Japanese	With the archaeological assessment of offshore survey data there is a growing body of data on military wrecks and aircraft and adjacent	There is the potential for positive enhancement through the provision of publicly available data on the wider setting and character of 20th century

Broad Character Types	Character Sub-Types	Description, Values and Perceptions	Qualification of Change Since HSC Baseline	Capacity to Accommodate Change with DBS
	Early Modern (AD1750 – 1900)	war in 1904 and the WWI second Battle of Dogger Bank	military installations along the coast and on the foreshore. The ongoing accumulation of publicly available data acquired as part of the consenting process is considered to be of public value.	military activity within the Offshore Archaeology Study Area.
	Navigation route - Medieval (AD1066 – 1540)	Coastal navigation routes are known to have existed through the Offshore Archaeology Study Area from at least the medieval period, mapped as part of the funded England's Shipping project in 2007, funded through the Aggregate Levy Sustainability Fund, which used GIS to map historic shipping movements recorded in historical archives. During the medieval period trading networks expanded across Europe and these coastal trade routes were fundamental to the connection of northeast England with this European trade. Although the routes themselves are not necessarily represented by tangible remains, and are not easily appreciated by people observing the sea from land, these historic routes are often associated with increased potential for wrecks and local accounts of historic wrecking events, with coastal vessels driven on to shore and lost in storms, for example.	No identified change.	As stated for the navigation route character type above, construction and maintenance activities and additional vessel traffic would occur within the context of existing navigation routes in to, and out of, Hull for example. However, this additional traffic is unlikely to be perceived as a material change. It is anticipated that no change to the perception of this character type would occur as a result of construction activities.

17.5.5 Future Trends

192. In the event that the Projects are not developed, an assessment of future conditions for offshore archaeology and cultural heritage has been carried out and is described within this section.

193. The existing environment for offshore archaeology and cultural heritage has been shaped by a combination of factors, with the most prevalent being changes in global sea levels and associated climatic and environmental conditions which have affected the burial and preservation of prehistoric archaeology, and latterly that of maritime and aviation archaeology. Historic England (2022) recognise, 'that the marine and inter-tidal zones are dynamic and have always undergone natural environmental change and changing patterns of use and exploitation which are nothing new'.

194. Cycles of burial and exposure resulting from marine physical processes, including storm events which can result in the stripping of shallow sediment from the seabed and beach, have an ongoing effect upon the preservation of archaeological material. Exposed heritage assets are at greater risk from erosion and degradation as a result of the effects of physical processes than those which remain buried and are consequently provided with greater protection from continued sediment cover. These cycles of burial and exposure are anticipated to continue although the effect upon individual heritage assets is difficult to predict as this will depend upon site specific conditions and the nature of any exposed archaeology.

195. As outlined in **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)** (section 8.8) the baseline conditions for marine physical processes will continue to be controlled by waves and tidal currents driving changes in sediment transport and then seabed morphology, as well as anthropogenic influences in relation to water quality. These long-term drivers may be affected by environmental changes including climate change driven sea-level rise. This will have the greatest impact at the coast where more waves will impinge on the cliffs, potentially increasing their rate of erosion. Climate change will have little effect offshore where landscape-scale changes in water levels (water depths) far outweigh the effect of minor changes due to sea-level rise.

196. Consequently, future trends in terms of marine physical processes suggest that continued erosion will result in further loss of archaeological material eroding from the cliffs in the long term. In particular, increased frequency and severity of storms, coupled with sea level rise, will likely impact coastal heritage assets and in the medium to long-term, sea-level rise is likely to drive a very significant change. The sub-surface archaeology which is exposed, investigated, and recorded to professional standards may, however, be considered a public benefit in terms of understanding of and building upon the archaeological record, and certainly preferable to assets and remains being lost altogether. This is particularly relevant for the landfall, where geophysical survey and archaeological trial trenching has already taken place.

197. In addition, survey and evaluation associated with the increased number of offshore development projects in recent years, and finds encountered as a result of activities, create new opportunities for discovery. However, this increasing awareness of the marine historic environment is accompanied by a heightened awareness of the threats from vandalism, the theft of artefacts or the non-disclosure of removed artefacts from shipwrecks. Archaeological protocols for commercial activity mean that finds from the dredging, fishing and offshore renewables industries are now routinely reported. Historic England (2022) also recognize the need for, 'new ways of engaging the public through developing dive trails, by community engagement and raising awareness through the latest technology, allowing non-divers and non-specialists to access information on maritime heritage'.

17.6 Assessment of Significance

17.6.1 Potential Effects During Construction

17.6.1.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets

198. There are no known seabed prehistory or aviation sites within the Offshore Archaeology Study Area. However, as described in section 17.5.2, there are 26 A1 anomalies within the Offshore Archaeology Study Area (which includes nine confirmed wrecks), plus 30 further A3 historic records which are of possible archaeological interest, one of which represents the wreck of the *Feltre* (70659, UKHO 6470) last recorded in 2016, but located within the construction buffer which was not covered by the 2022 geophysical data.

199. Direct (physical) impacts, as stated in the NPS for Renewable Energy Infrastructure (EN-3) (Department of Energy and Climate Change (DECC[1]) 2011b: 49, DESNZ 2023b: 59), encompass direct effects from the physical siting of the Projects. Direct impacts to heritage assets, either present on the seafloor or buried within seabed deposits, may result in damage to, or total destruction of, archaeological material or the relationships between that material and the wider environment (stratigraphic context or setting). These relationships are crucial to developing a full understanding of an asset. Such impacts may occur if heritage assets are present within the footprint of elements of the Projects (i.e. foundations or cables) or within the footprint of activities such as seabed clearance, anchoring or the placement of jack up barges.

200. There is potential for direct impact to these features during the following activities:

- Seabed preparation (including Unexploded Ordnance (UXO) and boulder clearance, where required);
- Installation of wind turbine foundations and foundations for other offshore infrastructure;
- Installation of ancillary infrastructure;
- Installation of offshore cabling; and
- Seabed contact by legs of jack-up vessels and / or anchors.

201. Within the intertidal zone (see section 17.5.3), known heritage assets comprise an organic deposit in the Ulrome Cliffs (Humber HER 18037) and the fragmented remains of former WWII coastal defences observed during the heritage walkover survey (**Appendix 22-4 (application ref: 7.22.22.4)**).

Until the final design and layouts are confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts. However, it is anticipated that all such remains could be avoided through the use of trenchless crossing technology e.g., Horizontal Directional Drilling (HDD) to install the cable ducts, passing below the beach deposits. In this instance there would be no direct pathway for impact to known intertidal assets.

[1] Department of Energy & Climate Change (DECC) became part of Department for Business, Energy & Industrial Strategy (BEIS) in July 2016. In 2023, this was then split to form the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ) and the Department for Science, Innovation and Technology (DSIT).

202. Should an exit in the intertidal zone be selected there would be potential for direct impact to intertidal assets within the footprint of the exit pits and cable trenches and from associated activities such as vehicle movement and storage compounds on the beach. However, the recorded locations of the organic deposit in the Ulrome Cliffs, and the fragmented remains of former WWII coastal defences, as observed in the heritage walkover survey, are located outside the area of the beach where landfall installation activities would be undertaken. Impacts to these known heritage assets will, therefore, not occur.

203. The depth of sedimentary sequences of archaeological interest at the landfall will be further clarified through the geoarchaeological assessment of geotechnical data post-consent, and will inform the design of the trenchless technique and nearshore cable installation.

17.6.1.1.1 Magnitude of Impact – DBS East or DBS West In Isolation

204. With regard to known wrecks and debris, all direct impacts that result in damage to, or disturbance of, a feature would be adverse, permanent and irreversible. The 'fabric' of the asset and, hence, its potential to inform our historical understanding, would be removed.

205. Until the final design and layout is confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts, should they occur within either DBS East or DBS West.

206. Therefore, with the application of a precautionary approach, it is necessary to assess the worst case scenario which assumes that, if any of the seabed features are directly impacted, key elements of the asset's fabric and / or setting could be lost or fundamentally altered, such that the asset's heritage significance is lost or severely compromised. Therefore, in accordance with the definitions set out in **Table 17-8**, without mitigation, there is potential for direct impacts of high adverse magnitude for any of the identified features.

17.6.1.1.2 Magnitude of Impact – DBS East and DBS West Together

207. As above, until the final design and layouts are confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts, should they occur within both Projects. Therefore, without mitigation, there is potential for direct impacts of high adverse magnitude for any of the identified wrecks and features.

17.6.1.1.3 Sensitivity of Receptor

208. The heritage importance (sensitivity) of identified assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

209. As there are no known seabed prehistory or aviation sites within the Offshore Archaeology Study Area, direct (physical) impacts to known heritage assets are limited to impacts to previously recorded wrecks and debris, the importance of which is assessed as follows:

- The A3 wreck *Feltre* ((70659, UKHO 6470)) is of medium importance.
- The nine unidentified wrecks, further A1 anomalies and the remining A3 historic records are of high importance (as a precautionary measure).
- Isolated items of debris are of medium importance.

17.6.1.1.4 Significance of Effect – DBS East or DBS West In Isolation

210. In accordance with the significance of effect matrix (**Volume 7, Chapter 6 EIA Methodology (application ref: 7.6), Table 6-6**) without mitigation, should impacts occur within either DBS East or DBS West In Isolation, these have the potential to be of **major** adverse significance.

17.6.1.1.5 Significance of Effect – DBS East and DBS West Together

211. The potential significance of effect for direct (physical) impacts to known heritage assets, without mitigation, is the same for DBS East and DBS West together as for DBS East or DBS West In Isolation (i.e. any direct impacts have the potential to be of **major** adverse significance).

17.6.1.1.6 Mitigation and Residual Significance of Effect – DBS East or DBS West In Isolation

212. With the application of mitigation, it is anticipated that all direct impacts to known heritage assets as a result of DBS East or DBS West can be avoided.

213. A total of 43 AEZs have been recommended by Wessex Archaeology within the Array Areas and 13 within the offshore cable corridor (55 in total). These are buffers around A1 and A3 discriminated anomalies. Buffers of 25m, 50m and 100m have been recommended as deemed appropriate, based on the relationships between how well constrained the anomaly is, confidence in positioning, and the likelihood of further buried or low lying material that is not currently visible. Anomalies that consist only of point data with uncertain, possibly buried, extents have been attributed a 100m buffer, this includes all A3s and Mag. anomalies. Nine of the anomalies are associated with wrecks and, therefore, have AEZs which are merged with the wider wreck AEZ. For this reason, there are 46 separate AEZs within the Offshore Archaeology Study Area.

Table 17-19 Recommended AEZs within the Offshore Archaeology Study Area

ID	Classification	Easting	Northing	Exclusion Zone
Array Areas				
70006	Wreck (A1)	440339	6028771	50m around visible wreck extent
70018	Debris field	440379	6037905	25m buffer merged with Wreck 70019
70019	Wreck (A1)	440388	6037926	100m around visible wreck extent
70030	Debris field (A1)	438293	6041881	50m around visible feature extents
70051	Magnetic (A1)	435289	6047757	100m centred on reported position
70118	Magnetic (A1)	429045	6050204	100m centred on reported position
70128	Wreck (A1)	430247	6032452	50m around visible wreck extents
70249	Debris field (A1)	412362	6045700	25m buffer merged with Wreck 70252
70251	Debris field (A1)	412413	6045729	25m buffer merged with Wreck 70252
70252	Wreck (A1)	412408	6045711	50m around visible wreck extents
70264	Debris (A1)	411305	6053692	25m centred on reported position
70267	Magnetic (A1)	410130	6056308	100m centred on reported position
70299	Magnetic (A1)	403769	6060507	100m centred on reported position
70348	Debris (A1)	399634	6059714	25m buffer merged with Wreck 70349
70349	Wreck (A1)	399649	6059722	50m around visible wreck extent

ID	Classification	Easting	Northing	Exclusion Zone
70350	Debris (A1)	399662	6059731	25m buffer merged with Wreck 70349
70448	Wreck (A1)	391947	6062989	50m around visible wreck extent
70449	Debris (A1)	391939	6062981	25m buffer merged with Wreck 70448
70004	Recorded wreck (A3)	440393	6028342	100m centred on recorded position
70035	Recorded wreck (A3)	439636	6028351	100m centred on recorded position
70076	Recorded wreck (A3)	435009	6030270	100m centred on recorded position
70107	Recorded wreck (A3)	429831	6038229	100m centred on recorded position
70146	Recorded wreck (A3)	429382	6032307	100m centred on recorded position
70181	Recorded wreck (A3)	422317	6049113	100m centred on recorded position
70211	Recorded wreck (A3)	416966	6051063	100m centred on recorded position
70220	Recorded wreck (A3)	415230	6057336	100m centred on recorded position
70271	Recorded wreck (A3)	412413	6045729	100m centred on recorded position
70286	Recorded wreck (A3)	408249	6057782	100m centred on recorded position
70340	Recorded wreck (A3)	402241	6053486	100m centred on recorded position
70378	Recorded wreck (A3)	398793	6055787	100m centred on recorded position

ID	Classification	Easting	Northing	Exclusion Zone
70419	Recorded wreck (A3)	395549	6055119	100m centred on recorded position
70444	Recorded wreck (A3)	392261	6062897	100m centred on recorded position
70458	Recorded obstruction (A3)	391397	6049161	100m centred on recorded position
70462	Recorded wreck (A3)	393159	6049609	100m centred on recorded position
70463	Recorded wreck (A3)	392061	6049918	100m centred on recorded position
70467	Recorded wreck (A3)	393068	6052579	100m centred on recorded position
70473	Recorded wreck (A3)	392322	6055195	100m centred on recorded position
70474	Recorded wreck (A3)	392635	6057042	100m centred on recorded position
70476	Recorded wreck (A3)	391671	6061703	100m centred on recorded position
70486	Recorded wreck (A3)	388892	6051381	100m centred on recorded position
70491	Recorded wreck (A3)	390126	6053392	100m centred on recorded position
70493	Recorded wreck (A3)	389054	6053603	100m centred on recorded position
70495	Recorded wreck (A3)	390141	6054010	100m centred on recorded position
Offshore Export Cable Corridor				
70571	Debris field (A1)	358909	6033583	50m buffer merged with Wreck 70572

ID	Classification	Easting	Northing	Exclusion Zone
70572	Wreck (A1)	358904	6033574	50m buffer around current feature extent
70573	Debris field (A1)	358906	6033568	50m buffer merged with Wreck 70572
70574	Debris (A1)	358875	6033584	25m buffer merged with Wreck 70572
70627	Debris (A1)	333923	6009726	25m buffer merged with Wreck 70628
70628	Wreck (A1)	333909	6009714	50m buffer around current feature extent
70774	Wreck (A1)	292143	5987147	100m buffer around current feature extent
70534	Recorded wreck (A3)	380150	6036054	100m around recorded position
70555	Recorded wreck (A3)	372484	6042818	100m around recorded position
70599	Magnetic (A1)	346370	6022437	100m around recorded position
70644	Recorded wreck (A3)	405957	6034121	100m around recorded position
70653	Recorded wreck (A3)	308058	5993801	100m around recorded position
70659	Recorded wreck (A3)	305470	5991998	100m around recorded position

214. AEZs may be reduced, enlarged or removed in agreement with Historic England if further relevant information becomes available. However, unless modified by agreement, it is important that AEZs are retained throughout the lifetime of the Projects and monitoring of AEZs may be required by the regulator and Historic England to ensure adherence both during construction and in the future operation of the wind farms.

215. The archaeological assessment of pre-construction survey data, including high resolution geophysical data undertaken for the purposes of UXO identification, will further clarify the nature and extent of any additional anomalies of possible archaeological interest and the scheme design will be modified (micro-sited) to avoid heritage assets where possible.

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

217. The approach to the implementation of these mitigation measures is set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)** submitted alongside the ES and DCO application . The WSI has been prepared in accordance with industry standards and guidance including Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021). With the application of AEZs and micro-siting to avoid additional anomalies of possible archaeological interest, direct impacts to known heritage assets would be avoided, and there would be no impact during construction.

218. Where micro-siting is not possible, although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor adverse** significance).

17.6.1.1.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

219. The application of mitigation (as detailed above) will be the same for the construction of both DBS East and DBS West, as for either Project built In Isolation. Therefore, with the application of mitigation it is anticipated that impacts will be avoided or that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.1.2 Impact 2 Direct Impact to Potential Heritage Assets

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

- Seabed preparation (including UXO and boulder clearance, where required);
- Installation of wind turbine foundations and foundations for other offshore infrastructure;
- Installation of ancillary infrastructure;
- Installation of offshore cabling;
- Seabed contact by legs of jack-up vessels and / or anchors; and
- Cable installation at the landfall.

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

- Potential *in situ* prehistoric sites, submerged landscape features, derived / isolated Prehistoric finds and palaeoenvironmental evidence;
- Potential wrecks and derived / isolated maritime finds (including both A2 seabed features and any further discoveries of material not seen in the geophysical data);
- Potential aircraft and derived / isolated aviation finds (including both A2 seabed features and any further discoveries of material not seen in the geophysical data);
- Potential intertidal finds and *in situ* features within the cliff face; and
- Potential finds eroded from the shoreline and now present within the nearshore area of the offshore export cable corridor.

17.6.1.2.1 Magnitude of Impact – DBS East or DBS West In Isolation

222. Within the intertidal zone, the use of trenchless installation techniques, with entry on the landward side of the cliffs, and exit below MLWS in the marine zone, would mean that impacts to potential intertidal archaeological material would be avoided. It is anticipated that trenchless installation will pass beneath Quaternary deposits of potential archaeological interest and therefore, no impacts will occur. However, should an exit in the intertidal zone be selected there would be potential for direct impact to archaeological material, if present, buried within beach deposits.

223. All direct impacts that result in damage to, or disturbance of, *in situ* prehistoric, maritime and aviation sites and potential submerged landscape features and potential palaeoenvironmental evidence (where associated with palaeolandscape features or archaeological material) would be adverse, permanent and irreversible. The 'fabric' of the asset and, hence, its potential to inform our historical understanding, would be removed. Similarly, should any buried archaeological remains be present within the footprint of the exit pits or cable trenches, or in areas within which associated activities such as vehicle movements would take place within the intertidal zone, all direct impacts would adverse, permanent and irreversible.

224. In practice, the magnitude of the effect will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred. The extent of any impact will depend on the presence, nature and depth of any such remains, in association with the depth, location and nature of construction-related groundworks and contact with the seabed. However, as a precautionary approach, it should be assumed that key elements of the asset's fabric could be lost or fundamentally altered, such that the asset's heritage significance is lost or severely compromised Therefore, in accordance with the definitions set out in **Table 17-8**, without mitigation, there is potential for direct impacts of high adverse magnitude upon potential *in situ* heritage assets.

225. Isolated / derived artefacts, either of terrestrial (i.e. eroded from the shoreline), prehistoric, maritime or aviation origin within reworked deposits may be considered less sensitive to change than *in situ* material, as their relationship with their context or physical setting is less relevant to understanding their significance. Therefore, in accordance with the definitions set out in **Table 17-8**, without mitigation, there is potential for direct impacts of low adverse magnitude upon potential isolated finds. Should such finds be encountered during construction activities, although removal from the marine context will still result in the destruction of that contextual relationship, albeit a secondary context (i.e. not *in situ*), isolated artefacts have capacity to accommodate physical changes, therefore resulting in only a slight loss of heritage significance.

17.6.1.2.2 Magnitude of Impact – DBS East and DBS West Together

226. As above, as the magnitude of the effect will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred there is no difference between the potential magnitude of effect for the Projects together, compared with the Projects In Isolation. Therefore, without mitigation, and as a precautionary approach, there is potential for direct impacts of high adverse magnitude upon potential *in situ* heritage assets. Potential impacts upon isolated finds would be of low adverse magnitude.

17.6.1.2.3 Sensitivity of Receptor

227. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

228. As a precautionary measure all potential *in situ* sites are assessed as being of high importance whilst all isolated finds are of medium importance and isolated examples of palaeoenvironmental material of low importance.

17.6.1.2.4 Significance of Effect – DBS East or DBS West In Isolation

229. In accordance with the significance of effect matrix (**Volume 7, Chapter 6 EIA Methodology (application ref: 7.6), Table 6-6**) without mitigation, should impacts occur to *in situ* sites within either DBS East or DBS West In Isolation, these have the potential to be of **major** adverse significance.

230. Should isolated / derived finds in secondary contexts, or isolated examples of palaeoenvironmental material be encountered during construction activities, impacts would be of potential **minor** adverse significance.

17.6.1.2.5 Significance of Effect – DBS East and DBS West Together

231. The potential impact significance for direct (physical) impacts to potential heritage assets, without mitigation, is the same for the Projects together as for the Projects In Isolation (i.e. any direct impacts upon *in situ* heritage assets have the potential to be of **major** adverse significance while direct impacts upon isolated finds, or isolated examples of paleoenvironmental material, would be of potential **minor** adverse significance).

17.6.1.2.6 Mitigation and Residual Significance of Effect – DBS East or DBS West In Isolation

232. Offshore, further archaeological assessment of high-resolution geophysical data and geoarchaeological assessment of geotechnical data will be undertaken post-consent in order to reduce, as far as possible, the potential for unintended impacts during construction.

233. The examination of potential prehistoric deposits through the assessment of preconstruction geotechnical and geophysical data will further contribute to the body of scientific data available for the study of seabed prehistory within the North Sea. There will be archaeological input into any future sampling programmes and all available geotechnical data (e.g. samples / geotechnical logs acquired as part of engineering-led ground investigation works) will be subject to geoarchaeological assessment during the post-application / post-consent stages of the Projects. If *in situ* prehistoric sites are identified as a result of such work then mitigation measures to record and / or protect such sites would be agreed in consultation with Historic England.

234. Similarly, planned pre-construction surveys will result in full coverage of the areas within which construction will take place (corresponding to the final wind farm layout and cable route) with high resolution SSS, MBES and magnetometer data. If features of archaeological interest are identified during these, they will be subject to the same mitigation as described for known heritage assets (see section 17.6.1.1.6). For example, where A2 anomalies cannot be avoided, then investigation of individual anomalies, or a selection of anomalies, (ground-truthing) through ROV and / or diver survey would be required (to be undertaken post-consent) to establish their archaeological interest. Once the character, nature and extent of selected features are more fully understood, appropriate mitigation measures (proportionate to the significance of the asset) to avoid, reduce or off-set impacts can be determined on a case by case basis.

    Within the intertidal zone, the depth of sedimentary sequences of archaeological interest at the landfall will be further clarified through the geoarchaeological assessment of geotechnical data post-consent, and will inform the design of trenchless landfall and cable installation. Should the short trenchless landfall option be taken forward, a programme of archaeological monitoring / watching brief may be required during ground works. This requirement would be informed by the results of ground investigations, considered against the depth and area of planned excavations and the risk of encountering deposits with archaeological or geoarchaeological / paleoenvironmental potential. Should material of archaeological interest be encountered during ground works, a programme of excavation, post-excavation assessment, and analysis, publication and archiving would be required to ensure that any remains are recorded appropriately (preservation by record).

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

236. In the event of an unexpected discovery of an isolated find, or where discoveries of multiple chance finds from a specific location might be indicative of a wider debris field representing previously unknown *in situ* archaeological material, this will be reported through a formal protocol for archaeological discoveries. This will be based upon the established Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014) (ORPAD). This will establish whether the recovered objects are of archaeological interest and allow for the application of appropriate mitigation measures, where necessary. For any new discoveries, any further mitigation which may be required would be considered on a case by case basis, proportionate to the significance of the discovery.

237. The approach to the implementation of these mitigation measures is set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**.

238. Therefore, although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, with the application of this mitigation it is anticipated that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in the **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.1.2.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

239. As impacts to potential heritage assets cannot be avoided, the worst case for direct impact is based upon the general assumption that the greatest potential footprint for the Projects represents the greatest potential for direct impacts (e.g. damage / destruction) to surviving archaeological material. The combined footprint of both Projects, therefore, represents a greater potential for direct impacts than if, for example, only DBS East or DBS West was to be built In Isolation.

240. However, the application of mitigation, comprising further assessment and investigation post-consent, and the application of the protocol for archaeological discoveries to ensure that prompt advice is received in the event of an unexpected discovery, would be the same for the construction of both DBS East and DBS West together, as for either Project being built In Isolation.

241. Therefore, although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, with this mitigation it is anticipated that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.1.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes

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

243. The potential indirect impact to heritage assets from changes to physical processes is assessed with reference to section 8.7.3 (Potential Effects During Construction) of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The following impacts are relevant to the assessment of the worst case for offshore archaeology and cultural heritage (i.e. increased exposure of buried archaeological material to marine processes due to loss of sediment cover):

- Changes to bedload sediment transport due to cable installation at the landfall; and
- Indentations on the seabed due installation vessels.

244. With regard to changes to bedload sediment transport due to cable installation activities at the landfall, the worst case scenario will be a 'short' HDD option that exits in the intertidal zone. Impacts upon potential heritage assets associated with the excavation of intertidal trenches and exit pits are addressed under Impact 2 above. However, as assessed in **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, any associated destabilisation, and increased erosion of the cliffs is considered likely to have a **major** adverse significance of effect. As such, this increased erosion also has the potential to result in damage to, or destruction of any upon sub-surface archaeological remains, including geoarchaeological / palaeoenvironmental deposits, within the cliffs.

245. With respect to indentations on the seabed due to installation vessels, as it is only sediments within the immediate vicinity of the leg that would be impacted, it is also only heritage assets within the footprint of the legs that would be impacted (with no change in the near- and / or far-field). As this corresponds to the same footprint as the direct impacts discussed above, these indirect impacts are considered to equate to the same conclusions and mitigation as presented above and are not considered further.

246. Marine physical processes impacts which correspond to increased seabed level, and, therefore, increased potential for the protection of heritage assets which are currently exposed through additional sediment cover (sediment deposited from plume) are:

- Changes in seabed level due to seabed preparation for foundation installation;
- Changes to seabed level due to drill arisings from foundations; and
- Changes in seabed level due to cable installation.

247. During foundation installation, coarser sediment disturbed during seabed preparation would fall rapidly to the seabed immediately after it is discharged. The resulting change would be a measurable protrusion above the existing seabed, but one which would remain local to the release point. With time, tidal processes would remobilise and transport this sediment as bedload. The results of modelling show that the maximum overall change in elevation of the seabed was <0.005m, resulting in a **negligible** significance of effect. Similarly, modelling of the changes in seabed level due to deposition of suspended sediment released from drill arisings from foundation installation show there is no observable change greater than 5mm. This change is considered to be within the range of natural background variability and a **negligible** significance of effect.

248. Changes in seabed level during both the seabed levelling and trenching phase of cable installation (array, inter-platform and export) have also been modelled with the maximum change shown to be up to 0.5m within the Array Areas, and less within the export cable corridor. During the levelling phase, changes in seabed level are spatially restricted to within the cable corridors and are typically <0.03m. Changes in seabed level beyond the cable corridors is of the order of millimetres. Therefore, changes in seabed level due to cable installation are also assessed as a **negligible** significance of effect. The greatest changes (up to 0.5m within the Array Areas and 0.25m in localised hotpots of the export cable corridor will be restricted to the corridors themselves and will be short term.

249. As each of these impacts is assessed as a **negligible** significance of effect, there is no measurable potential for the increased protection of heritage assets which are currently exposed through additional sediment cover and these effects are not considered further.

17.6.1.3.1 Magnitude of Impact – DBS East or DBS West In Isolation

250. If the projects are built In Isolation, a maximum of three trenchless landfall exits pits will be required during a single construction phase of 18 months.

251. Sub-surface archaeological remains, including geoarchaeological / palaeoenvironmental deposits, which may be buried within the cliffs are at risk of physical damage, or destruction, through the destabilisation, and increased erosion associated with the short trenchless landfall installation option. Should they occur, indirect physical impacts would be adverse, permanent and irreversible (i.e. no different to direct physical impacts). The 'fabric' of the asset and, hence, its potential to inform our historical understanding, would be removed.

252. In practice, the magnitude of the impact will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred. The extent of any impact will depend on the presence, nature and depth of any such remains, in association with the extent and location of erosion. However, as a precautionary approach, it should be assumed that key elements of the asset's fabric could be lost or fundamentally altered, such that the asset's heritage significance is lost or severely compromised Therefore, in accordance with the definitions set out in **Table 17-8**, without mitigation, there is potential for direct impacts of high adverse magnitude upon archaeological material buried within the cliffs.

17.6.1.3.2 Magnitude of Impact – DBS East and DBS West Together

253. If DBS East and DBS West are built together (concurrently or sequentially) a maximum of six trenchless landfall exit pits will be required, installed during a single phase that will not exceed 18 months. By increasing the number of exit pits, a greater length of cliff coastline will be affected potentially enhancing cliff erosion more than if DBS East and DBS West were built In Isolation.

254. However, whilst the greater magnitude of cliff erosion would increase the risk of encountering, and impacting sub-surface archaeological, or geoarchaeological, remains, the assessed magnitude of impact would remain the same. The extent of any impact will depend on the presence, nature and depth of any such remains and, as a precautionary measure, without mitigation, there is potential for direct impacts of high adverse magnitude.

17.6.1.3.3 Sensitivity of Receptor

255. The heritage importance (sensitivity) of heritage assets at the landfall is set out in section 22.6.1.2.3.1 of **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**. The archaeological trial trenching undertaken by AOC Archaeology Group (**Volume 7, Appendix 22-8 (application ref: 7.22.22.8)**) has revealed evidence of Iron Age and Roman activity, a medieval settlement (possibly the lost village of Cleeton), and further undated and post-medieval features within the site adjacent to the cliff top.

256. The evaluation has identified some level of archaeological activity across the whole landfall area which have been assigned low to high heritage importance. Notable concentrations of more significant activity suggestive of settlement are located in two key zones in the northwest and southeast.

257. The archaeological features in the northwest corner of the landfall zone represent medieval settlement over more than one phase of activity, likely to be the location of the 'lost' medieval hamlet of Cleeton. These remains have been assigned high heritage importance.

258. In the southeast corner of the landfall area a double-ditched trackway along with settlement environs of probable Iron Age to Roman activity was located. These remains have been assigned medium-high heritage importance.

17.6.1.3.4 Significance of Effect – DBS East or DBS West In Isolation

259. The importance of the receptors at risk from increased cliff erosion range from low to high. In a worst case scenario, there would be a high adverse magnitude of impact. In accordance with the significance of effect matrix (**Volume 7, Chapter 6 EIA Methodology (application ref: 7.6), Table 6-6**) without mitigation, should impacts occur within either DBS East or DBS West In Isolation, these have the potential to be of **major** adverse significance.

17.6.1.3.5 Significance of Effect – DBS East and DBS West Together

260. The potential significance of effect for indirect (physical) impacts to buried archaeological and geoarchaeological / palaeoenvironmental remains, without mitigation, is the same for DBS East and DBS West together as for DBS East or DBS West In Isolation (i.e. any direct impacts have the potential to be of **major** adverse significance).

17.6.1.3.6 Mitigation and Residual Significance of Effect – DBS East or DBS West In Isolation

261. As set out in section 22.6.1.2.6 of **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22).** The preferred and optimum mitigation measure is preservation *in situ*, wherever possible. However, this would not be possible in the event of indirect (physical) associated with destabilisation and increased cliff erosion.

262. This impact can be mitigated by ensuring the location of the exit pits are set back from the cliffs by a suitable distance that would ensure the excavations do not destabilise the toe of the cliffs. If the exit pits are located away from the toe of the cliffs, the magnitude of impact would be negligible, although the heritage importance would remain high (as a worst case), resulting is a residual minor adverse significance of effect.

263. However, where avoidance is not possible, significant impacts upon buried archaeological and geoarchaeological / palaeoenvironmental remains may potentially, to a degree, be off-set by the application of appropriate alternative mitigation measures which serve to preserve archaeological remains, where present, by record (e.g. following intrusive evaluation and subsequent excavation, where required).

264. Although preservation by record cannot be considered to reduce the magnitude of impact (and associated significance of effect) per se, given the physical loss of a given asset, the acquisition of a robust archaeological record of an asset may be considered to adequately compensate identified, recognised and acceptable harm to a heritage asset in line with industry standard good practice mitigation measures and compatible with the definitions outlined in section 22.4.3.

265. Any programme of archaeological mitigation would need to be established as part of an ongoing monitoring programme to ensure that any sub-surface archaeological, or geoarchaeological / palaeoenvironmental, remains could be recorded as the cliffs erode and new features or deposits become exposed. It is anticipated that site-specific mitigation would be agreed post-consent as part of additional mitigation measures and commitments set out in the project-specific **Volume 8, Outline WSI (Onshore) (application ref: 8.14)**.

266. With the application of mitigation through ensuring the location of the exit pits are set back from the cliffs by a suitable distance, or through preservation by record, it is anticipated that the residual magnitude of impact and significance of effect can be reduced or offset to levels considered non-significant in EIA terms (i.e. anticipated to be no worse than a **minor adverse** significance of effect).

17.6.1.3.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

267. The application of mitigation (as outlined above) will be the same for the construction of both DBS East and DBS West together, as for either Project built In Isolation. Therefore, with the application of mitigation through ensuring the location of the exit pits are set back from the cliffs by a suitable distance, or through preservation by record, it is anticipated that the residual magnitude of impact and significance of effect can be reduced or offset to levels considered non-significant in EIA terms (i.e. anticipated to be no worse than a **minor** adverse significance of effect).

17.6.1.4 Impact 4 Changes to the Setting of Heritage Assets

268. Activities undertaken as part of construction works for the Projects have the potential to impact heritage assets through a temporary change in their setting which may affect their heritage significance. Temporary changes in the setting of heritage assets, should they occur, may do so for example through the presence of construction vessels and general construction activities taking place within and adjacent to the Offshore Development Area.

17.6.1.4.1 Magnitude of Impact – DBS East or DBS West In Isolation

269. As assessed in sections 17.5.1.2 and 17.5.2.2, the setting of marine heritage assets is not considered to form a key part of their significance, which lies primarily in their historical and research value. Similarly, within the intertidal zone (section 17.5.3.2) previously recorded assets and findspots are no longer present within their 'setting' and setting does not, therefore, contribute to their significance. The presence of any WWII defensive structures, however, would be encountered within their intended coastal setting, a contextual setting which was fundamental to their use in the defence of Britain during WWII.

270. It is only the WWII defensive structures within the intertidal zone, therefore, which are considered potentially susceptible to a temporary change to their setting. However, this susceptibility is further limited through their survival as fragmentary, buried remains as opposed to *in situ* extant structures.

271. The heritage settings assessment, **Volume 7, Appendix 22-5 (application ref: 7.22.22.5)** undertaken in relation to onshore heritage assets, Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage **(application ref: 7.22)** concluded that only changes in setting due to the operation of the Projects would be of sufficient duration to merit more detailed assessment. Any changes in setting due to construction activities would be temporary and of sufficiently short duration that they would not give rise to material harm. The same conclusions are considered as applicable to these WWII intertidal heritage assets.

272. Changes to the setting of both marine and intertidal heritage assets during construction, therefore, are concluded to result in no impact.

17.6.1.4.2 Magnitude of Impact – DBS East and DBS West Together

273. The duration of the construction phase of both DBS East and DBS West together represents a greater potential for changes to the setting of heritage assets than if, for example, only DBS East or DBS West were to be built In Isolation. However, whilst there is a greater potential for changes to setting, the longer construction duration of building DBS East and DBS West sequentially would not lead to an increase to the magnitude of impact for changes to setting and associated heritage significance as the impact remains temporary and reversible.

274. Changes to the setting of both marine and intertidal heritage assets during construction of both DBS East and DBS West together, therefore, are concluded to result in no impact.

17.6.1.4.3 Sensitivity of Receptor

275. The heritage importance (sensitivity) of intertidal, WWII coastal defences (comprising fragmentary and buried remains on beach) are assessed as medium assets in section 17.5.3.3.

17.6.1.4.4 Significance of Effect – DBS East or DBS West In Isolation

276. As the magnitude of impact is concluded to be no impact the significance would be **no change**. Therefore, no additional mitigation is required.

17.6.1.4.5 Significance of Effect – DBS East and DBS West Together

277. As the magnitude of impact is concluded to be no impact the significance would be **no change**. Therefore, no additional mitigation is required.

17.6.2 Potential Effects During Operation

17.6.2.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets

278. As all known heritage assets will be avoided through the retention of AEZs throughout the lifetime of the Projects, there is no pathway for impact during routine or unscheduled maintenance activities.

17.6.2.2 Impact 2 Direct (Physical) Impact to Potential Heritage Assets

17.6.2.2.1 Magnitude of Impact – DBS East or DBS West In Isolation

279. Direct impacts to potential heritage assets are unlikely to occur as a result of intrusive maintenance as any impacts would already have occurred during installation of the wind farm infrastructure during the construction phase and been subject to appropriate and proportionate additional mitigation measures, as and where necessary. There would be no impact at the landfall during the operational phase as there would be no groundworks within or disturbance of intertidal deposits.

280. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-ups or vessel anchors deployed during planned or unscheduled maintenance activities, if these are located in areas which were not previously subject to disturbance. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred. Therefore, as for construction activities, and as a worst case, there is potential for direct impacts of high adverse magnitude upon potential *in situ* heritage assets and low adverse magnitude upon potential isolated finds.

17.6.2.2.2 Magnitude of Impact – DBS East and DBS West Together

281. As above, as the magnitude of the impact will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred there is no difference between the potential magnitude of impact for DBS East and DBS West together, compared with DBS East or DBS West In Isolation. Therefore, without mitigation, and as a precautionary approach, there is potential for direct impacts of high adverse magnitude upon potential *in situ* heritage assets and low adverse magnitude upon potential isolated finds.

17.6.2.2.3 Sensitivity of Receptor

282. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

283. As a precautionary measure all potential *in situ* sites are assessed as being of high importance whilst all isolated finds are of medium importance and isolated examples of palaeoenvironmental material of low importance.

17.6.2.2.4 Significance of Effect – DBS East or DBS West In Isolation

284. In accordance with the significance of effect matrix (**Volume 7, Chapter 6 EIA Methodology (application ref: 7.6), Table 6-6**) without mitigation, should impacts occur to *in situ* sites within either DBS East or DBS West In Isolation, these have the potential to be of **major** adverse significance.

285. Should isolated / derived finds in secondary contexts, or isolated examples of palaeoenvironmental material, be encountered during operation activities, impacts would be of potential **minor** adverse significance.

17.6.2.2.5 Significance of Effect – DBS East and DBS West Together

286. The potential impact significance for direct (physical) impacts to potential heritage assets, without mitigation, is the same for DBS East and DBS West together as for DBS East and DBS West In Isolation (i.e. any direct impacts upon *in situ* heritage assets have the potential to be of **major** adverse significance while direct impacts upon isolated finds will be of potential **minor** adverse significance).

17.6.2.2.6 Mitigation and Residual Significance of Effect – DBS East or DBS West In Isolation

287. The archaeological assessment of post-construction monitoring data will further reduce, as far as possible, the potential for unintended impacts during operation. If further features of archaeological interest are identified these will be subject to the same mitigation as described for known heritage assets described in in section 17.6.1.1.6 above with the primary approach being avoidance.

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

289. The approach to the implementation of these mitigation measures has been set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**.

290. Although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that with this mitigation the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.2.2.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

291. The combined footprint of potential jack-up and anchor locations during operation for both Projects represents a greater potential for direct impacts than if, for example, only DBS East or DBS West was to be built In Isolation. However, the application of a formal protocol for archaeological discoveries to ensure that prompt advice is received in the event of an unexpected discovery, will be the same for the construction of both DBS East and DBS West together, as for either Project being built In Isolation. Therefore, with the application of this mitigation it is anticipated that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.2.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes

292. The potential indirect impact to heritage assets from changes to physical processes is assessed with reference to section 8.7.4 (Potential Effects During Operation) of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**. The following impacts are relevant to the worst case for offshore archaeology and cultural heritage (i.e. increased exposure of buried archaeological material to marine processes due to loss of sediment cover):

- Changes to the tidal regime due to the presence of infrastructure (wind turbines and offshore platforms);
- Changes to the wave regime due to the presence of infrastructure (wind turbines and offshore platforms);
- Changes to bedload sediment transport and seabed morphology due to the presence of infrastructure (wind turbines and offshore platforms);
- Changes to bedload sediment transport and seabed morphology due to the presence of cable protection measures;
- Cable repairs and reburial; and
- Indentations on the seabed due to installation vessels.

293. Modifications to the tidal regime and / or the wave regime due to the presence of the foundation structures during the operational phase may manifest as changes in sediment transport regime. However, modelling shows that changes to the tidal and wave regime will be of low (near-field) and negligible (far-field) magnitude as a worst case with an overall **negligible** significance of effect. Changes to bedload sediment transport are similarly shown though modelling to be of low (near-field) and negligible (far-field) magnitude as a worst case with an overall **negligible** significance of effect.

294. Cable protection measures may take the form of rock armour, concrete mattresses, steel bridging / ducting, Cable Protection System ducting / articulated pipe (cast iron or plastic), concrete bridging and / or rock bags. The effects that export cable protection may have on the marine physical environment primarily relate to the potential for interruption of sediment transport processes and the footprint they present on the seabed. However, as for foundation effects described above, modelling shows that changes to bedload sediment transport and seabed morphology due to cable protection measures are likely to be of low (near-field) and negligible (far-field) magnitude as a worst case, with an overall **negligible** significance of effect.

295. Similarly, there is potential for temporary physical disturbance due to cable maintenance and repair. However, the disturbance areas for reburial and repairs of cables during operation are extremely small in comparison to construction and are assessed as being of negligible magnitude and a **negligible** significance of effect.

296. As each of these impacts is assessed as a **negligible** significance of effect, there is no measurable potential for the increased protection or exposure of heritage assets.

297. Therefore, the indirect effect of changes to marine physical process upon offshore heritage assets during operation is concluded to result in no impact and the significance would be **no change**. Therefore, no additional mitigation is required.

17.6.2.4 Impact 4: Changes to the Setting of Heritage Assets

298. During the operational life of the Projects the presence of the wind turbines and offshore platforms will introduce a clear change to the setting of offshore assets which may affect their heritage significance.

17.6.2.4.1 Magnitude of Impact – DBS East or DBS West In Isolation

299. As assessed in sections 17.5.1.2 and 17.5.2.2, the setting of marine heritage assets is not considered to form a key part of their significance, which lies primarily in their historical and research value. Furthermore, the baseline setting is already influenced by passing vessels in this area associated with industry, fishing and recreation, thereby reducing the potential magnitude of impact from the presence of vessels, personnel and infrastructure associated with maintenance activities, for example. As such, it is concluded that the cultural significance of the assets would not be impacted by changes to their setting.

300. With regard to the setting of intertidal heritage assets (section 17.5.3.2), as the distance from shore means that there would be no intervisibility between these assets and the wind turbines, there is no pathway for impact, and no impact would occur.

301. The potential change to the setting of onshore heritage assets is discussed in **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**.

17.6.2.4.2 Magnitude of Impact – DBS East and DBS West Together

302. The magnitude of impact of both DBS East and DBS West together will be no greater that for each project In Isolation (no impact).

17.6.2.4.3 Sensitivity of Receptor

303. The heritage importance (sensitivity) of heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

17.6.2.4.4 Significance of Effect – DBS East or DBS West In Isolation

304. As the magnitude of impact is concluded to be no impact the significance would be **no change**. Therefore, no additional mitigation is required.

17.6.2.4.5 Significance of Effect – DBS East and DBS West Together

305. As the magnitude of impact is concluded to be no impact the significance would be **no change**. Therefore, no additional mitigation is required.

17.6.3 Potential Effects During Decommissioning

17.6.3.1 Impact 1 Direct (Physical) Impact to Known Heritage Assets

306. As all known heritage assets will be avoided through the retention of AEZs throughout the lifetime of the Projects, there is no pathway for impact during decommissioning activities.

17.6.3.2 Impact 2 Direct (Physical) Impact to Potential Heritage Assets

17.6.3.2.1 Magnitude of Impact – DBS East or DBS West In Isolation

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

308. There is, however, potential for impacts to occur if archaeological material is present within the footprint of jack-ups or vessel anchors deployed during decommissioning activities, if these are located in areas which were not previously subject to disturbance. In practice, the nature and extent of individual impacts cannot be fully understood until after the impact has occurred. Therefore, as for construction activities, and as a worst case, there is potential for direct impacts of high adverse magnitude upon potential *in situ* heritage assets and low adverse magnitude upon potential isolated finds.

17.6.3.2.2 Magnitude of Impact – DBS East and DBS West Together

309. As above, as the magnitude of the impact will not be fully understood until after the potential heritage asset has been encountered and the impact has occurred there is no difference between the potential magnitude of impact for DBS East and DBS West together, compared with either Project built In Isolation. Therefore, without mitigation, and as a precautionary approach, there is potential for direct impacts of high adverse magnitude upon potential *in situ* heritage assets and low adverse magnitude upon potential isolated finds.

17.6.3.2.3 Sensitivity of Receptor

310. The heritage importance (sensitivity) of potential heritage assets is set out in sections 17.5.1.3, 17.5.2.3 and 17.5.3.3.

311. As a precautionary measure all potential *in situ* sites are assessed as being of high importance whilst all isolated finds are of medium importance and isolated examples of palaeoenvironmental material of low importance.

17.6.3.2.4 Significance of Effect – DBS East or DBS West In Isolation

312. In accordance with the significance of effect matrix (**Volume 7, Chapter 6 EIA Methodology (application ref: 7.6), Table 6-6**) without mitigation, should impacts occur to *in situ* sites within either DBS East or DBS West In Isolation, these have the potential to be of **major** adverse significance.

313. Should isolated / derived finds in secondary contexts, or isolated examples of palaeoenvironmental material, be encountered during decommissioning activities, impacts would be of potential **minor** adverse significance.

17.6.3.2.5 Significance of Effect – DBS East and DBS West Together

314. The potential impact significance for direct (physical) impacts to potential heritage assets, without mitigation, is the same for DBS East and DBS West together as for DBS East and DBS West In Isolation (i.e. any direct impacts upon *in situ* heritage assets have the potential to be of **major** adverse significance while direct impacts upon isolated finds would be of potential **minor** adverse significance).

17.6.3.2.6 Mitigation and Residual Significance of Effect – DBS East or DBS West In Isolation

315. The archaeological assessment of any further geophysical data will further reduce, as far as possible, the potential for unintended impacts during decommissioning. If further features of archaeological interest are identified these will be subject to the same mitigation as described for known heritage assets described in section 17.6.1.1.6 with the primary approach being avoidance.

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

317. The approach to the implementation of these mitigation measures will be set out **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**.

318. Although the precise nature of the impact, and the heritage significance of any material impacted, cannot be fully understood until the impact has occurred, it is anticipated that with this mitigation the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.3.2.7 Mitigation and Residual Significance of Effect – DBS East and DBS West Together

319. The combined footprint of potential jack-up and anchor locations during decommissioning for both Projects represents a greater potential for direct impacts than if, for example, only DBS East or DBS West was to be built In Isolation. However, the application of a formal protocol for archaeological discoveries to ensure that prompt advice is received in the event of an unexpected discovery, would be the same for the construction of both DBS East and DBS West, as for either Project being built In Isolation. Therefore, with the application of this mitigation it is anticipated that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

17.6.3.3 Impact 3 Indirect Impact to Heritage Assets from Changes to Physical Processes

320. Potential indirect impact to heritage assets from changes to physical processes is assessed with reference to section 8.7.5 (Potential Impact during Decommissioning) of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**.

321. During the decommissioning phase, there is potential for wind turbine foundation and cable removal activities to cause changes in suspended sediment concentrations and / or seabed or shoreline levels because of sediment disturbance effects. The types of effect would be comparable to those identified for the construction phase and there would be no impact to heritage assets.

322. Therefore, the indirect effect of changes to marine physical process upon offshore heritage assets during decommissioning is concluded to result in no impact and the significance would be **no change**. Therefore, no additional mitigation is required.

17.6.3.4 Impact 4 Changes to the Setting of Heritage Assets

323. Decommissioning may result in a further change to the setting of heritage assets with the removal of the wind turbines and associated infrastructure. The presence of vessels, personnel and infrastructure associated with decommissioning activities will also temporarily affect the setting. However, as for construction these impacts are temporary and reversible and the same conclusions would apply. Therefore, as the magnitude of impact is concluded to be no impact the significance would be **no change**. Therefore, no additional mitigation is required.

17.7 Potential Monitoring Requirements

324. Offshore Monitoring requirements are described in **Volume 8, In-Principle Monitoring Plan (IPMP) (application ref: 8.23)**.

325. Anticipated monitoring requirements for offshore archaeology and cultural heritage have also been described in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**. It is anticipated that monitoring requirements will consist of archaeological analysis of any pre- and post-construction geophysical and geotechnical survey data to identify known and potentially unknown heritage assets, seabed / palaeolandscape features and to monitor construction and post-construction effects. These will be further developed and agreed with stakeholders prior to construction, taking account of the final detailed design of the Projects.

326. It is recognised that monitoring will form an important element in the management and verification of the impacts of the Projects. In particular, AEZs will be retained throughout the Project lifetimes and monitoring of AEZs may be required by the regulator to ensure adherence both during construction and in the future operation of the Projects (as relevant to Impact 1: Direct (physical) impact to known heritage assets).

327. Post-construction monitoring may also be required to assess any changes to sediment cover across the Offshore Archaeology Study Area which may result in the exposure or burial of heritage assets, which may affect their long term preservation (see Impact 3: Indirect impact to heritage assets from changes to physical processes). This requirement may be triggered should monitoring during the Projects lifetime show greater than anticipated changes in marine physical processes. The approach to post-construction monitoring is set out in the **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**.

17.8 Cumulative Effects

17.8.1 Screening for Cumulative Effects

328. Cumulative effects can be defined as incremental effects on that same receptor from other proposed and reasonably foreseeable schemes and developments in combination with the Projects. This includes all schemes that result in a comparative effect that is not intrinsically considered as part of the existing environment and is not limited to offshore wind projects.

329. The overarching method followed in identifying and assessing potential cumulative effects is set out in **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6)** and **Volume 7, Appendix 6-2 Offshore CEA Methodology (application ref: 7.6.6.2)**. The overall approach is based upon the Planning Inspectorate Advice Note Seventeen: Cumulative Effects Assessment (PINS, 2017) and Phase III Best Practice by Natural England and DEFRA (Parker *et al.*, 2022). The approach to the CEA is intended to be specific to the Projects and takes account of the available knowledge or the environment and other activities around the Offshore Development Area.

330. The CEA has followed a four-stage approach developed from the Planning Inspectorate Advice Note Seventeen. These stages are set out in **Table 1-1** of **Volume 7, Appendix 6-2 Offshore CEA Methodology (application ref: 7.6.6.2)**. Stage four of this process, the CEA assessment is undertaken in two phases. The first step in the CEA is the identification of which residual impacts assessed for the Projects on their own have the potential for a cumulative impact with other schemes and activities. This information is set out in **Table 17-20** which sets out the potential impacts assessed in this chapter and identifies the potential for cumulative effects to arise, providing a rationale for such determinations. Only potential impacts assessed in section 17.6 where the potential for cumulative effects has been identified (minor, moderate or major), have been taken forward to the final CEA (i.e. those assessed as 'negligible' or 'no change' are not taken forward, as there is no potential for them to contribute to a cumulative effect). 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.

Table 17-20 Potential Cumulative Effects

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Construction			
Impact 1 Direct (physical) impact to known heritage assets	No	High	Direct cumulative impacts to known heritage assets are unlikely to occur due to the application of AEZs identified through EIA for constructed and planned projects as part of the consenting process.

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Impact 2 Direct impact to potential heritage assets	Yes	High	Although the effect of unavoidable impacts will be mitigated by agreed measures as part of the consenting process for each of the constructed and planned projects, the impacts will still have occurred and permanent damage or destruction will have taken place. The assessment of cumulative impacts, therefore, needs to consider the effect of multiple unavoidable impacts from multiple projects upon the archaeological resource.
Impact 3 Indirect impact to heritage assets from changes to physical processes	Yes	High	As set out in **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, with the exception of changes to bedload sediment transport due to cable installation at the landfall all impacts are assessed as a **negligible** significance of effect and are excluded from CEA. At the landfall, depending on the construction timetable from nearby plans / projects there is potential for temporal overlap in construction periods which could have a cumulative effect and this impact is taken forward to CEA.
Impact 4 Changes to the setting of heritage assets	No	High	Impacts to the setting of individual assets are not anticipated to give rise to material harm.
Operation & Maintenance			
Impact 1 Direct (physical) impact to known heritage assets	No	High	Direct cumulative impacts to known heritage assets are unlikely to occur due to the continued avoidance and retention of AEZs throughout the life of constructed and planned projects.

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Impact 2 Direct impact to potential heritage assets	Yes	High	There is potential for multiple unavoidable impacts associated with operations and maintenance activities (e.g. cable repairs and vessel anchors / jack up legs) during the operation phases of multiple projects
Impact 3 Indirect impact to heritage assets from changes to physical processes	No	High	As set out in **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**, all impacts are assessed as a **negligible** significance of effect.
Impact 4 Changes to the setting of heritage assets	No	High	Impacts to the setting of individual assets are not anticipated to give rise to material harm.
Decommissioning			
Impact 1 Direct (physical) impact to known heritage assets	No	High	Direct cumulative impacts to known heritage assets are unlikely to occur due to the continued avoidance and retention of AEZs throughout the life of constructed and planned projects.
Impact 2 Direct impact to potential heritage assets	No	High	There is potential for multiple unavoidable impacts associated with decommissioning considered cumulatively with activities associated with other projects.
Impact 3 Indirect impact to heritage assets from changes to physical processes	No	High	As no cumulative impacts are anticipated during the decommissioning phase (see **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**), there is no pathway for cumulative impacts to heritage assets.

Impact	Potential for Cumulative Effects	Data Confidence	Rationale
Impact 4 Changes to the setting of heritage assets	No	High	Impacts to the setting of individual assets are not anticipated to give rise to material harm.

17.8.2 Schemes Considered for Cumulative Impacts

331. The second phase of the CEA is a project specific assessment of the potential for any significant cumulative effects to arise due to the construction and / or operation and maintenance of the Projects. To do this, a short-list of schemes for the CEA has been produced relevant to offshore archaeology and cultural heritage following the approach outlined in **Volume 7, Appendix 6-2 Offshore CEA Methodology (application ref: 7.6.6.2).** The second phase of this assessment is only undertaken if the first phase identifies that cumulative effects are possible.

332. The CEA has been based on information available on each relevant scheme as of January 2024. It is noted that the further information regarding the identified schemes may become available in the period up to construction, or may not be available in detail at all prior to construction. The assessment presented here is therefore considered to be conservative, with the level of impacts expected to be reduced compared to those presented here.

333. Schemes have been assigned a tier, based on information used within the CEA. A seven tier system, based on the guidance issued by Natural England and Defra (Parker *et al.*, 2022) has been employed, as presented in **Volume 7, Appendix 6-2 Offshore CEA Methodology (application ref: 7.6.6.2)**.

334. This approach has been agreed via EIA Scoping and consultation with technical working groups and follows advice from Natural England. Further information on the methodology can be found in **Volume 7, Chapter 6 EIA Methodology (application ref: 7.6**).

335. Types of projects that could potentially be considered for the cumulative assessment of offshore archaeology and cultural heritage include:

- Other offshore wind farms;
- Strategic plans;
- Protected Areas;

- Carbon Capture Storage (CCS);
- Marine aggregate extraction;
- Oil and gas exploration and extraction; and
- Sub-sea cables and pipelines
- Commercial shipping.

336. With respect to these types of schemes, for those that are fully operational (ie. Tier 1 schemes) at the time of this assessment, the cumulative assessment methodology considers them to be part of the baseline conditions for the surrounding area (and assumes that any residual effect has been captured within the baseline). As such, it is not expected that the Projects would contribute to cumulative effects with these existing activities and, therefore, these have not been the subject of further assessment.

337. For schemes that are not currently fully operational, i.e. those in planning / pre-construction stages, or even where construction may have commenced but not yet be complete, these are screened in for further assessment in the final cumulative assessment.

338. Schemes included in the CEA, and their distance to the Array Areas and Offshore Export Cable Corridor for the Projects are provided below in **Table 17-21**.

339. For the offshore archaeology and cultural heritage CEA, only those projects which spatially coincide with the Projects are included in **Table 17-21**. However, it is also recognised that impacts upon potential heritage assets may extend beyond these boundaries as discussed in section 17.8.3.1.2.

Table 17-21 List of Projects Screened in for CEA

Tier	Scheme	Closest distance to (km):	
		Export Cable Corridor	Array Areas
Offshore Wind Farms and associated export cables			
2	Dogger Bank A	20	8
2	Dogger Bank A export cable	0.25 (export cable corridor overs the Projects 1km Construction Buffer Zone	4

Tier	Scheme	Closest distance to (km):	
		Export Cable Corridor	**Array Areas**
2	Dogger Bank B	20	17
2	Dogger Bank B export cable	0.25 (Export Cable Corridor overs the Projects 1km Construction Buffer Zone)	8
3	Hornsea Project Four	30	41
1	Hornsea Project Four export cable[1]	0 (Export Cable Corridor crosses the Projects)	41
Carbon Capture and Storage			
3	Northern Endurance CCS	12	37
4	Northern Endurance Pipeline	0 (pipeline crosses the Projects' Offshore Export Cable Corridor)	45
7	CCS North Sea Leasing Round SNS Area 1 - Licences CS020 & CS025	0 (Overlaps Projects' Offshore Export Cable Corridor and Array Areas)	
7	CCS North Sea Leasing Round SNS Area 3 – Licence CS028	0km (overlaps Projects Offshore Export Cable Corridor)	92
Sub-sea Cables			
7	Eastern Green Link 3 (EGL3)*	0 (potentially crosses Projects Offshore Export Cable Corridor)	Not available
7	Eastern Green Link 4 (EGL4)*	0 (potentially crosses Projects Offshore Export Cable Corridor)	Not Available

Tier	Scheme	Closest distance to (km):	
		Export Cable Corridor	Array Areas
7	National Grid HND Bootstrap**	Potentially within the Array Areas TBC	Not Available
7	Aminth Energy Interconnector*	Not available	
7	Continental Link*	Not available	

**Current routes detailed publicly are for illustrative purposes only, but if accurate are projected to cross the Projects Offshore Export Cable Corridor*

***Cable route not yet finalised*

17.8.3 Assessment of Cumulative Effects

17.8.3.1 Impact 2 Direct impact to potential heritage assets

340. Studies undertaken for Dogger Bank A and B, Northern Endurance CCS and Hornsea Project Four offshore wind farm, have all indicated the presence of seabed and palaeolandscape features. These features are relevant to understanding the potential for previously undiscovered maritime, aviation and submerged prehistoric archaeology, within the different project boundaries. Publicly available studies are not yet available for the Tier 6 and Tier 7 projects although these will be subject to the same assessment and mitigation requirements discussed below.

341. Of those projects for which data is available, the cable corridor for Hornsea Project Four spatially coincides with the Projects (**Volume 7, Figure 17-3 (application ref: 7.17.1)**), crossing the Offshore Export Cable Corridor between c. 8.5 and 12.5km offshore (within Block B). The Northern Endurance Teesside Pipeline also crosses Offshore Export Cable Corridor c. 65km offshore. In addition, the cable corridor for Dogger Bank A and Dogger Bank B runs adjacent to the northern edge of the Offshore Export Cable Corridor, and partially overlaps with the construction buffer, to c. 55km offshore where it diverts northwards (**Volume 7, Figure 17-3 (application ref: 7.17.1)**).

17.8.3.1.1 Cumulative Effects With Hornsea Project 4, Northern Endurance and Dogger Bank A and B (Spatial Overlap)

342. The archaeological assessment of marine geophysical data for Hornsea Project Four was undertaken by MSDS Marine (2021a) and a gazetteer of anomalies is included in the ES, including co-ordinates, allowing their locations to be mapped alongside the results of the DBS archaeological assessment (**Volume 7, Figure 17-3 (application ref: 7.17.1)**). This shows the presence of eight geophysical anomalies interpreted by MSDS Marine within the Offshore Export Cable Corridor where they spatially coincide.

343. Of these eight, five are determined of low potential and unlikely to be of archaeological significance. No specific mitigation strategy has been recommended for these five anomalies, other than reporting any finds of potential archaeological significance during construction and site preparation activities, through an appropriate protocol for reporting archaeological discoveries. Two of the anomalies are described as large magnetic anomalies without correlating seabed features. No specific mitigation is recommended although it is noted the areas will be monitored during future assessments, with the anomalies reconciled, and positions fixed, during future high resolution and full coverage survey works. The remaining anomaly is a medium potential anomaly described as potential anthropogenic debris with a large magnetic anomaly. This anomaly has been assigned a 15m AEZ.

344. In comparison, eight of the A2 seabed features interpreted by Wessex Archaeology (section 17.5.2.1) as part of the DBS studies are located within the area of spatial overlap. None of these correspond to features identified by MSDS Marine (2021a). This is potentially indicative of differences in data acquisition for both schemes within this area. For the Projects, data were acquired from the Offshore Export Cable Corridor at a line spacing of between 65m and 100m (according to water depth). Within this section of Block B, however, vessels were inhibited by the presence of fishing gear from obtaining data from towed sensors (SSS and Mag.) and MBBS was additionally assessed. For Hornsea Project Four, all data were acquired and assessed, but at a line spacing of 500m within this section of the cable corridor.

345. For the Projects, avoidance through micro-siting, where possible, or further investigation of the eight A2 anomalies is recommended as mitigation. Whilst this mitigation varies to that recommended for Hornsea Project 4, the objective is the same, to ensure avoidance of known heritage assets as far as possible. For both the Projects and Hornsea Project Four, this objective will be further informed through the acquisition, and archaeological assessment, of high-resolution, pre-construction survey data, to be undertaken post-consent once the project design is refined. These surveys will provide full coverage of construction footprints and will further reduce the potential for unexpected discoveries, and the effects on potential heritage assets. If features of archaeological interest are identified during these surveys, they will be subject to the same mitigation as described for known heritage assets (see section 17.6.1.1.6) and cumulative effects will not occur.

346. A commitment to the application of industry standard mitigation for both Projects, is set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)** for the Projects and Hornsea Project Four (Maritime Archaeology, 2022). With mitigation, therefore, the residual cumulative effects on seabed features of potential archaeological interest, located within the area of the spatial overlap, are assessed as being no greater than the effects of the Projects alone (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

347. Also within the area of overlap are a channel (7705) and cut and fill feature (7706), also possibly the remnant of a former fluvial feature, recorded in the palaeolandscapes assessment (**Volume 7, Appendix 17-3 (application ref: 7.17.17.3)**). The Stage 1 review of vibrocores, acquired from this area for the Projects (**Volume 7, Appendix 17-4 (application ref: 7.17.17.4)**), shows the presence of glacial deposits within this section of the offshore export cable corridor which are of low geoarchaeological and paleoenvironmental potential. None of the vibrocores undertaken to date are co-located with the subsequently defined channel (7705) and feature (7706). At time of writing of the Hornsea Project Four ES, geotechnical surveys had not yet been completed, although the preliminary review of geophysical data had similarly identified fine- grained sediments and channel features along the export cable corridor, demonstrating areas of palaeoenvironmental potential (MSDS Marine, 2021b).

348. However, with the application of the mitigation set out in the **Volume 8**, **Outline WSI (Offshore)** (**application ref: 8.22)** for the Projects and Hornsea Project Four (Maritime Archaeology, 2022), the cumulative effect of both projects upon palaeolandscape features (and potential paleoenvironmental deposits and prehistoric archaeology) within the spatial overlap is assessed as being no worse than for the Projects on their own (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance). As described in section 17.6.1.2.6, this will include the examination of potential prehistoric deposits through the assessment further geotechnical and geophysical data which will further contribute to the body of scientific data available for the study of seabed prehistory within the North Sea. If *in situ* prehistoric sites are identified as a result of such work then mitigation measures to record and / or protect such sites would be agreed in consultation with Historic England.

349. A comparison was also undertaken using GIS to map seabed features, recorded with their co-ordinates in the respective gazetteers, from the Dogger Bank A and B export cable corridor (Wessex Archaeology,2013a) and the Northern Endurance Teesside pipeline (Wessex Archaeology, 2023).

350. There are no seabed features recorded in the geophysical data assessed for the ES from Dogger Bank A and B where the export cable corridor overlaps with the construction buffer (Wessex Archaeology,2013a). The results of pre-construction survey and assessment for the Dogger Bank A and B schemes are not yet publicly available with both projects currently in the construction phase of development. Although GIS data is not publicly available for palaeolandscape features, locations of features illustrated in the assessment report (Wessex Archaeology, 2013a) suggest the presence of a channel feature (75001) recorded in the vicinity of channel feature 7705 (within the overlap for Hornsea Project 4 as described above). This suggests continuation of a channel feature, or palaeochannel network, beyond the boundary of the Projects. However, as above, with the application of mitigation for both schemes, the cumulative effect of both schemes upon these palaeolandscape features (and potential paleoenvironmental deposits and prehistoric archaeology) is assessed as being no worse than for the Projects alone (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance). Opportunities for the Projects to contribute to wider regional studies, post-consent, is discussed further in section 17.8.3.1.2 below.

351. The Northern Endurance archaeological assessment reports that there no palaeolandscape features within the Teesside pipeline corridor (Wessex Archaeology, 2023) and there are none recorded as part of the DBS studies within the offshore export cable corridor where they overlap. There are two A2 seabed features recorded in the Northern Endurance gazetteer within the area of overlap, and five A2 seabed features recorded as part of the DBS studies which do not match those from the Northern Endurance assessment. Furthermore, although the mitigation is the same for both projects (avoidance or further assessment) it is also acknowledged that the potential for micro-siting to avoid features at the location of a potential pipeline crossing may be more restrictive. Therefore, ground-truthing to establish the archaeological interest of these features (e.g. investigation of individual anomalies (ground-truthing) through ROV and / or diver survey) would be essential prior to installation of the export cable to reduce the potential for significant cumulative effects.

17.8.3.1.2 Cumulative Effects With Other Projects (No Spatial Overlap)

352. Although no other schemes directly overlap with the offshore development boundary, there is also potential for cumulative effects upon seascapes or landscapes which extend beyond the boundary of the Projects and may extend into other project areas.

353. Assessments undertaken for EIA as part of the consents process for each of the schemes in **Table 17-21** have indicated the likely potential for previously undiscovered prehistoric, maritime and aviation archaeology within the region. This includes palaeolandscape features mapped through interpretations of SBP and MBES data and geoarchaeological assessment of geotechnical data. This informs understanding of the potential for terrestrial landscapes, and inhabitable environments, where prehistoric populations may have settled when sea levels were lower. Similarly, studies have also shown that historic maritime and aviation networks can be mapped, such as the East Coast War Channels (Firth 2014), whilst the group value of individual wrecks, or crash sites, for example, also collectively form part of the variously perceived historic seascape characters (e.g. wartime conflict, fishing areas, transport, leisure industry etc) of the North Sea.

354. At a project level, the application of appropriate mitigation to reduce or offset direct (physical) impacts, potential effects on these landscapes / seascapes would be reduced to no greater than a minor adverse significance. However, if multiple unavoidable impacts occur during the construction, operation or decommissioning of multiple projects, then cumulative effects may be considered of greater significance. For example, it is possible that unique aspects of former landscapes, or of the *in situ* maritime and aviation archaeological resource, may be lost as a result. In addition, if a site is damaged or destroyed, comparable sites elsewhere may increase in importance as a result of greater rarity and any future direct impacts would be of greater significance.

355. However, despite the significant data that is being produced through the consenting process, the extent of these networks and seascapes / landscapes from various periods remain largely unmapped. Whilst EIA assessments for the Tier 2 to 3 schemes in **Table 17-21** are in the public domain (in the form of downloadable reports) the results of further survey and assessment, undertaken post-consent, are not yet publicly available. A requirement to upload copies of all archaeological reports for a scheme, via the Online Access to the Index of Archaeological Investigations (OASIS) system, is anticipated for each of the schemes (i.e. as a condition of consent). However, this will occur only on completion of scheme construction and, as all of the schemes are either still in construction, or at pre-construction stage, studies remain ongoing and the results have not yet been published.

356. Recent studies have acknowledged that strategic analysis would facilitate greater understanding of the cumulative effects of multiple constructed and planned projects, but that a lack of data often makes such assessments impossible (Office for Environmental Protection, 2023). Whilst analysis at a strategic level is beyond the scope of an individual project, the contribution of publicly available data from the Projects has the potential to contribute to the ongoing industry wide build-up of data which would form the basis for such a study.

357. Research agendas and academic research focussing on the marine historic environment of the North Sea have gained considerable momentum in recent decades, with data acquired from development-led investigations increasingly considered to represent a significant opportunity to enhance our understanding of the archaeology and cultural heritage resource in offshore contexts. Examples include (but are not limited to):

- People and the Sea: A Maritime Research Agenda for England (Ransley *et al.*, 2013);

- Europe's Lost Frontiers (https://lostfrontiers.teamapp.com) and Taken at the Flood (Research led by Professor Vince Gaffney, University of Bradford);
- Submerged Palaeolithic Archaeology of the North Sea (Research led by Dr Rachel Bynoe, University of Southampton);
- Unpath'd Waters (https://unpathd.ads.ac.uk) and the forthcoming National Marine Heritage Record (Historic England);
- Research using development data to map palaeolandscapes such as 'Ice sheet and palaeoclimate controls on drainage network evolution: an example from Dogger Bank, North Sea' (Emery et al. 2019); and
- North Sea Prehistory Research and Management Framework (https://researchframeworks.org/nsprmf).

358. This research falls in line with various policy frameworks which have been developed to ensure the sustainable development of the North Sea, taking into account the non-renewable nature of the marine historic environment. Through the delivery of further investigation and mitigation post-application / post-consent, with account of current research agendas, policy frameworks and academic or industry led research initiatives, the Projects have the potential to contribute to this overall cumulative beneficial impact. For example, a series of ongoing geoarchaeological and marine geophysical assessments are being undertaken for the consented Dogger Bank A, Dogger Bank B, Dogger Bank C and Sofia offshore wind farms and there is potential for the Projects to also contribute to the compiled maps and data from palaeoenvironmental assessment, dating and analysis.

359. In addition to scientific research objectives, the Projects also have the potential to contribute significantly to wider public interest. Marine heritage assets, and in particular shipwreck sites, are often connected to significant past events and, in themselves, retain and reflect stories of the crew, vessel construction, trade, immigration, emigration and conflict, for example. As such, discoveries within the Offshore Archaeology Study Area have the potential to be of significant interest to the public, creating opportunities for outreach and education, particularly with local audiences.

360. Should the Projects be granted consent, the approach to realising this public benefit, and to the creation of joined-up objectives for post-consent investigation and mitigation, including links with academic and industry wide research initiatives, will be established post-consent in consultation with key stakeholders, including Historic England. A commitment to the delivery of this beneficial effect, including the completion of studies to professional archaeological standards and to making the results of such work publicly available, is set out in **Volume 8, Outline WSI (Offshore)** (**application ref: 8.22)**.

17.8.3.2 Impact 3 Indirect impact to heritage assets from changes to physical processes

361. Potential cumulative effects are assessed in section 8.8 of **Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8).** In summary, no significant cumulative effects are predicted to occur during construction or operation. As such, there is no pathway for indirect cumulative affects upon heritage assets.

17.9 Transboundary Effects

362. Transboundary impacts to individual heritage assets will not occur due to the localised nature of disturbance which do not cross territorial borders.

363. However, although the Projects are within the UK's EEZ, any data acquired and archaeologically assessed as part of the Projects also has the potential to feed into wider research objectives initiated by neighbouring EEZs in the North Sea. In terms of palaeolandscapes, Doggerland was a landscape of central importance in northern Europe, larger than many current European countries, and boasting a wealth of unexplored archaeology and environmental data vital to our understanding of how past populations met challenges of climate change and sea-level rise. With regard to maritime and aviation archaeology, the North Sea has played host to numerous conflicts, migration and trade routes and wrecks and aircraft from multiple nations are known to be present on the seafloor. Therefore, impacts discussed above, are not restricted to the UK's EEZ and transboundary effects should also be considered.

364. The nature of these transboundary effects are connected to cumulative effects and the potential for integrated research and management to represent a positive cumulative, transboundary impact of development-led initiatives across all sectors of the North Sea. Alongside data produced through UK offshore wind farm development, and that of other European nations bordering the North Sea, data sharing across national boundaries has the potential to result in a significant beneficial effect.

365. As for cumulative effects, should the Projects be granted consent, the approach to realising this public benefit, and to the creation of joined-up objectives for post-consent investigation and mitigation, including links with academic and transboundary research initiatives, will be established post-consent in consultation with key stakeholders, including Historic England. A commitment to the delivery of this beneficial effect, including the completion of studies to professional archaeological standards and to making the results of such work publicly available, is set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**.

17.10 Interactions

366. The effects identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between effects are presented in **Table 17-22**. This provides a screening tool for which effects have the potential to interact. **Table 17-23** provides an assessment for each receptor (or receptor group) as related to these impacts.

367. Within **Table 17-23** the effects are assessed relative to each development phase to see if multiple effects could increase the significance of the effect upon a receptor. Following this a lifetime assessment is undertaken which considers the potential for effect to affect receptors across all development phases.

Table 17-22 Interactions Between Impacts - Screening

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

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

Table 17-23 Interaction Between Impacts - Phase and Lifetime Assessment

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

17.11 Inter-relationships

368. For offshore archaeology and cultural heritage potential inter-relationships between other topics include Marine Physical Processes and Onshore Archaeology and Cultural Heritage. A summary of the potential inter-relationships is provided in **Table 17-24**.

Table 17-24 Offshore Archaeology and Cultural Heritage Inter-Relationships

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
Construction			
Indirect impact to heritage assets from changes to physical processes	**Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**	Section 17.6.1.3	Significant changes to physical processes may impact the preservation / survival of buried / exposed heritage assets.
Changes to the setting of heritage assets	**Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**	Addressed in **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**	Impacts to the setting of heritage assets onshore may occur due to activities associated with the installation of offshore infrastructure.
Operation			
Indirect impact to heritage assets from changes to physical processes	**Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**	Section 17.6.2.3	Significant changes to physical processes may impact the preservation / survival of buried / exposed heritage assets.
Changes to the setting of heritage assets	**Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**	Addressed in **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**	Impacts to the setting of heritage assets onshore may occur due to activities associated with the installation of offshore infrastructure.

Topic and Description	Related Chapter	Where Addressed in this Chapter	Rationale
Decommissioning			
Indirect impact to heritage assets from changes to physical processes	**Volume 7, Chapter 8 Marine Physical Environment (application ref: 7.8)**	Section 17.6.3.3	Significant changes to physical processes may impact the preservation / survival of buried / exposed heritage assets.
Changes to the setting of heritage assets	**Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**	Addressed in **Volume 7, Chapter 22 Onshore Archaeology and Cultural Heritage (application ref: 7.22)**	Impacts to the setting of heritage assets onshore may occur due to activities associated with the installation of offshore infrastructure.

17.12 Summary

369. This chapter has provided a characterisation of the existing environment for offshore archaeology and cultural heritage based on existing data. The assessment of impacts has established that with mitigation all potential impacts would be avoided, or of minor adverse significance.

370. There are no known *in situ* prehistory sites within the Offshore Archaeology Study Area. However, the assessment of marine geophysical (**Volume 7, Appendix 17-3 (application ref: 7.17.17.3)**) and geotechnical (**Volume 7, Appendix 17-4 (application ref: 7.17.17.4)**) data has identified a multi-age sequence of channel features within the Array Areas that could represent periodic sub-aerial exposure of the Dogger Bank from the Eemian interglacial to the early Holocene. The palaeolandscape potential of the offshore export cable is lower in comparison, but localised pockets of alluvium are preserved, potentially associated with palaeochannel features. The nearshore part of the export cable route shows evidence of relict channels and other potentially terrestrial features that could correlate to the extensive wetland environments at Skipsea Withow Mere.

371. With regard to maritime and aviation archaeology, the site specific geophysical data assessed by Wessex Archaeology (**Volume 7, Appendix 17-2 (application ref: 7.17.17.2)**) has demonstrated the presence of 847 seabed features which have been identified as being of archaeological interest (A1) or potential archaeological interest (A2 and A3) including nine confirmed wrecks, all of which are unidentified. There is one identified A3 wreck which is considered to exist but is located in the construction buffer, beyond the geophysical survey area (70659, *Feltre*).

372. Within the intertidal zone, there is high potential for the discovery of isolated finds, and potentially *in situ* features in the cliff face which may include palaeoenvironmental evidence, as indicated by the organic deposit in the Ulrome Cliffs (Humber HER 18037) observed during the heritage walkover (**Volume 7, Appendix 22-4 (application ref: 7.22.22.4)**). Due to the high levels of erosion of the cliffs, archaeological material is eroding from both the cliff top, and buried within the cliffs themselves, and the fragmented remains of former WWII coastal defences were also observed during the heritage walkover. Iron Age / Roman, medieval and post-medieval settlement activity has been identified in archaeological trial trenching undertaken within the Onshore Development Area, in the four fields adjacent to the cliff top (**Volume 7, Appendix 22-8 (application ref: 7.22.22.8)**), which demonstrates a high potential for associated finds eroded from the cliffs.

373. The historic seascape character of the Offshore Archaeology Study Area is primarily associated with commercial fishing activities with documentary evidence for fishing on the Dogger Bank from at least the 14th century. The presence of the wind farm infrastructure is not anticipated to fundamentally alter perceptions of the historic fishing industry. Whilst fishing activities are temporarily displaced as a result of construction works, fishing activities will still be permitted in areas of the offshore development not undergoing construction activities. Also, the distance of the Projects Array Areas from the coast, and the minimal above ground infrastructure at the coast, means that the Projects would be largely undetectable by the public and historic perceptions of the traditional fishing industry, which the HSC described as having taken on a 'quaint' character, a memory of better days, will remain largely unchanged.

374. A further dominant character type mapped within the Offshore Archaeology Study Area is hydrocarbon industry. The most significant change since compilation of the HSC dataset is the introduction of new offshore wind farms to the north and south of the Projects. Overall, perceptions of the North Sea energy industry place greater emphasis upon nuclear power and renewable energy and changing perceptions associated with the construction of the Projects are therefore likely to be seen as part of this natural progression for energy generation and as a positive change from fossil fuels to renewable energy.

375. Until the final design and layouts are confirmed, there will remain uncertainty in the precise nature and extent of any direct impacts, however, it is anticipated that, within the intertidal zone, the use of trenchless techniques, with entry on the landward side of the cliffs, and exit below MLWS in the subtidal, will mean that impacts to potential intertidal archaeological material would be avoided. The depth of sedimentary sequences of archaeological interest at the landfall would be further clarified through the geoarchaeological assessment of geotechnical data, and will inform the trenchless cable installation design so that it will pass beneath deposits of potential archaeological interest. However, should an exit in the intertidal zone be selected there would be potential for direct impact to archaeological material that may be buried within beach deposits.

376. With the application of mitigation, it is anticipated that all direct impacts to known heritage assets as a result of the Projects would be avoided. A total of 43 AEZs have been recommended by Wessex Archaeology within the Array Areas and 13 within the offshore cable corridor (55 in total) (**Table 17-19**).

377. Where possible, features of possible interest (A2s) will be avoided through micro-siting of the design. If features cannot be avoided, then additional work may be required (to be undertaken post-consent) to establish the archaeological interest of the feature (e.g. investigation of individual anomalies (ground-truthing) through ROV and / or diver survey). Once the character, nature and extent of selected features are more fully understood, appropriate mitigation measures (proportionate to the significance of the asset) to reduce or off-set impacts can be determined on a case by case basis.

378. In order to further minimise potential impacts, the archaeological assessment of high-resolution geophysical data and geoarchaeological assessment of geotechnical data will be undertaken post-application / post-consent in order to reduce, as far as possible, the potential for unintended impacts during construction. In the event of an unexpected discovery, this will be reported using a formal protocol for archaeological discoveries which will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures where necessary. Through the protocol, any possible *in situ* heritage assets encountered on the seabed will be immediately provided with a temporary exclusion zone to prevent further impacts from taking place until advice had been received. Following confirmation of the presence of archaeological material, additional mitigation measures to record or conserve the site will be agreed in consultation with Historic England.

379. With the application of this mitigation it is anticipated that the residual magnitude and significance can be reduced or offset (i.e. through investigation and recording, preservation by record, as set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**) so that effects may be considered non-significant in EIA terms (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance). Similarly, with regard to cumulative effects, the application of mitigation for all other projects considered for CEA means that the cumulative effect is assessed as being no greater than for the Projects alone (i.e. anticipated to be no worse than a negligible magnitude and **minor** adverse significance).

380. There is, however, potential for the Projects to contribute to the wider, cumulative, beneficial effect of accumulated data for offshore archaeology from multiple studies for offshore development within the North Sea. Data sharing across national boundaries equally has the potential to result in a significant beneficial transboundary effect. Should the Projects be granted consent, the approach to realising this public benefit, and to the creation of joined-up objectives for post-consent investigation and mitigation, including links with academic and industry wide research initiatives, will be established post-consent in consultation with key stakeholders, including Historic England.

381. A summary of potential likely significant effects on offshore archaeology and cultural heritage is included in **Table 17-25**.

382. The approach to the implementation of these mitigation measures have been set out in **Volume 8, Outline WSI (Offshore) (application ref: 8.22)**.

Table 17-25 Summary of Potential Likely Significant Effects on Offshore Archaeology and Cultural Heritage

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
Construction							
Impact 1 Direct impact to known heritage assets	Known wrecks and debris of archaeological interest	High	High	Major adverse	AEZs	No change	N/A
Impact 2 Direct impact to potential heritage assets	In situ prehistoric, maritime or aviation sites below MHWS	High	High	Major adverse	Further assessment and investigation and additional mitigation to avoid, reduce or offset impacts.	Minor adverse	Minor adverse
	Sub-surface archaeology and geoarchaeological / palaeoenvironmental deposits	High	High	Major Adverse	Watching brief and preservation by record of any exposed remains	Minor adverse	Minor adverse
	Isolated finds	Medium	Low	Minor adverse	Protocol for archaeological discoveries	Minor adverse	Minor adverse
Impact 3 Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets below MHWS	Medium to high	No impact	No change	N/A	No change	No change
	Sub-surface archaeology and geoarchaeological / palaeoenvironmental deposits within the cliffs	Low to high	High	Major Adverse	Locating exit pits a suitable distance from the cliffs / monitoring and preservation by record of any exposed remains	Minor adverse	Minor adverse
Impact 4 Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	N/A
Operation							
Impact 1 Direct impact to known heritage assets	Known heritage assets	Medium to high	High	Major adverse	AEZs	No change	N/A
Impact 2 Direct impact to	In situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment of geophysical and geotechnical data.	Minor adverse	Minor adverse

Potential Impact	Receptor	Importance (Sensitivity)	Magnitude of Impact	Pre-mitigation Effect	Mitigation Measures Proposed	Residual Effect	Residual Cumulative Effect
potential heritage assets	Isolated finds	Medium	Low	Minor adverse	Protocol for archaeological discoveries.	Minor adverse	Minor adverse
Impact 3 Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	No change
Impact 4 Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	N/A
Decommissioning							
Impact 1 Direct impact to known heritage assets	Known wrecks and debris of archaeological interest	High	High	Major adverse	AEZs	No impact	N/A
Impact 2 Direct impact to potential heritage assets	In situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment and investigation and additional mitigation to avoid, reduce or offset impacts.	Minor adverse	Minor adverse
	Isolated finds	Medium	Low	Minor adverse	Protocol for archaeological discoveries	Minor adverse	Minor adverse
Impact 3 Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	No change
Impact 4 Impacts to the setting of heritage assets	Known and potential heritage assets	Medium to high	No impact	No change	N/A	No change	N/A

References

Allen, M.J., Bronk Ramsey, C., McNeill, E., Meadows, J., van der Plicht, J. and Selby, I. (2008) 'Radiocarbon dating of a mammoth tusk from the Southern North Sea reported upon through the English Heritage / BMAPA awareness programme', Quaternary Newsletter 116: 7.

Bicket A and Tizzard L (2015) A review of the submerged prehistory and palaeolandscapes of the British Isles Proc Geol Assoc 126, 6 643-663

CIfA (2020) Standard and Guidance for Historic Environment Desk-Based Assessment. Available at: https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_4.pdf. Accessed: 01/12/2022.

CIfA (2022) Code of Conduct: Professional Ethics in Archaeology. Available at: https://www.archaeologists.net/sites/default/files/Code%20of%20conduct%20revOct2022.pdf. Assessed: 01/12/2022.

Coles, B. (1998). Doggerland: A Speculative Survey. Proceedings of the Prehistoric Society,64, 45-81.

DEFRA (2011) Marine Policy Statement. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf. Accessed: 01/11/2023.

DEFRA (2014) East Inshore and East Offshore Marine Plans. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/312496/east-plan.pdf. Accessed: 01/11/2023.

DEFRA (2021) North East Inshore and North East Offshore Marine Plans. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/995743/FINAL_North_East_Marine_Plan.pdf. Accessed: 01/11/2023.

DESNZ (2023a) Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/media/655dc190d03a8d001207fe33/overarching-nps-for-energy-en1.pdf. Accessed 28/11/2023.

DESNZ (2023b) National Policy Statement for Renewable Energy Infrastructure (EN 3). Available at: https://assets.publishing.service.gov.uk/media/655dc352d03a8d001207fe37/nps-renewable-energy-infrastructure-en3.pdf. Accessed 28/11/2023.

DESNZ (2023c) National Policy Statement for Electricity Networks Infrastructure (EN-5). Available at: https://assets.publishing.service.gov.uk/media/655dc25e046ed400148b9dca/nps-electricity-networks-infrastructure-en5.pdf. Access 28/11/2023

Department for Levelling Up, Housing & Communities (2023) National Planning Policy Framework. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf. Accessed: 02/11/2023.

East Riding of Yorkshire District Council (2016). East Riding Local Plan. Available at: https://www.eastriding.gov.uk/planning-permission-and-building-control/planning-policy-and-the-local-plan/east-riding-local-plan. Accessed 01/11/2023

Emery, A.R., Hodgson, D.M., Barlow, N.L., Carrivick, J.L., Cotterill, C.J. and Phillips, E. (2019). 'Left high and dry: deglaciation of Dogger Bank, North Sea, recorded in proglacial lake evolution' Frontiers in Earth Science 7, 234.

Evans, D.J.A. and Thomson, S.A. (2010) Glacial sediments and landforms of Holderness, eastern England: A glacial depositional model for the North Sea lobe of the British – Irish Ice Sheet. Earth Science Reviews, v101, n 3-4 (201008), pp147- 189.

Fitch, S., Thomson, K. and Gaffney, V. (2005). Late Pleistocene and Holocene depositional systems and the palaeogeography of the Dogger Bank, North Sea. Quaternary Research, 64(2), pp.185-196.

Fugro (2023) DBS WPM2 WPM3 ECR Seafloor and Shallow Geological Results Report Dogger Bank South Offshore Wind Farm. Reference: 004267912 02.

Gaffney V, Thomson, K and Fitch. S (2007) Mapping Doggerland: the Mesolithic landscapes of the southern North Sea. Archaeopress

Gribble, J. and Leather, S. (2011) Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector. Guidance prepared by Emu and issued by COWRIE. Available at: https://www.historicenvironment.scot/media/2376/2011-01-offshore-geotechnical-investigations-and-historic-environment-analysis-guidance-for-the-renewable-energy-sector.pdf. Accessed: 01/12/2022.

Historic England (2013) Marine Geophysics Data Acquisition, Processing and Interpretation. Guidance prepared by Plets, R., Dix, J., Bates, R. Available at: https://historicengland.org.uk/images-books/publications/marine-geophysics-data-acquisition-processing-interpretation/mgdapai-guidance-notes. Accessed: 01/12/2022.

Historic England (2017a) The Setting of Heritage Assets. Historic Environment Good Practice Advice in Planning Note 3 (Second Edition). Available at: https://historicengland.org.uk/images-books/publications/gpa3-setting-of-heritage-assets/heag180-gpa3-setting-heritage-assets. Accessed: 01/12/2022.

Historic England (2017b) Conservation Principles For The Sustainable Management Of The Historic Environment (Consultation Draft 10th November 2017). Available at: https://historicengland.org.uk/content/docs/guidance/conservation-principles-consultation-draft-pdf. Accessed: 26/09/2022.

Historic England (2022) Opportunities and Threats to the Maritime Environment. Available at: https://historicengland.org.uk/research/current/threats/martime-marine. Accessed: 13/12/2022.

IEMA, IHBC and CIfA (2021) Principles of Cultural Heritage Impact Assessment in the UK. Available at: https://www.archaeologists.net/sites/default/files/j30361_iema_principlesofchia_v8.pdf. Accessed: 01/12/2022.

JNAPC (2006) JNAPC Code of Practice for Seabed Development. Available at: https://www.historicenvironment.scot/media/2374/jnapc_brochure_may_2006.pdf. Accessed: 01/12/2022.

LUC (2017a) National Historic Seascape Characterisation (NHSC): Technical Advice Document. Available at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-2958-1/dissemination/pdf/National_HSC_Database_Technical_Advice_Document.pdf. Accessed: 04/14/2023.

LUC (2017b) National Historic Seascape Characterisation (NHSC): User Guide. Available at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-2958-1/dissemination/pdf/National_HSC_Database_User_Guide.pdf. Accessed: 04/14/2023.

LUC (2017c) Historic Seascape Characterisation (HSC): Consolidating the National HSC. Available at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-2958-1/dissemination/pdf/Consolidating_the_National_HSC_Database_Project_Report_-_Final_Report.pdf. Accessed: 04/14/2023.

Maritime Archaeology (2022) Hornsea Project Four Outline Marine Written Scheme of Investigation. Document submitted at Deadline 5 (20 June 2022). Document Reference: F2.4

MSDS Marine (2021a) Hornsea Project Four Offshore Wind Farm Archaeological Review of Geophysical and Hydrographic Data. Hornsea Project Four: Environmental Statement Appendix C of ES Annex 9.1.

MSDS Marine (2021b) Hornsea Project Four Offshore Wind Farm Palaeogeographic Review of Geophysical Survey Data. Hornsea Project Four: Environmental Statement Appendix D of ES Annex 9.1.

Office for Environmental Protection (2023) A review of the implementation of environmental assessment regimes in England. Available at: https://www.theoep.org.uk/report/environmental-assessments-are-not-effective-they-should-be-due-practical-barriers.

Oxford Archaeology (2008) Guidance for the Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy. Guidance prepared by Oxford Archaeology and issued by COWRIE. Available at: http://www.biofund.org.mz/wp-content/uploads/2018/11/F1349.Cowrie-Ciarch-Web.pdf. Accessed: 01/12/2022.

Phillips, E., Cotterill, C., Johnson, K., Crombie, K., James, L., Carr, S. and Ruiter, A. (2018). 'Large-scale glacitectonic deformation in response to active ice sheet retreat across Dogger Bank (southern central North Sea) during the Last Glacial Maximum', Quaternary Science Reviews 179, 24-47.

Ransley, J, Sturt, F, Dix, J, Adams, J and Blue, L (eds.) (2013) People and the Sea: A Maritime Archaeological Research Agenda for England, York, GB. Council for British Archaeology, 272pp. (Research Reports, 171)

Reid, C. (1913) Submerged Forests, Cambridge Series of Manuals of Literature and Science. Oxford

Russell, J. W. and Stevens, C. J (2014) Palaeoenvironmental assessment of peat samples. The Crown Estate.

The Crown Estate (2014). Protocol for Archaeological Discoveries: Offshore Renewables. Available at: https://www.wessexarch.co.uk/sites/default/files/field_file/2_Protocol%20For%20Archaeological%20Discoveries.pdf. Accessed: 01/12/2022.

The Crown Estate (2021) Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects. Available at: https://www.thecrownestate.co.uk/media/3917/guide-to-archaeological-requirements-for-offshore-wind.pdf. Accessed: 01/12/2022.

Wessex Archaeology (2007) Historic Environment Guidance for the Offshore Renewable Energy Sector. Guidance prepared by Wessex Archaeology and issued by COWRIE. Available at: https://www.wessexarch.co.uk/sites/default/files/field_file/COWRIE_2007_Wessex_%20-%20archaeo_%20guidance_Final_1-2-07.pdf. Accessed: 01/12/2022.

Wessex Archaeology (2013a) Dogger Bank Tranche A (Creyke Beck) Environmental Impact Assessment Archaeology and Cultural History Technical Report, Salisbury unpublished report 78040.05

Wessex Archaeology (2013b) Dogger Bank Teesside A & B Marine and Coastal Archaeology Environmental Impact Assessment Technical Report – Appendix 2 Geophysical Assessment Tranche B, Salisbury, unpublished rep 78041.04

Wessex Archaeology (2014) Offshore Renewables Protocol for Archaeological Discoveries ORPAD Palaeoenvironmental Assessment of Peat Samples. Salisbury, unpublished report 86900.02.

Wessex Archaeology (2020a) Dogger Bank Creyke Beck Archaeological Assessment of Marine Geophysical Data. Salisbury, unpublished report 201322.01

Wessex Archaeology (2020b) Creyke Beck Offshore Wind Farms Export Cable Corridor Stage 1 and Stage 2 Geoarchaeological Assessment of Vibrocores. Salisbury, unpublished report 201321.01.

Wessex Archaeology (2022) Dogger Bank A, B & C Offshore Wind Farm Stage 1 & Stage 2 Geoarchaeological Assessment of Geotechnical Data (2020 & 2021). Salisbury, unpublished report 201324.01.

Wessex Archaeology (2023) Offshore CCS Infrastructure: Northern Endurance Partnership Marine Archaeological Technical Report. Salisbury, unpublished report 254110.03. Appendix I to the Offshore Environmental Statement for the Northern Endurance Partnership. Available at: https://assets.publishing.service.gov.uk/media/651ed1027309a1000db0a920/NS051-EV-REP-000-00021_NEP_Environmental_Statement_Appendices__1_.pdf. Accessed: 05/12/2023.

RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Windmill Hill Business Park

Whitehill Way

Swindon

Wiltshire, SN5 6PB