East Anglia
Offshore Wind

VATTENFALL

SCOTTISHPOWER
RENEWABLES

East Anglia THREE

Chapter 17

Offshore Archaeology and Cultural Heritage

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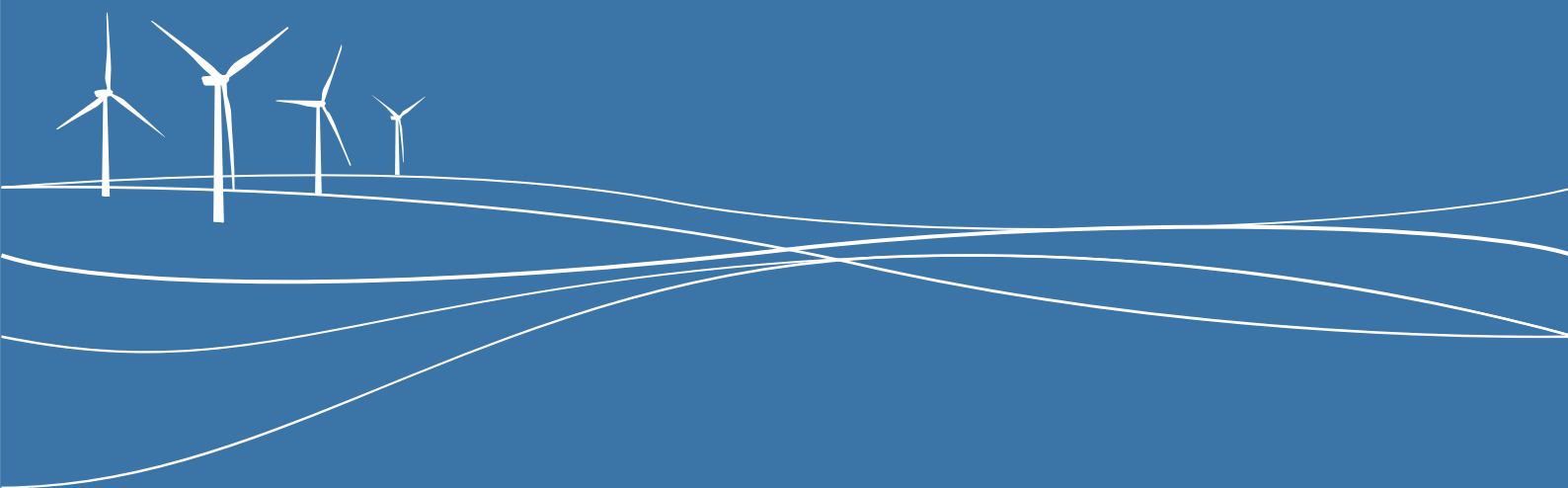

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17 OFFSHORE ARCHAEOLOGY AND CULTURAL HERITAGE

17.1 Introduction

1. This chapter has been compiled by Wessex Archaeology and sets out existing baseline conditions for the marine archaeological environment and offshore cultural heritage within the East Anglia THREE site, the Interconnector cable corridor and the offshore export cable corridor, hereafter termed the 'Study Area'. This chapter assesses the potential impacts to offshore archaeological receptors from the proposed East Anglia THREE project and the embedded mitigation which will be applied.

2. The assessment of potential impacts upon archaeology and cultural heritage has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to offshore archaeology and cultural heritage with respect to the East Anglia THREE site, the Interconnector cable corridor and the offshore export cable corridor are:

   - Overarching NPS for Energy (EN-1) (July 2011); and
   - NPS for Renewable Energy Infrastructure (EN-3) (July 2011).

3. The specific assessment requirements for archaeology and cultural heritage, as detailed within the above NPSs, are repeated in *Table 17.1* below. Where any part of the NPS has not been followed within this assessment, it is stated within this Environmental Statement (ES) why the requirement was not deemed relevant or was met in another manner.

Table 17.1 Summary of NPS-guidance

NPS-guidance in relation to the historic environment	East Anglia THREE assessment
EN-1 Paragraph 5.8.8 states that "*as part of the ES the applicant should provide a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. 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 the significance of the heritage asset*."	The significance and value of the archaeological receptors considered in this ES have been detailed in section 17.6.1. Submerged cultural heritage assets are not considered to have a setting as there are no views to or from them beyond their immediate extent. Issues relating to the setting of onshore heritage assets have been considered as part of Chapter 25 Onshore Archaeological and Cultural Heritage.
EN-1 Paragraph 5.8.9 requires that "*where a development site includes, or the available evidence suggests it has the potential to include, heritage assets with an archaeological interest, the applicant should carry out appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation. Where proposed development will affect the setting of a heritage asset, representative visualisations may be necessary to explain the impact."*	This ES has been informed by a desk-based assessment (see *Appendices 17.1* to *17.3*) which identified the presence of archaeological receptors within East Anglia THREE and the offshore cable corridor footprint.
EN-1 Paragraph 5.8.10 states that "*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."*	This ES provides an account of the potential impact of East Anglia THREE and the offshore cable corridor works upon heritage assets and their significance (section 17.6).
EN-3 Paragraph 2.6.140 requires that "*consultation with the relevant statutory consultees (including English Heritage or Cadw) should be undertaken by the applicants at an early stage of the development*."	Consultation has been undertaken with relevant statutory consultees, as outlined in section 17.2. Consultation will be on going throughout the process.
EN-3 Paragraph 2.6.141 requires that the "*assessment should be undertaken as set out in Section 5.8 of EN-1. Desk-based studies should take into account any geotechnical or geophysical surveys that have been undertaken to aid the windfarm design."*	This ES has been undertaken in accordance with section 5.8 of EN-1, as detailed above. Geophysical and geotechnical studies have underpinned the assessment (section 17.4.2, 17.5 and *Appendices 17.1 to 17.3*).
EN-3 Paragraph 2.6.142 states that "*the assessment should also include the identification of any beneficial effects on the historic marine environment, for example through improved access or the contribution to new knowledge that arises from investigation."*	Any beneficial effects to the offshore archaeology and cultural heritage resource resulting from the proposed East Anglia THREE project have been identified and incorporated as part of section 17.6, Potential Impacts.

NPS-guidance in relation to the historic environment	East Anglia THREE assessment
EN-3 Paragraph 2.6.143 also requires that "*where elements of an application (whether offshore or onshore) interact with features of historic maritime significance that are located onshore, the effects should be assessed in accordance with the policy at Section 5.8 of EN-1.*"	Potential impacts of the proposed East Anglia THREE project upon onshore heritage assets have been considered in Chapter 25 Onshore Archaeology and Cultural Heritage.

4. This assessment has also been prepared in accordance with the East Inshore and East Offshore Marine Plans (DEFRA 2014), which outlines the objective 'to conserve heritage assets, nationally protected landscapes and ensure the decisions consider the seascape of the local area'. This objective recognises the need to consider whether developments are appropriate to the area they will be located in and have an influence upon, and seeks to ensure that, as far as possible, the value of such assets and characteristics are not compromised. Policies specific to heritage assets are outlined in *Table 17.2*.

Table 17.2 Summary of East Inshore and East Offshore Marine Plans

Plan policies specific to heritage assets	East Anglia THREE assessment
Policy SOC2: Proposals that may affect heritage assets should demonstrate, in order of preference: a) That they will not compromise or harm elements which contribute to the significance of the heritage asset b) How, if there is compromise or harm to a heritage asset, this will be minimised c) How, where compromise or harm to a heritage asset cannot be minimised it will be mitigated against or d) The public benefits for proceeding with the proposal if it is not possible to minimise or mitigate compromise or harm to the heritage asset	The primary method of mitigation when dealing with the archaeological resource as set out in this chapter is the precautionary principle, based on the prevention of damage to receptors by putting in place protective measures rather than attempting to repair damage. Avoidance by means of Archaeological Exclusion Zones (AEZ) will serve to ensure that such assets will not be compromised. Potential archaeological receptors are safeguarded or the effects upon them minimised by means of mitigation measures outlined in section 17.3.3.

5. The offshore archaeology and cultural heritage environmental baseline includes a description of known archaeological receptors and a summary of the potential archaeological resource with the Study Area defined below. As identified in the UK Marine Policy Statement (MPS), the existence and location of many heritage assets are often unknown prior to investigation. As such, it is required that an assessment of the likely presence of these potential archaeological receptors is undertaken. The full assessment of potential is included as an appendix along with the geophysical assessment technical report and a gazetteer of receptors.

17.2 Consultation

6. *Table 17.3* presents consultee responses to the East Anglia THREE Offshore Windfarm Scoping Report, December 2012. Consultation followed a staged approach comprising stakeholder responses at Scoping stage, and subsequently more detailed assessment of the Preliminary Environmental Information Report (PEIR). Feedback received during these stages was incorporated into this stage, the ES.

7. Consultation responses and how they were addressed are compiled in *Table 17.3*.

Table 17.3 Consultation Responses

Consultee	Date /Document	Comment	Response / where addressed in the ES
The Planning Inspectorate on behalf of the Secretary of State (SoS)	December 2012/Scoping Responses	The SoS notes that a geophysical survey will be carried out on the East Anglia THREE site and the area of the export cable corridor not covered within the previous East Anglia ONE surveys. In order for the geophysical data collected for the East Anglia ONE development to be sufficient for the East Anglia THREE development in respect of the offshore cable route, the applicant should ensure that this data remains up to date and relevant and when available new data should also be taken into account.	This ES was informed by the archaeological assessment of up-to-date geophysical data obtained for East Anglia THREE between June and October 2012. The results of this assessment are presented in *Appendix 17.2* and inform section 17.5 of this chapter.
SoS	December 2012/Scoping Responses	The SoS emphasises the importance that the methodology for geotechnical surveys and archaeological interpretation is agreed with English Heritage (now Historic England). Confirmation of this should be provided within the ES.	Further geotechnical survey programmes would be designed inclusive of archaeological objectives in line with the Offshore Geotechnical Investigations and Historic Environment Analysis (Emu 2011). Such surveys would be subject to a project specific WSI which would be prepared in accordance with the Model Clauses for Archaeological Written Schemes of Investigation (WS, Wessex Archaeology and The Crown Estate 2010) and will be prepared in agreement with EH. See section 17.3.3.
SoS	December 2012/Scoping Responses	The applicant should ensure that they address the comments of EH (now Historic England), including the information required within the ES and of the application of a 'worst case scenario'.	This ES has been informed by comments raised by EH as part of the Scoping Responses (see below). The 'worst case scenario' has been applied in section 17.6 Potential Impacts.
SoS	December 2012/Scoping Responses	The ES should clearly define mitigation of impacts upon marine archaeology and cultural heritage that is embedded within the design of the proposed development and that which constitutes additional mitigation.	Mitigation measures embedded within the design of East Anglia THREE and its offshore cable corridor are clearly defined in section 17.3.3.

Consultee	Date /Document	Comment	Response / where addressed in the ES
English Heritage (EH)	December 2012/Scoping Responses	The *Wind Energy and the Historic Environment* (EH 2005) guidance should be used to inform the preparation of the ES of East Anglia THREE.	This ES was prepared in accordance with relevant guidance, including *Wind Energy and the Historic Environment*, as outlined in section 17.4.1.
EH	December 2012/Scoping Responses	In consideration of the sequential development of the East Anglia Zone, English Heritage advise that a number of matters will need to be taken into account inclusive of the cumulative nature of ancillary infrastructure, such as cabling as substations as well as the wind turbines themselves.	Cumulative impacts associated with the various elements of the East Anglia THREE offshore works are considered in section 17.7 Cumulative Impacts.
EH	December 2012/Scoping Responses	The ES should assess direct impacts upon historic or archaeological marine or terrestrial sites and areas, whether statutorily protected or not.	Direct impacts have been assessed in relation to both designated and undesignated sites alike. See section 17.6 Potential Impacts. Direct impacts upon onshore heritage assets are considered as part of Chapter 25 Onshore Archaeology and Cultural Heritage.
EH	December 2012/Scoping Responses	The ES should determine any indirect impacts, particularly the setting of listed buildings, scheduled monuments, conservation areas etc, including change to historic landscape and seascapes character from the cumulative development of the East Anglia Zone.	Indirect impacts relating to the setting of onshore heritage assets and changes to the historic landscape character are considered as part of Chapter 25 Onshore Archaeology and Cultural Heritage. The historic seascape character of the Study Area is outlined in section 17.5.4 of this chapter and indirect impacts upon the historic seascape character are discussed as part of both the impact assessment (section 17.6) and the Cumulative Impacts (section 17.7).
EH	December 2012/Scoping Responses	The ES should detail the potential to encounter buried archaeology as revealed by both desk-based analysis of available records (national and local) and interpretation of geophysical and geotechnical marine survey data.	Potential receptors are considered as part of this ES chapter. A detailed baseline assessment of potential receptors within the Study Area is provided in *Appendix 17.1*. Potential receptors are also included as part of the baseline characterisation sections of this chapter (section 17.5).

Consultee	Date /Document	Comment	Response / where addressed in the ES
EH	December 2012/Scoping Responses	There is potential for all heritage assets to be taken into consideration, whether they are designated or not in accordance with the principles set out in the National Planning Policy Framework (NPPF) and the UK MPS.	This chapter assesses potential impacts of the proposed project upon both designated and non-designated heritage assets within the Study Area (section 17.6).
EH	December 2012/Scoping Responses	The impact assessment exercise must consider that the 'worst case scenario' is inclusive of historic environment factors with particular reference to the selection of geotechnical survey objectives to ensure data generated is sufficient to support archaeological analysis and interpretation. The geophysical survey data mentioned in the East Anglia THREE EIA Scoping Report must be subject to archaeological interpretation to support preparation of this ES.	Geophysical data obtained for East Anglia THREE has been archaeologically reviewed and informs this chapter (section 17.5 and *Appendices 17.2 and 17.3*).
EH	December 2012/Scoping Responses	It is crucial that the 'site-specific data' details archaeological objectives and agreed methodology to ensure data generated are capable of supporting archaeological interpretation.	Further geophysical or geotechnical survey programmes would be designed inclusive of archaeological objectives to assist further site evaluation and to support further advice concerning mitigation. Such surveys would be subject to a project specific WSI which would be prepared in accordance with the Model Clauses for Archaeological Written Schemes of Investigation (Wessex Archaeology and The Crown Estate 2010) (section 17.3.3)
EH	December 2012/Scoping Responses	Geotechnical survey objectives must be agreed to support palaeo-environmental analysis.	Further geotechnical survey programmes would be designed inclusive of archaeological objectives in line with the Offshore Geotechnical Investigations and Historic Environment Analysis (Emu 2011). Such surveys would be subject to a project specific WSI which will be prepared in accordance with the Model Clauses for Archaeological Written Schemes of Investigation (Wessex Archaeology and The Crown Estate 2010) (Section 17.3.3.)

Consultee	Date /Document	Comment	Response / where addressed in the ES
EH	December 2012/Scoping Responses	If a gravity base design is adopted, consideration must be given to the direct impacts associated with the extent of sea bed preparation required for the installation of gravity base foundations. The preparation of the Written Scheme of Investigation (WSI) should clarify the methodologies to address unavoidable impacts associated with the worst case scenario.	These direct impacts are assessed as part of section 17.6. It is stated within this chapter that the forthcoming project specific WSI that will be prepared at the project application stage will outline mitigation measures which reduce the significance of unavoidable impacts which are addressed in association with potential archaeological receptors.
EH	December 2012/Scoping Responses	The following publications are to be used to inform this EIA exercise: *Marine Aggregate Dredging and the Historic Environment: Guidance Note* (British Marine Aggregate Producers Association and English Heritage, 2003); the Joint Nautical Archaeological Policy Committee *Code of Practice for Sea bed Development* (JNAPC, 2006) and *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector* (Gribble and Leather, 2011).	This chapter was informed by these publications (see section 17.4.1).
EH	December 2012/Scoping Responses	The Historic Seascape Characterisation (HSC) work undertaken by English Heritage should be used to inform the ES.	The historic seascape character baseline of the Study Area is presented in section 17.5.4 and was informed by the Newport to Clacton Historic Seascapes Characterisation project (Oxford Archaeology 2011).
Suffolk County Council (SCC)	December 2012/Scoping Responses	Buried archaeology should be a primary consideration during construction.	The potential for buried archaeology in offshore contexts is incorporated as part of the discussion outlined in the Potential Archaeological Receptors (*Appendix 17.1*) and informs the baseline characterisation sections of this chapter (section 17.5). The potential for buried archaeology within the onshore context is considered as part of Chapter 25 Onshore Archaeology and Cultural Heritage.

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	June 2014/PEIR Responses	We note that to support installation of gravity base foundation it will be necessary to conduct ground preparation works inclusive of dredging (0.1 to 5m) and that suction bucket foundation designs will penetrate the seabed to a depth of 15m. It is therefore essential that if this foundation design is selected that all necessary seabed and sub-seabed surveys are completed to a standard sufficient to support professional archaeological interpretation and analysis given that material of archaeological interest might require recovery to avoid direct impact.	This impact is identified in section 17.6.1.1. Due to the embedded mitigation (17.3.3), such preparation works will not impact upon known receptors on the basis of the implementation of AEZ. Measures to deal with impacts upon potential receptors will be outlined in a WSI submitted as part of the ES chapter. This will outline that geoarchaeological surveys will be undertaken prior to construction - such surveys will be suitable for archaeological analysis (section 17.3.3).
HE	June 2014/PEIR Responses	Paragraphs 135 to 139 – detail is provided about ground preparation requirements prior to cable installation and we recommend that any ES prepared for this project provides adequate attention to the mitigation measures necessary should the proposed project encounter material of archaeological interest.	Unexpected discoveries encountered during the course of the development are mitigated by the implementation of the Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) - outlined in the Embedded Mitigation section (section 17.3.3).
HE	June 2014/PEIR Responses	Paragraph 230 – it is estimated that up to 45 vessels will be operating within the identified offshore development area at any one time. It is therefore necessary that any of these vessels that require anchoring or leg jacks are fully informed about sites of known or potential archaeological interest that should be avoided.	Vessels associated with the construction, operation and decommissioning of the windfarm will be informed on the presence of AEZs and will be prohibited to drop anchor or leg jacks within their boundaries. Text to this effect has been included in the Embedded Mitigation section (17.3.3).

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	June 2014/PEIR Responses	Paragraph 38 – Modelling scour assessments for the different foundation options. We note that the calculations assume water depths of 35m although deeper water exists in the majority of the project offshore area (as described in paragraphs 40 and 42 with addition models assuming a 45m water depth). However, as foundations and spacings of the turbines have not yet been decided, these calculations will need to be re-done to take the decisions into account, and be linked to the marine archaeology sections to address potential impacts with particular reference to the worst case scenario (e.g. conical gravity foundations).	No action necessary. Shallower conditions are worst case as they result in larger scours. As such, the impacts of scour pits upon marine archaeological receptors are unchanged.
HE	June 2014/PEIR Responses	Paragraph 18 – We note that measures to deal with unavoidable impacts to potential receptors will be set out in an archaeological WSI, but this PEIR for this proposed project should have included a draft WSI. For example, indicative information sufficient to support completion of this EIA exercise should have included AEZs (permanent and temporary).	A WSI has been included as part of the ES application.

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	June 2014/PEIR Responses	Paragraph 20 – States that "any receptors" identified as part of the East Anglia ONE assessment have already been mitigated for, but we must question this statement as the only attention given to "mitigation" at present is the provision of an archaeological WSI which might identify seabed anomalies of archaeological interest and therefore outline exclusion zones, but as far as we are aware the WSI method statements that directly inform subsequent marine survey investigations, as necessary to finalise engineering design, have yet to be commissioned. It is therefore not possible at this stage to concur with the statement made in this paragraph.	In response to this comment, the relevant paragraph was amended to state that such receptors will be subject to the same mitigation measures outlined as part of the East Anglia ONE assessment. This serves to ensure consistency between the East Anglia projects. These mitigation measures are detailed within the ES alongside the mitigation for the remaining receptors.
HE	June 2014/PEIR Responses	Paragraph 27 - We noted the statement that potential prehistoric features of archaeological interest will be investigated further using geophysical and geotechnical data and we must stress the importance of ensuring that archaeological objectives are used to inform these survey designs so that data gathered are sufficiently robust to support archaeological interpretation.	The relevant paragraph was amended for clarity, stating that such surveys will be suitable for robust archaeological assessment.
HE	June 2014/PEIR Responses	Paragraph 28 – This paragraph makes important statements regarding the preparation of a "project specific WSI" to be "compiled at the project application stage". In consideration of what the PEIR should represent i.e. the project at the pre-application state it is disappointing that a draft WSI was not provided and we therefore cannot provide further advice regarding the viability of any mitigation strategies proposed.	A WSI has been included as part of the ES application.

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	June 2014/PEIR Responses	Table 17.5 - Geophysical anomalies and data. We note the detail of the geophysical surveys results and the commentary that "data confidence is considered to be low" (e.g. wrecks and aircraft losses). We therefore understand that data presented is sufficient for an overarching understanding about the potential to encounter archaeological material of interest, but that there is high potential for this project to encounter more anomalies during detailed geophysical survey as necessary to inform the final design for this proposed project. It is therefore crucial that a draft archaeological WSI is produced as part of any application submitted.	A WSI has been included as part of the ES application.
HE	June 2014/PEIR Responses	Section 17.5.2 - For the wrecks that are identified in this report, such as HMS Fitzroy, the ES prepared for this project should include sufficient detail to state the spatial extent of any proposed archaeological exclusion zone or other proposed mitigation strategy.	Table of AEZs added (*Table 17.4*) and illustrated in *Figures 17.26 and 17.27*.
HE	June 2014/PEIR Responses	Section 17.6 – We note the statements made that direct impacts to archaeological receptors are not expected as these receptors will be avoided. However, unavoidable direct impacts may occur as not all remains are known; such impacts would be significant, but would be mitigated (i.e. as per embedded mitigation set out in section 17.3.3). We add that in the absence of a draft WSIs and uncertainties regarding the positioning and construction design of the turbines it is not possible to offer further advice at this stage.	A WSI has been included as part of the ES application.

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	October 2015/ES Responses	HE seek reassurances from EA THREE that an archaeological contractor is appointed for both the Onshore and Offshore elements of the development in sufficient time to allow a suitable level of engagement with HE and Suffolk County Council.	The appointment of an archaeological contractor is considered as part of the WSI, included as part of this application.
HE	October 2015/ES Responses	HE request that all cross referencing and figure numbers correlate correctly to each individual ES chapter and that the chapter be checked thoroughly for formatting and numbering issues.	This chapter has been checked thoroughly throughout with regards to cross-referencing, figure numbers, formatting and numbering.
HE	October 2015/ES Responses	The ES should address plan policies specific to heritage assets within the Marine Management Organisations (MMO) East Inshore and East Offshore Marine Plans. Such plans apply or clarify the intent of national policy in the East Inshore and Offshore areas, taking into account the specific characteristics of the plan areas.	This chapter and the embedded mitigation therein (Section 17.3.3) has been prepared in accordance with the East Inshore and East Offshore Marine Plans (Section 17.1).
HE	October 2015/ES Responses	HE notes that of the 30 boreholes within the East Anglia Zone, two were positioned in the East Anglia THREE development site. Furthermore, the logs of these boreholes were only made available to the archaeological contractor in which to corroborate with sub seabed geophysical data, not the physical boreholes themselves. As such these limitations demonstrate the need for additional comprehensive geotechnical work to carry out through the implementation of the Offshore WSI to fully address the impacts to deposits of significant archaeological potential.	Any perceived limitations in geotechnical/geophysical data assessed to date will be compensated for prior to construction through the implementation of geotechnical survey data suitable for archaeological review to address any data gaps and enhance understanding of features of potential archaeological interest (see Section 17.3.3.2).

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	October 2015/ES Responses	In regards to the observable deficiencies of the magnetometer and sub-bottom profiler data (see Table 17.8), it again demonstrates the need for a clear and prescriptive understanding of archaeological investigations prior to seabed preparations and construction. Specifically, the variability of magnetometer data illustrates the need for careful judgement in determining the archaeological potential of anomalies that may be interacted with. Additionally, the placement of future geotechnical cores must consider where such "very poor" seismic data has been captured, and how such geotechnical seabed works can either supplement gaps or clarify our understanding as to the likely Palaeogeographic features, for instance that are to be impacted, through the staged approach of expert archaeological interpretation, assessment and analysis.	As above, any perceived limitations in geotechnical/geophysical data assessed to date will be compensated for prior to construction through the implementation of geotechnical survey data suitable for archaeological review to address any data gaps and enhance understanding of features of potential archaeological interest (see Section 17.3.3.2).
HE	October 2015/ES Responses	HE notes the standard approach to assigning value to known maritime sites. Whilst HE do not have any general concern with this approach, it should be noted that embedded mitigation i.e. avoidance through appropriate exclusion zones will protect these sites from adverse impacts (direct or secondary). Therefore such determinations placed upon known maritime sites are done so as a means of fulfilling and formulating a generally realistic resulting significance of impact, but are based upon a relatively limited level of desk based archaeological data, and therefore should not be seen as a determination of heritage value endorsed by HE, and it should be noted that should an impact arise, all known maritime sites should be considered consistently.	The values that have been assigned to heritage assets in this chapter should be considered as an indication of archaeological interest in order to assess the potential significance of effects upon such assets arising from the proposed development. Section 17.4.3.3 states that such values are based on often limited data available to date and are not absolute. The embedded mitigation (Section 17.3.3) does not discriminate assets on the basis of their value as presented in this chapter. The precautionary principle applies to all heritage assets. Where avoidance is not possible, measures to reduce or offset any potential impacts will be considered with regards to low, medium and high value assets alike.

Consultee	Date /Document	Comment	Response / where addressed in the ES
HE	October 2015/ES response	As two minor points as a means to clarification, we note the consistent use of the term "Carvel" to denote vessels built with flush planking. However, given its original meaning this term is best avoided and should be changed to flush-laid strakes. Similarly, and this only relates to the archaeological assessment 17.1, the use of the term 'evolution' to describe changes in ship design and construction is also one which should be avoided in view of how ships are constructed based upon human decisions which relate to a multitude of factors, with traditions or adaptations being notable examples.	References to the "Carvel" technique have been removed from the chapter (*Table 17.9*) and *Appendix 17.1*. The term 'evolution' is no longer used as a term in relation to ship design and construction (*Appendix 17.1*).

17.3 Scope

17.3.1 Scope of Assessment

8. Archaeological evidence may comprise finds, discrete sites and artefact assemblages within a primary context (in situ), or as derived material within secondary contexts, whereby deposits have been reworked by natural or human processes.

9. For the purposes of this assessment, the offshore archaeological resource is considered to comprise:

- Prehistoric archaeology;
- Maritime archaeology; and
- Aviation Archaeology.

10. Prehistoric archaeology includes both the study of prehistoric sites and the study of palaeolandscapes. Prehistoric sites include anthropogenic features, artefacts and palaeoenvironmental evidence representing aspects of past human activities. Palaeolandscapes comprise submerged palaeogeographic features and palaeoenvironmental evidence which are indicative of the prevailing landscape, climate, flora and fauna that may have influenced where, when and how these activities took place.

11. Maritime sites are considered to comprise both wreck sites and material accidentally or deliberately lost overboard (e.g. fishing gear, abandoned anchors or ordnance).

12. Aviation sites may include both the remains of crashed aircraft as well as material jettisoned from aircraft. The majority of aviation sites across the UK are associated with former military activities, predominantly World War II (WWII).

13. Additional geophysical anomalies of uncertain origin are also included in the assessment as being of possible archaeological interest.

17.3.2 Study Area

14. The Study Area assessed in this chapter is defined by the East Anglia THREE site, the interconnector cable corridor and the export cable corridor locations, as defined in Chapter 5 Description of the Development. These areas are referred to collectively as the Study Area. Due to an overlap between the interconnector and export cable corridors, these areas are referred to jointly as the offshore cable corridor, where applicable. The Study Area has been confined to the proposed East Anglia THREE Development Area on the basis that impacts are only predicted to occur within the immediate project footprint. Information pertaining to the known and potential

marine archaeological resource has previously been evaluated within the wider region as part of the Zonal Environmental Assessment (ZEA) (Wessex Archaeology 2012) and underpins the more area-specific assessment presented in this chapter.

15. The East Anglia THREE site comprises an area of 305km^2. The offshore cable corridor comprises an area of 571km^2 (consisting of 454km^2 for the export cable corridor and 238km^{2}for the interconnector cable corridor). The Export and Interconnector cable corridor joins the East Anglia THREE site at its south-western extent.

16. The project boundaries and Study Area assessed in this chapter is illustrated in *Figure 17.1*.

17.3.3 Embedded Mitigation

17.3.3.1 Overview

17. The primary method of mitigation when dealing with the archaeological resource is the precautionary principle, based on the prevention of damage to receptors by putting in place protective measures rather than attempting to repair damage (which may be irreversible) after it has occurred. A description of embedded mitigation is found in Chapter 6 Environmental Impact Assessment Methodology.

18. To achieve this, the following embedded mitigation would be implemented:

- The implementation of AEZs around known archaeological assets (all A1 receptors and some A3 receptors, as set out below);
- The design-layout to avoid, where possible, the sites identified through geophysical survey as having potential archaeological interest (A2 receptors); and,
- Measures to deal with unavoidable impacts to potential receptors, if they should occur, will be set out in a WSI.

19. Classification of cultural heritage receptors as A1, A2 or A3 has been undertaken in order to allow clear discrimination between archaeological receptors in the East Anglia THREE site and offshore cable corridor. These classifications are defined as follows:

- A1 receptors: where geophysical anomalies demonstrate the clear presence of a site of anthropogenic origin of archaeological interest (including anomalies corresponding to historic records and newly identified sites);

- A2 receptors: where geophysical anomalies have been identified as being of potential archaeological interest but where the origin is uncertain; and
- A3 receptors: where historical records indicating the presence of a wreck have not been found to correspond to a geophysical anomaly within current data.

20. This discrimination is further discussed in *Appendix 17.2.* Due to a spatial overlap in assessment areas, a number of receptors within the offshore cable corridor have been previously identified as part of the East Anglia ONE assessment (EA ONE 2012). These receptors will be subject to the same mitigation measures outlined as part of that assessment and will not be considered independently as part of the East Anglia THREE assessment. Such measures will be detailed accordingly alongside the mitigation for the remaining receptors.

21. AEZs of 100m will be implemented around the measured extents of A1 receptors identified by geophysical survey (*Appendix 17.3*, section 1.2). AEZs may also be placed around the recorded centre points of A3 receptors not seen in the geophysical survey within the Study Area, although this will depend on the nature of the A3 site in question (e.g. some sites classified as A3 are based on the reported sinking location of a vessel where no tangible remains have been identified on the sea bed to date as a result of hydrographic surveys and would not be considered subject to AEZs).

22. All construction, maintenance and related activities which could impact on these known archaeological sites would be prohibited within the boundaries of the AEZs. Vessels associated with the construction, operation and decommissioning of the windfarm will be made aware of the AEZs and will be prohibited from anchoring or using jack-up rigs within their boundaries.

23. Further prohibited activities within the boundaries of the AEZs includes the deposition of dredged material as part of sea bed preparation activities, as approximately 90% of the sediment released at the water surface from the dredger is deposited from the highly turbid dynamic plume which has the potential to impact upon archaeological and cultural heritage receptors beneath it (see Chapter 7 Marine Geology, Oceanography and Physical Processes and sections 17.3.4 and 17.6 within this chapter for further information). Furthermore, in the event that scour protection is not incorporated into the project design, the parameters of the AEZs must account for the potential for large scour pits to form around the foundation structures to ensure that the potential for archaeological and cultural heritage receptors to be exposed as a result of scour formation is reduced.

24. The full extent of many archaeological sites is often unclear. As such, AEZs necessarily incorporate a cautionary buffer to ensure that, as far as possible, all associated material is captured within the boundary.

25. The use of buffers as a form of mitigation complies with the methodologies for AEZs as set out in the *Model Clauses for Archaeological Written Schemes of Investigation* (Wessex Archaeology and The Crown Estate 2010).

26. The location and size of the AEZs may be refined if further information becomes available. For example, if engineering constraints preclude the application of an AEZs (A1 or A3) at any given location then the buffer may be altered following further consultation with archaeological curators and further data assessment or archaeological field evaluation of data. Provision for the alteration of buffers would be set out in the project WSI.

17.3.3.2 Palaeogeographic features

27. Palaeogeographic features, classified as P1 and P2, are distinguished as follows:

- P1 receptors: features of probable archaeological interest either because of its palaeogeography or likelihood for producing palaeoenvironmental material (e.g. palaeochannel, cut and fill, gravel terraces); and
- P2 receptors are features of possible archaeological interest (e.g. gas blanking, fine-grained infills, ravinement surface).

28. Palaeogeographic features classified as P1 and P2 receptors are not archaeological sites but are key indicators (along with palaeoenvironmental data) of where potential prehistoric sites might be located and the types of anthropogenic activities that took place (*Appendix 17.3*, section 1.3). As such, these features are not mitigated by avoidance. Rather, the potential of these prehistoric features would be investigated further through geoarchaeological survey (such as geophysical, geotechnical and palaeoenvironmental sampling) prior to construction. Any pre-construction surveys undertaken for geoarchaeological review will be designed inclusive of archaeological objectives to ensure that the data obtained are sufficient to support professional archaeological interpretation and analysis. The design of such surveys will take into account the quality and coverage of the existing geotechnical and geophysical data used to indicate the likely presence of Palaeogeographic features to date in order to supplement any data gaps or to clarify an understanding of any identified deposits or features of potential archaeological interest. In addition, if these deposits do contain archaeological material, measures

would be put in place to deal with the unavoidable impacts and unexpected discoveries.

17.3.3.3 Written Scheme of Investigation

29. Prior to the construction of the East Anglia THREE site, interconnector cable corridor and offshore export cable corridor, an outline project specific WSI would be compiled at the project application stage which makes provision for all archaeological mitigation that might be required in the light of preconstruction investigations, including field investigation, post-fieldwork activities, archiving and dissemination of results. The WSI includes provision to update the document as the project design is refined and as the results of further archaeological assessment become available.

30. The ability to investigate and excavate offshore sites is limited in comparison to land-based sites. As such, the loss of any component of a cultural heritage asset would require suitable mitigation actions to be agreed with Historic England (HE), the MMO and any relevant local authority (e.g. SCC). Such measures may include excavation and recording, if possible, and compensatory works. If impact has already occurred then this may be remedied by restabilising sites that have been destabilised, but not destroyed, or offset by detailed analysis and safeguarding of otherwise comparable sites elsewhere.

31. The potential for unexpected discoveries during the course of the project would be accounted for through the implementation of the ORPAD. ORPAD is a system for reporting and investigating unexpected archaeological discoveries made during construction and installation work.

32. The protocol makes provision for the implementation of temporary AEZs around areas of possible archaeological interest, for prompt archaeological advice and, if necessary, for archaeological inspection of important features prior to further construction in the area. Industry staff are offered guidance and advice on how to protect heritage assets and all finds of archaeological interest are reported through the ORPAD Implementation Service. It complies with the *Merchant Shipping Act 1995*, including notification of the Receiver of Wreck, and accords with the Joint Nautical archaeology Policy Committee (JNAPC) Code of Practice for Sea Bed Developers.

33. The NPPF is clear that the dissemination and publication of results are important and that information about the historic environment gathered as part of the planning process should be made publically accessible. Likewise, the MPS states that ‘opportunities should be taken to contribute to our knowledge and understanding of

our past by capturing evidence from the historic environment and making this publicly available, particularly if a heritage asset is to be lost'.

34. The WSI will be compiled in accordance with *Model Clauses for Archaeological Written Schemes of Investigations* and will be advised and approved by Historic England, any relevant local authority (Suffolk County Council) and the marine licensing authority (MMO). This will be a 'living' document.

17.3.3.4 Archaeological Exclusion Zones (AEZs)

35. *Table 17.4* summarises embedded mitigation (AEZs) for maritime receptors within the East Anglia THREE site.

Table 17.4 AEZs - Known Wreck Receptors: the East Anglia THREE site

WA ID	Receptor Summary	Archaeological Receptor Category	Archaeological Exclusion Zone (AEZ)
70911	Wreck of an unknown vessel recorded by the UK Hydrographic Office (UKHO) and seen in geophysical data (31.3 x 8.1m) (UKHO Live Wreck)	A1	Receptor Extent + 100m
71008	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (33 x 10.3m) (UKHO Live Wreck)	A1	Receptor Extent + 100m
71012	Wreck of the minesweeper HMS *Fitzroy* recorded by the UKHO and seen in geophysical data (70.5 x 15.3m) (UKHO Live Wreck)	A1	Receptor Extent + 100m
71016	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (23.3 x 8.5m) (UKHO Live Wreck)	A1	Receptor Extent + 100m
71017	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (112.2 x 38.1m) (UKHO Live Wreck)	A1	Receptor Extent + 100m
71020	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (58.7 x 24.7m) (UKHO Live Wreck)	A1	Receptor Extent + 100m
76056	Wreck of an unknown vessel not recorded by the UKHO but seen in geophysical data (17.5 x 12.8m)	A1	Receptor Extent + 100m
76145	Wreck of an unknown vessel not recorded by the UKHO but seen in geophysical data (10.1 x 7.8m)	A1	Receptor Extent + 100m
71005	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	A3	Location +100m
71013	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	A3	Location +100m
71014	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	A3	Location +100m
71015	Possible wreck of unknown vessel identified by Gardline but not seen in geophysical data	A3	Location +100m

Table 17.5 summarises embedded mitigation (AEZs) for maritime receptors within the East Anglia THREE interconnector cable corridor and offshore export cable corridor.

Table 17.5 AEZs - Known Wreck Receptors: the East Anglia THREE Offshore Cable Corridor

WA ID	Receptor Summary	Archaeological Receptor Category	Archaeological Exclusion Zone (AEZ)
70523	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (44.9 x 19.6m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
70611	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (41.2 x 11.1m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
70616	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (54 x 16.1m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
70619	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (93 x 14m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
70620	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (30.3 x 13m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
70621	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (24 x 8m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72360	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (14.5 x 6m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72389	Wreck, possibly the steamship *Grenadier*, recorded by the UKHO and seen in geophysical data (85.4 x 11.5m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72390	Wreck, possibly the steamship *Petshenga* recorded by the UKHO and seen in geophysical data (127.6 x 27.4m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72410	Wreck, possibly the steamship *Disa,* recorded by the UKHO and seen in geophysical data (52.0 x 14.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m

WA ID	Receptor Summary	Archaeological Receptor Category	Archaeological Exclusion Zone (AEZ)
72437	Wreck, possibly the steamship *Tergestea*, recorded by the UKHO and seen in geophysical data (67.0 x 16.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72439	Wreck of the steamship *Brixton* recorded by the UKHO and seen in geophysical data (88.1 x 20.9m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72443	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (30.7 x 5.8m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72455	Wreck, probably the steamship *Dagmar*, recorded by the UKHO and seen in geophysical data (72.7 x 16.8m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72471	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (53.5 x 17.1m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72474	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (57.3 x 13.8m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72482	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (14.1 x 13.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72490	Unknown charted obstruction, possibly a wreck, recorded by the UKHO and seen in geophysical data (22.2 x 8.7m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72492	Wreck, possibly the steamship *Friargate*, recorded by the UKHO and seen in geophysical data (46.5 x 8.4m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72497	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (97.0 x 36.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m

WA ID	Receptor Summary	Archaeological Receptor Category	Archaeological Exclusion Zone (AEZ)
72506	Wreck of the steamship *Carica Milica* recorded by the UKHO and seen in geophysical data (153.0 x 105.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72606	Wreck of an unknown and uncharted vessel seen in geophysical data (7.6 x 17.1m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72651	Wreck of an unknown and uncharted vessel seen in geophysical data (83.7 x 32.1m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72665	Wreck of an unknown and uncharted vessel seen in geophysical data (17.0 x 8.3m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72790	Possible wreck of an unknown and uncharted vessel seen in geophysical data (19.3 x 7.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72826	Possible wreck of an unknown and uncharted vessel seen in geophysical data (47.0 x 24.9m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72827	Wreck of an unknown and uncharted vessel seen in geophysical data (20.3 x 8.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72958	Wreck of an unknown and uncharted vessel seen in geophysical data (32.0 x 9.0m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
72999	Wreck of the minesweeper HMS *Ludlow* recorded by the UKHO and seen in geophysical data (60.1 x 30.2m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
73073	Wreck of the sailing barge *Sunbeam* recorded by the UKHO and seen in geophysical data (11.9 x 8.6m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m

WA ID	Receptor Summary	Archaeological Receptor Category	Archaeological Exclusion Zone (AEZ)
73078	Wreck of the light cruiser HMS *Arethusa* recorded by the UKHO and seen in geophysical data (140.5 x 32.4m). Considered as part of the existing East Anglia ONE ES.	A1	Receptor Extent + 100m
73205	Unknown wreck recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73206	Wreck of *Bradwell* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73207	Unknown wreck recorded as dead by the UKHO and not seen in geophysical data. Possibly associated with debris field WA72767. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73208	Unknown wreck recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73209	Unknown wreck recorded as live by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73217	Wreck of the steamship *Rubio* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73220	Loss location of the steam tug *Numitor* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73221	Loss location of the steamship *Gannet* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73223	Loss location of the steamship *Lonada* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m

WA ID	Receptor Summary	Archaeological Receptor Category	Archaeological Exclusion Zone (AEZ)
73228	Debris recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
73242	Loss location of the *Dominion* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	A3	Location +100m
78160	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	A3	Location +100m

36. In addition, for the purposes of facilitating embedded mitigation, it is noted here that three wrecks (A1 receptors) identified during previous archaeological assessment (Wessex Archaeology 2012) are located within 100m of the East Anglia THREE offshore cable corridor and would be subject to AEZs which would intersect with the Study Area. The WSI shall incorporate these wrecks (*Table 17.4*) in order to satisfy the mitigation strategy set out for the East Anglia THREE site, interconnector cable corridor and export cable corridor complementing the existing strategy for East Anglia ONE.

Table 17.6 Additional Known Wreck Receptors: requiring EZs within 100m of the Offshore Cable Corridor

WA ID	Receptor Summary		Archaeological Receptor Category	Easting	Northing	Source
70609	Wreck of the *Edinardue Antoinette* (possibly) recorded by the UKHO and seen in geophysical data (48.7m x 10.6m) (UKHO Live Wreck)	Height 2.9m, partially intact wreck with internal structure visible, largely covered by sediment, with associated debris present.	A1	455969	5795273	EA ONE (WA 2012)
73181	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (66.4 x 34.4m)	Height 3.9m. Well preserved wreck that appears to be sitting upright and leaning to one side.	A1	419211	5777559	EA ONE (WA 2012)
73192	Wreck of an unknown vessel seen in geophysical data (31.3 x 5.9m)	Height 2.3m. Partially buried wreck or a very large piece of debris. A single main linear dark reflector is visible along with regularly spaced short dark reflectors crossing this long one.	A1	405609	5770277	EA ONE (WA 2012)

17.3.4 Worst Case

37. The worst case scenarios with regard to archaeology and cultural heritage offshore are presented by impact in *Table 17.7*. By employing a worst case scenario approach for each individual impact, this assessment presents the maximum possible effect upon the marine archaeological environment within the Study Area. As such, impacts of greater adverse significance would not arise should any other development scenario (from those described in Chapter 5 Description of the Development) than that assessed within this chapter be taken forward in the final project design. That is, any other combination of the development options under consideration other than that directly discussed in this chapter would result in effects of an equivalent or lesser significance upon archaeological receptors. This is supported by embedded mitigation strategies (see section 17.3.3) that will ensure appropriate levels of protection for archaeological receptors when the project design is finalised.

38. The construction of the project may be undertaken as a Single Phase, or Two Phased approach. The Two Phased approach comprises two construction phases comprising up to 600MW each.

39. The main influence on considering the worst case scenario between these two construction timetable options is that the Two Phased approach would require an additional offshore platform, i.e. an extra seabed foundation and four cable trenches would be required, rather than two for the Single Phase approach: requiring an additional 190km of interconnector cable trenching and thus increased seabed construction footprint (*Table 17.5)*.

Table 17.7 Worst Case Assumptions

Impact	Key Design Parameters forming the Worst Case Scenario	Rationale
Construction		
Direct Impacts: Direct disturbance to archaeological receptors and / or their physical setting	**Single Phase approach** Sea bed Preparation (including the deposition of dredged material). Installation of foundations for wind turbines, meteorological masts and offshore platforms. Installation of scour protection if required. Cable installation, burial and cable protection (including inter-array, platform link, export and interconnector). Installation of offshore ancillary structures. Sea bed contact from the anchors of support vessels (indicative numbers and movements in Chapter 5*, Table 5.30* and *5.31*). Sea bed contact from the legs of jack-up vessels. **Two Phased approach** Under the Two phased approach there would be one additional foundation for an offshore platform and 3 additional platform link cables adding an additional 45km of cable within the site. Furthermore the interconnector cables	The worst case scenario is defined by the development options which result in the maximum possible disturbance to the sea bed. This includes consideration of the largest sea bed footprint area, the greatest volume of spoil and the highest number of locations which may be subject to physical impacts. The sea bed preparation and installation of Conical Gravity Base foundations typically comprise the worst case scenario for archaeological and cultural heritage receptors on and under the sea bed (dependent on the depth of sea bed preparation). This is due to requiring the largest foundation and scour protection footprint and the substantial volume of sea bed sediment dredged from the sea bed in preparation for installation, leading to significant vertical and horizontal removal of sediment. In this case the maximum diameter base is 60 for a 12MW turbine, comprising a maximum footprint per base of 2,828m^2 which would remove a maximum of 26,000m^3 of seabed sediment per foundation (Chapter 5, *Table 5.8* and *Table 5.9*). This is also the worst case scenario for the deposition of dredged material, whereby 90% of all sediment released at the water surface from the dredger is deposited from the highly turbid dynamic plume which would rapidly fall to the sea bed following its release, potentially impacting upon archaeological and cultural heritage receptors located within the deposition footprint. The sea bed footprint from jack-up vessels comprises the worst case situation for attendant vessels during construction of decommissioning due to the largest footprint and the compression of the sea bed which may damage potential archaeological and cultural heritage receptors of all types. Dynamic Positioning is a preferred method and may be used for heavy lift vessels, which would aid the minimisation of this seabed impact during the construction phase of the

Impact	Key Design Parameters forming the Worst Case Scenario	Rationale
	would be installed in four trenches rather than two creating an additional 190km of trench.	project. For potentially prehistoric archaeology receptors buried at depth within sub-sea bed sediments the worst case situation comprises the installation of 4x3.5m diameter pin piles for jacket foundations (Chapter 5) as these could be piled or drilled to a depth of 50m below the seabed. The worst case situation for the installation of the offshore cable corridor and array cabling comprises a trench of maximum width 17.5m, and maximum depth 5m; alternatively for sections that cannot be buried any protection materials may induce physical impacts to sea bed receptors adjacent to the cable route. Here, the preferred method is the use of mattresses, minimising seabed effects.
Indirect Impacts: Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	Sea bed levelling through dredging prior to installation of foundations and cables. (see Chapter 7).	The worst case scenario is defined by the development options which provide for the greatest changes to the hydrodynamic and sedimentary regimes likely to cause increased deterioration to receptors.
Changes to the historic seascape character	Construction activities associated with the installation of the windfarm and associated infrastructure.	The worst case scenario for historic seascape character is associated with the maximum potential change to that character.
Operation		
Direct Impacts: Direct disturbance to archaeological receptors and / or their physical setting	Sea bed contact from the anchors of support vessels and from the legs of jack-up vessels during maintenance works.	The worst case scenario is controlled by the development options which result in the maximum possible disturbance to the sea bed. The worst case scenario is therefore determined by the greatest number of maintenance vessels and jack-up cranes. The sea bed footprint from jack-up vessels comprises the worst case situation for attendant vessels during operation due to the largest footprint and the compression of the sea bed which may damage potential archaeological and

Impact	Key Design Parameters forming the Worst Case Scenario	Rationale
		cultural heritage receptors of all types.
Indirect Impacts: Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	Presence of offshore windfarm components (including wind turbines, ancillary structures and associated foundations).	The worst case scenario is defined by the development options which provide for the greatest change to the hydrodynamic and sedimentary regimes likely to cause increased deterioration to receptors. The worst case situation comprises Conical Gravity base foundations and the potential for 'near-field' scour around the base at the sea bed which may extend over several hundred metres (without scour protection) (Chapter 7 Marine Geology, Oceanography and Physical Processes). Indirect physical damage to archaeology and cultural heritage receptors within this near-field area would be significant.
Changes to the historic seascape character	The presence of an installed offshore windfarm and the associated infrastructure.	The worst case scenario for historic seascape character is associated with the maximum potential change to that character.
Decommissioning		
Direct Impacts: Direct disturbance to archaeological receptors and / or their physical setting	Removal of offshore components (including foundations, scour protection and offshore cables). Sea bed contact from the anchors of support vessels. Sea bed contact from the legs of jack-up vessels.	The worst case scenario is defined by the development options which result in the maximum possible disturbance to the sea bed. This includes the greatest number of vessels and jack-up vessels used during the decommissioning phase. The sea bed footprint from jack-up vessels comprises the worst case situation for attendant vessels during decommissioning due to the largest footprint and the compression of the sea bed which may damage potential archaeological and cultural heritage receptors of all types.
Indirect Impacts: Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	Removal of offshore windfarm components (including wind turbines, ancillary structures and associated foundations).	The worst case scenario is defined by the development options which provide for the greatest change to the hydrodynamic and sedimentary regimes likely to cause increased deterioration to receptors. The worst case scenario is considered to be comparable to that identified in

Impact	Key Design Parameters forming the Worst Case Scenario	Rationale
		relation to indirect impacts associated with the construction phase (Chapter 7 Marine Geology, Oceanography and Physical Processes).
Changes to the historic seascape character	The removal of the offshore windfarm components and associated infrastructure.	The worst case scenario for historic seascape character is associated with the maximum potential change to that character.

40. It should be noted that there would be up to two cables to interconnect the proposed East Anglia THREE and consented East Anglia ONE projects. The two cables would be subject to detailed design and future technology developments. Each would be up to 90km in length. The locations where these interconnections join the East Anglia ONE electrical infrastructure would be identified following detailed electrical design and would be dependent upon the location of the East Anglia ONE converter stations. These cables have not been assessed as part of the worst case and once interconnection cable routeing has been determined they will be added into the assessment.

17.4 Assessment Methodology

17.4.1 Legislation, Policy and Guidance

41. This assessment was carried out in a manner consistent with the *National Policy Statement* (NPS) for Energy (Department of Energy and Climate Change (DECC), 2010a and b). The key points of the NPS in relation to marine archaeological and cultural heritage concerns are listed in section 17.1 above. The impact assessment also takes account of relevant government policy including the UK MPS published by all UK administrations in March 2011.

42. This assessment was also carried out in a manner consistent with other available guidance, including:

- JNAPC Code of Practice for Sea bed Developers (JNAPC 2008);
- Institute for Archaeologists (CI*f*A) Standard and Guidance for Historic Environment Desk-Based Assessment (Chartered Institute for Archaeologists 2014);
- Historic Environment Guidance for the Renewable Energy Sector (Wessex Archaeology 2007a);
- Guidance for Assessment of Cumulative Impact on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology 2008);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather 2011);
- Designation Selection Guide: Ships and Boat: Prehistory to Present (English Heritage 2012);
- Wessex Archaeology Marine Class Descriptions and Principles of Selection (Wessex Archaeology 2008a);

- Wind Energy and the Historic Environment (EH 2005); and
- Marine Aggregate Dredging and the Historic Environment: Guidance Note (Wessex Archaeology 2003).

17.4.2 Data sources

43. The Study Area, which comprise the East Anglia THREE site, the Interconnector cable corridor and the offshore export cable corridor, has been used to define the search areas for cultural heritage data including prehistoric, maritime and aviation archaeology, incorporating the archaeological assessment of both geotechnical and geophysical data acquired across East Anglia THREE. The principal data sources consulted to inform this chapter are presented in *Table 17.8*.

Table 17.8 Data Sources Features

Data	Year	Coverage	Confidence	Notes
Geotechnical Data	2010 (27th July – 23rd August)	30 boreholes within the East Anglia Zone, two of which are in the East Anglia THREE site	Due to limited coverage of the site, confidence in geotechnical data is regarded with medium confidence. The assessment was based on the interpreted logs rather than the boreholes themselves which has reduced the certainty of this confidence. The use of this data is therefore limited as there are only two boreholes within East Anglia THREE.	Geotechnical data supplements the archaeological assessment of sub-bottom profiler data within East Anglia THREE. Boreholes EA 10/G/002 and EA 10/G/030 are located within East Anglia THREE. No geotechnical data has been archaeologically assessed for the offshore cable corridor at this stage of enquiry.
Geophysical anomalies in East Anglia THREE Study Area identified through the archaeological assessment of geophysical data	2012 (19th June – 4th September)	Sidescan Sonar and Magnetometer: All data for the Study Area assessed. Multibeam Bathymetry: All wreck locations and sea bed features of potential archaeological interest identified in sidescan sonar and magnetometer data in the Study Area. Sub-bottom profiler: data assessed on every 5th line of data giving 20% coverage of the Study Area.	Confidence is considered to variable, as expressed by the assigned data quality. Data quality for archaeological assessment is as follows: Sidescan Sonar: 'Good' Magnetometer: 'Variable' Multibeam Bathymetry: 'Good' Sub-bottom profiler: 'Average'	Magnetometer classified as 'varied' as data were affected by geological composition of the site. Sub-bottom profiler data classified as 'average' as a degree of swell was identified on a number of lines which could not be completely removed, although it did not detrimentally affect the data to a great degree.

Data	Year	Coverage	Confidence	Notes
Geophysical anomalies in East Anglia THREE offshore cable corridor identified through the archaeological assessment of geophysical data	2012 (19th June – 8th October)	Sidescan Sonar and Magnetometer: All data for 2012 Survey Area assessed. Multibeam Bathymetry: All wreck locations and sea bed features of potential archaeological interest identified in sidescan sonar and magnetometer data in 2012 Survey Area. Sub-bottom profiler: data assessed on every 5th line of data giving 20% coverage of 2012 Survey Area.	Confidence is considered to variable, as expressed by the assigned data quality. Data quality for archaeological assessment is as follows: Sidescan Sonar: 'Good' Magnetometer: 'Good' to 'Variable' Multibeam Bathymetry: 'Good' Sub-bottom profiler: 'Very Poor' to 'Good'	Magnetometer data classified as 'variable' were affected by geological composition of the site. Sub-bottom profiler data classified as 'as 'very poor' or 'poor' were affected by high degrees of swell resulting in the low penetration and resolution of features.
	2012 (November) (final submission of East Anglia ONE ES chapter	East Anglia ONE offshore cable corridor	Confidence is considered to variable, as expressed by the assigned data quality. Data quality for archaeological assessment is as follows: Sidescan Sonar: 'Good' to 'Average' Magnetometer: 'Average' Multibeam Bathymetry: 'Good' Sub-bottom profiler: 'Average'	The archaeological assessment of the geophysical data assessed for East Anglia ONE was reviewed in areas where the East Anglia ONE Study Area overlapped with those considered in this chapter. Further information regarding specific data collection dates, coverage details and data quality can be found in the East Anglia ONE ES.

Data	Year	Coverage	Confidence	Notes
Charted wrecks and Obstructions from the United Kingdom Hydrographic Office (UKHO) via SeaZone	2013 (September)	The Study Area	Charted data is considered to be of variable confidence. Charted data provides a good understanding of the spatial and structural characteristics of live wrecks and obstructions as well as some documentary evidence to support an understanding of archaeological interest and is therefore regarded of high confidence. Dead wrecks and obstructions are mapped by charted data although their current status is unclear, although some documentary evidence is often available. Data relating to dead wrecks and obstructions is therefore regarded of low confidence.	Charted data is assessed archaeologically in conjunction with geophysical data.
Records of shipping and aircraft losses held by the National Records of the Historic Environment (NRHE)	2011	The East Anglia THREE offshore cable corridor	Data confidence is considered to be low. Data for shipping and aircraft losses provides an indication of potential, although this potential is poorly understood. Data for shipping losses is based on contemporary accounts of the loss of a vessel or aircraft and is considered to be fragmentary.	Data supplements an understanding of the potential archaeological resource. Data held by the NRHE is limited to the 12nm limit and does not extend to the East Anglia THREE site.
WWII Air/Sea Rescue Operations	1941 - 5	The Study Area	Data confidence is considered to be low. Data documenting air / sea rescue operations in WWII. Provides an indication of potential, although this potential is poorly understood and lacking in quantitative data. This data is considered to be fragmentary.	Data supplements an understanding of the potential aviation resource.

Data	Year	Coverage	Confidence	Notes
England's Historic Seascapes Projects	2011	The majority of the East Anglia THREE site (southern section) and the entire offshore cable corridor	Data characterising the historic seascape within the East Anglian region. Data is regarded with a high level of confidence and adheres to the National Historic Seascapes Characterisation (HSC) Method Statement developed by English Heritage and Tapper and Johns (2008).	Data reviewed from the Newport to Clacton HSC (Oxford Archaeology 2011)
Previous archaeological studies in the area	Various	Wider East Anglian region	Data confidence is variable (ranging between good to poor) and depends on the nature of the source in question (i.e. data relating to the potential archaeological resource often has a degree of uncertainty whereas data relating to the known archaeological resource is regarded with a high level of confidence).	Provides supplementary data on the known and potential archaeological resource. Includes the Thames Estuary Marine Aggregate Regional Environmental Assessments (MAREA) and Regional Environmental Characteristions (REC), work undertaken by WA in marine aggregate dredging licence area 240, the ZEA for the East Anglia Zone and the ES undertaken for East Anglia ONE.

Data	Year	Coverage	Confidence	Notes
Thematic strategic desk-based assessment projects	Various	Wider East Anglian region	Data confidence is variable and depends on the nature of the source in question.	Provides characterisation and context for the known and potential archaeological resource within the Study Area. Data reviewed includes Aircraft Crash Sites at Sea (ALSF 5223, Wessex Archaeology 2008), England's Shipping (ALSF 3323 / 3878, Wessex Archaeology 2007), Enhancing our Understanding: Mapping Navigational Hazards as areas of Maritime Archaeological Potential (ALSF 3917, Bournemouth University 2007), Early Ships and Boats (English Heritage 6440, Wessex Archaeology 2011e) and Assessing Boats and Ships 1860 - 1950 (ALSF 5693 Wessex Archaeology 2011a-d).
Records of isolated finds from the East Coast region	Various	Wider East Coast region	Data confidence is medium-high. This range is based on the fact that the exact location of isolated finds is sometimes difficult to pinpoint (e.g. an isolated find may be assigned a discovery location at the centre point of an aggregate area or may be more accurately assigned to a more precise location based on the recorded track plot).	Data obtained from the Marine Aggregates Industry Protocol for the Reporting of Finds of Archaeological Interest.

Data	Year	Coverage	Confidence	Notes
Secondary sources relating to the palaeo-environment of the North Sea and to the Palaeolithic and Mesolithic archaeology of Northern Europe	Various	Wider East Anglian region	Data confidence is variable.	These secondary sources provide a context for the prehistoric baseline characterisation and supplement an understanding of the potential prehistoric resource.
Secondary sources relating to historic shipping patterns	Various	Wider East Anglian region	Data confidence is variable.	These secondary sources provide a context for the maritime baseline characterisation and supplement an understanding of the potential maritime resource.
Secondary sources relating to historic aviation patterns	Various	Wider East Anglian region	Data confidence is variable.	These secondary sources provide a context for the aviation baseline characterisation and supplement an understanding of the potential aviation resource.

44. Where possible, data from the sources outlined above were analysed and synthesised to create project gazetteers (*Appendix 17.3*), providing a baseline context for the known and potential archaeological resource within the Study Area.

17.4.3 Impact Assessment Methodology

17.4.3.1 Introduction

45. The impact assessment was carried out in accordance with the methodology set out in Chapter 6 Environmental Impact Assessment Methodology. This section details the ES methodology used to determine the significance of the impacts of sea bed preparation, construction, operation and decommissioning activities of the proposed East Anglia THREE project on cultural heritage receptors. The assessment criteria and assignment of significance with respect to archaeology and cultural heritage concerns are based on available standards and guidance (Wessex Archaeology 2007a and Oxford Archaeology 2008), best practice, consultation and on professional judgement. This process considers the following:

- The sensitivity of a receptor to an effect;
- The value of a receptor;
- The magnitude of effect; and
- The criteria used to determine the impact significance.

46. The assessment approach adopts the conceptual 'source-pathway-receptor' model, the parameters of which are defined in Chapter 6 Environmental Impact Assessment Methodology. The types of impacts could be described as direct, indirect and cumulative, and are defined as follows:

- Direct impacts: these arise from impacts associated with the construction, operation or decommissioning of the Project;
- Indirect impacts: these may be experienced by a receptor that is removed (in space or time) from the direct impact. These equate to inter-relationships; and,
- Cumulative impacts: these can occur as a result of the Project in conjunction with other, existing or planned offshore windfarms or other planned marine and coastal developments or activities.

47. All impacts will be assessed with reference to the realistic worst case scenario. This chapter will assess potential impacts to Prehistoric, Maritime and Aviation

Receptors. These receptors include both those known and unknown (e.g. 'potential' archaeological receptors) and are sub-divided as follows:

- Prehistoric Receptors;
  - In situ Prehistoric sites;
  - Submerged landscape features;
  - Derived Prehistoric finds; and
  - Palaeoenvironmental evidence.
- Maritime Receptors;
  - Wrecks; and
  - Derived Maritime finds.
- Aviation Receptors;
  - Aircraft remains; and
  - Derived Aviation finds.

17.4.3.2 Sensitivity

48. The capability of a receptor to accommodate change and its ability to recover if affected is a function of its sensitivity. Receptor sensitivity is considered between negligible and high and is assessed via the following factors:

- Robustness to change, including:
  - Adaptability: The degree to which a receptor could avoid or adapt to an effect;
  - Tolerance: The ability of a receptor to accommodate temporary or permanent change without a significance adverse impact; and
  - Recoverability: The temporal scale over and extent to which a receptor will recover following an effect.
- Scale; and
- Value: A measure of the receptor's importance, rarity and worth.

49. The NPPF states that heritage assets should be recognised as "an irreplaceable resource" and to "conserve them in a manner appropriate to their significance" (Department for Communities and Local Government 2013:30). Since archaeological receptors cannot adapt, tolerate or recover from direct impacts caused by a proposed development, then for the purpose of this chapter, the sensitivity of each receptor was quantified only by their value.

17.4.3.3 Value

50. For the purpose of this assessment, and where possible, the value of archaeological receptors has been determined in accordance with the definitions displayed in *Table 17.9*. Each receptor received a rating from negligible (receptors considered to be a limited value or importance) to high (receptors that are regarded as an extremely significant component of the cultural heritage resource).

51. In accordance with the NPPF and the MPS, while the definitions displayed in *Table 17.9* outline that designation indicates that a receptor has been identified as being of high value, non-designated heritage assets are not necessarily of lesser importance. Very few offshore archaeological sites are designated. This is due to a lack of investigation and data and the difficulties of identifying archaeological features and material offshore.

52. The nature of the archaeological resource is such that there is a high level of uncertainty concerning remains on the sea bed. It is often the case that data concerning the nature and extent of sites is out of date, extremely limited or entirely lacking. As such, in line with COWRIE guidance (Wessex Archaeology 2007a), the precautionary principle is often necessarily applied to aspects of archaeological impact assessment.

53. Where uncertainty occurs, the precautionary approach is to assign high value to the resource. Consequently, if a receptor is impacted, magnitude and significance may in some cases be over assessed.

Table 17.9 Definition of the Value Levels for Marine Archaeological Receptors

Value	Definition
High	Above average example and / or high potential to contribute to knowledge and understanding and / or outreach. Receptors with a demonstrable international or national dimension to their importance or those considered to be rare are likely to fall within this category. Sites with statutory protection (i.e. those protected under the Protection of Wreck Act 1973, Ancient Monuments and Archaeological Areas Act 1979 or the Protection of Military Remains Act 1986) plus as-yet undesignated sites that are demonstrably of equivalent cultural heritage value. Palaeogeographic features with demonstrable potential to include artefactual and / or palaeoenvironmental material, possibly as part of a prehistoric site or landscape.
Medium	Average example and / or moderate potential to contribute to knowledge and understanding and / or outreach. Receptors with a demonstrable regional dimension to their importance or those considered to be comparatively rare are likely to fall within this category. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent, but have moderate potential based on formal assessment of their importance in terms of build, use, loss, survival and investigation ('BULSI' system, Wessex Archaeology 2011a-d). Prehistoric deposits with moderate potential to contribute to an understanding of the palaeoenvironment.
Low	Below average example and / or low potential to contribute to knowledge and understanding and / or outreach. Receptors with a demonstrable local dimension to their importance are likely to fall within this category. Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance, but have low potential based on a formal assessment of their importance in terms of build, use, loss, survival and investigation ('BULSI' system, Wessex Archaeology 2011a-d). Prehistoric deposits with low potential to contribute to an understanding of the palaeoenvironment.
Negligible	Poor example and / or little or no potential to contribute to knowledge and understanding and / or outreach. Assets that are not considered to be rare with little or no surviving archaeological interest.

54. For marine cultural heritage receptors, the perceived importance of each asset is generally assessed and assigned on a site-by-site basis, depending on the criteria listed above. Value in terms of wreck sites, the most commonly encountered marine archaeological receptor for offshore developments, could be further refined by the following criteria. In relation to EH's *Designation Selection Guide for Ships and Boats* (English Heritage 2012), the criteria used to assess an asset in terms of its value are:

- Period;

- Rarity;
- Documentation;
- Group Value;
- Survival and Condition; and
- Potential.

55. These aspects help to characterise each asset whilst also enabling their relative merit to be explored in relation to other similar assets. The criteria also enable the potential to contribute to knowledge, understanding and outreach to be assessed.

56. The ALSF-funded *Marine Class Description and principles of selection for aggregate producing areas project* (ALSF 5383; Wessex Archaeology 2008a) devised a composite timeline that considered wrecks in five distinct date ranges. This composite timeline took into account the broad chronology of shipbuilding and was thus able to draw out generalisations regarding the age and special value of sites. The timeline is summarised as follows:

- Pre- 1508AD: this covers the period from the earliest prehistoric evidence for human maritime activity to the end of the medieval period, c. 1508. Little is known of watercraft or vessels from this period and archaeological evidence of them is so rare that all examples of craft are likely to be of special value
- 1509 to 1815: this encompasses the Tudor and Stuart periods, the English Civil War, the Anglo-Dutch Wars and later the American Independence and French Revolutionary Wars. Wrecks and vessel remains from this date are also quite rare, and could be expected to be of special value
- 1816 to 1913: this period witnessed great changes in the way in which vessels were built and used, corresponding with the introduction of metal to shipbuilding, and steam to propulsion technology. Examples of watercraft from this period are more numerous and as such, it is those that specifically contribute to an understanding of these changes that should be regarded as having special value
- 1914 to 1945: this period encompasses World War I (WWI), the Interwar years and WWII. This date range contains Britain's highest volume of recorded boat and ships losses. Those which might be regarded as having special interest are likely to relate to technological changes and to local and global activities during this period; and,

- Post 1945: the final period extends from 1946 through the post-war years to the present day. Vessels from this date range would have to present a strong case if they are to be considered of special interest.

57. According to this composite timeline, vessels that pre-date 1816 are likely to be considered of special value on the basis of their rarity and subsequent national and international importance in our understanding of maritime activity and shipping movements during these periods.

58. Wrecks dating from 1816 to the present day are more plentiful amongst known wrecks and their special value thus depends upon their ability to exhibit both integral and relative factors based on attributes relating to the WA 'BULSI' system (Build, Use, Loss, Survival and Investigation) of wreck assessment. For a wreck of this period to be of special interest it is likely to have to make a distinctive contribution in respect of one or more of the following (Wessex Archaeology 2011a-d):

- Illustrate a key narrative of the period;
- Represent a distinct and tangible link to significant persons or events;
- Be representative of significant loss of life or related responses in seafaring safety;
- Have made a distinct cultural contribution; and
- Have current relevance or parallels.

59. In addition, in order to have special interest a wreck must be considered to have relative merit in comparison to other wrecks or surviving vessels of the period (Wessex Archaeology 2011a-d). The factors used to express relative merit are likely to include the following:

- Rarity;
- Representation;
- Diversity;
- Survival; and
- Setting and context.

17.4.3.4 It is important to note that the assignment of value to a wreck site based on the criteria outlined above relies to a large degree on available data recorded in desk-

based resources. Such data is often limited and cannot always afford a full evaluation of any given wreck site. On this basis, it must be borne in mind that the assignment of value is not absolute, but is rather an indication of the perceived archaeological interest of a site based on available data to date. In line with policy SOC2 of the East Inshore and East Offshore Marine Plans (DEFRA 2014), all assets that have the potential to be compromised by the proposed development, regardless of their value at this stage of enquiry, will require appropriate mitigation to safeguard, offset or minimise any such impacts from occurring

17.4.3.5 Magnitude

60. The magnitude of the effect of any given impact describes the extent or degree of change that is predicted to occur. In determining the magnitude of any given effect, this assessment therefore considered the spatial extent, likelihood, duration and frequency of the impact. Using archaeological professional judgement, the magnitude of each impact were rated between negligible and high, ranging from those that result in little or no effects upon archaeological receptors to those where adverse effects could comprise the damage or destruction of archaeological receptors. Definitions of the magnitude levels for archaeological receptors are presented in *Table 17.10* below.

Table 17.10 Definitions of the Magnitude Levels for Archaeological Receptors

Magnitude	Definition
High	Total loss or major alteration to key elements / features of the existing baseline (pre-development) conditions such that post-development character / distinctiveness / composition / attributes will be fundamentally changed and may be lost from the site altogether. Includes permanent/irreversible changes to existing baseline conditions.
Medium	Loss or alteration to one or more key elements / features of the existing baseline conditions such that post-development character / distinctiveness / composition / attributes of the baseline will be partially but considerably changed. Includes permanent/irreversible changes to existing baseline conditions.
Low	Minor shift away from existing baseline conditions. Change arising from the loss / alteration will be discernible but underlying character / distinctiveness / composition / attributes of baseline condition will be similar to pre-development circumstances / patterns. Includes temporary (throughout project duration) changes.
Negligible	Very slight change from existing baseline conditions. Change barely distinguishable, approximating to the 'no change' situation or temporary (for part of the project duration) change.

17.4.3.6 Impact significance

61. The significance of an effect as identified in this ES was assessed by combining the evaluations of the magnitude of a potential impact and the sensitivity of the receptor affected. With regards to archaeology and cultural heritage, impact significance could thus be regarded as a product of both the magnitude of the impact, and the public importance of the historic environment asset that is impacted (Wessex Archaeology 2007a). Significant impacts (i.e. those classified as major or moderate) were distinguished from non-significant impacts (i.e. those classified as minor or negligible) according to defined parameters expressed as a matrix, as shown in *Table 17.11*.

Table 17.11 Impact Significance Matrix

Sensitivity	Magnitude				
	High	Medium	Low	Negligible	No change
High	Major	Major	Moderate	Minor	No Impact
Medium	Major	Moderate	Minor	Negligible	No Impact
Low	Moderate	Minor	Minor	Negligible	No Impact
Negligible	Minor	Negligible	Negligible	Negligible	No Impact

62. The definitions of impact significance from the above matrix are outlined below in *Table 17.12*.

Table 17.12 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, adverse or beneficial, which are likely to be important considerations at a regional or district level. Major beneficial effects may contribute to achieving national, regional or local objectives in providing a significant positive gain to the environment. Major adverse effects could result in exceeding statutory objectives and / or breaches of legislation and give rise to serious concern. Such impacts are deemed significant in EIA terms.
Moderate	Intermediate change in receptor condition, adverse or beneficial. Moderate beneficial effects may provide some gain to the environment. Moderate adverse effects may give rise to some concern and are likely to be an important consideration at a local level. Such impacts are deemed significant in EIA terms.
Minor	Small change in receptor condition, adverse or beneficial. Minor beneficial effects may have some environmental benefits. Minor adverse effects may be undesirable, but of limited concern. Such changes are unlikely to be important in the decision making process and are deemed not significant in EIA terms.
Negligible	No discernible change in receptor condition. The impact is deemed not significant in EIA terms.
No Impact	No change in receptor condition. The impact is deemed not significant in EIA terms.

63. The primary method of mitigation when dealing with the archaeological resource is the precautionary principle, based on the prevention of damage to receptors by proactively putting in place protective measures rather than attempting to repair damage (which may be irreversible) after it has occurred. To achieve this, embedded mitigation will be applied (see section 17.3.3 above).

64. Potential impacts of the proposed East Anglia THREE project upon the setting of onshore cultural heritage assets are considered as part of the Chapter 25 Onshore Archaeological and Cultural Heritage chapter. Known heritage assets within the East Anglia THREE site are confined to wreck sites (A1s and A3s) and sites of potential anthropogenic origin and archaeological interest (A2s). Wrecks lost other than by design are not regarded as having a setting as their siting is based on chance alone. As such, potential impacts upon the setting of the maritime sites outlined in this assessment are regarded as **negligible**.

17.4.4 Cumulative Impact Assessment (CIA)

65. The CIA presented in this chapter was carried out in accordance with the methodology set out in Chapter 6 Environmental Impact Assessment Methodology

and is based on available standards and guidance (Oxford Archaeology 2008 and Renewable UK 2013), best practice, consultation and on professional judgement.

66. As defined for the purposes of this impact assessment, cumulative impacts are those which could occur as a result of the proposed project in conjunction with other, existing or planned offshore windfarms or other planned marine and coastal developments or activities. Cumulative impacts may therefore occur to archaeological receptors that have the potential to be incrementally impacted by other existing, consented and / or proposed developments or activities. These impacts maybe regarded individually as minor but collectively as significant. However, the emphasis is on the assessment of potentially significant impacts rather than on comprehensively cataloguing every conceivable impact that might occur.

67. The assessment of cumulative impact upon archaeological receptors therefore considered whether impacts on a receptor could occur on a cumulative basis between the proposed project and other windfarm projects, activities and plans in the area (either consented or forthcoming). Other known plans or projects considered as part of this CIA are outlined in section 17.7.

68. Significant cumulative impacts are restricted to direct impacts upon the potential archaeological resource from the Study Area with other plans and projects across the wider region that would have an indirect impact upon receptors within the Study Area.

69. Known archaeological receptors within the East Anglia THREE site would not be subject to direct impacts from other plans or projects as there is no geographical overlap. There is, however, geographical overlap between the offshore cable corridor and other plans or projects (see section 17.7). Where there is potential for geographical overlap with existing or future planned projects, it is expected that such projects have already been or would be subject to assessment and direct impacts would therefore be avoided or reduced to an acceptable level through the implementation of appropriate mitigation measures.

70. Significant cumulative impacts to potential archaeological receptors within the Study Area may occur as a result of multiple unavoidable impacts to a receptor across a region.

71. Individual sites at specific locations represent both archaeological receptors in themselves, but are also part of the archaeological resource as a body of data and as collective heritage. Hence, not only is it necessary to consider the full range of other plans or projects across the region, not just those in close proximity, but it is also

necessary to consider how a number of impacts upon a specific aspect of the collective heritage may result in a significant cumulative impact.

17.4.5 Transboundary Impact Assessment

72. The transboundary impact assessment presented in this chapter was carried out in accordance with the methodology set out in Chapter 6 Environmental Impact Assessment Methodology.

73. Significant transboundary impacts are considered to occur where a planned activity results in a significant adverse effect in a transboundary context. With regards to archaeology and cultural heritage, transboundary impacts may be relevant where wrecks or aircraft remains of non-British, European nationality are 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. In theory, there is the possibility of the remains of vessels from maritime nations to be present within the Study Area which may be of importance to that country.

74. As all direct impacts to known receptors would be prevented by AEZs, prohibiting development activities within their boundaries, transboundary impacts to known wrecks and aircraft are not expected. It is possible that potential, as yet undiscovered wrecks and aircraft may be impacted, although the implementation of embedded mitigation measures serves to reduce this likelihood and to address unexpected discoveries of an archaeological nature promptly and appropriately should they be discovered throughout the construction, operation or decommissioning of the proposed East Anglia THREE project. If wrecks or aircraft that could be positively identified as being of foreign nationality are discovered during the course of the development then further advice should be sought regarding the legal status of the remains in their home country.

17.5 Existing Environment

17.5.1 Prehistory

17.5.1.1 Introduction

75. The archaeological record of the southern North Sea basin is one of the oldest in Europe, with the earliest evidence of hominin activity from Happisburgh , Norfolk around 970,000 years ago (Parfitt et al. 2010). A series of hominins including *Homo heidelbergensis*, *H. neanderthalensis* and modern humans *H. sapiens* have inhabited and moved through now-submerged landscapes in the North Sea and English Channel regions (Cohen et al. 2012); illustrated vividly by the intertidal discovery in East Anglia of ancient footprints of multiple individuals dating to around 800,000

years ago (Ashton et al. 2014). These submerged palaeolandscapes are popularly referred to as 'Doggerland' (Coles 1998).

17.5.1.2 Known Prehistoric Receptors

76. There are currently no known prehistoric sites within the Study Area. However, this is likely to be due to both the lack of previous investigation and the variable survival rate of prehistoric archaeological material rather than an indication that hominin populations were absent.

17.5.1.3 Potential Prehistoric Receptors

77. The Early Prehistory of the southern North Sea basin is fundamentally linked to several phases of lower-than-now relative sea level during the last million years until the Neolithic, c 6,000 years ago. The internationally important Middle Palaeolithic archaeology (c. MIS 8 / 7; 250,000 BP) recovered from the aggregate dredging Area 240 in the palaeo-Yare catchment, which may also contain Lower or Late Middle Palaeolithic elements highlights potential for encountering submerged early prehistory in the East Anglia region from offshore contexts (Tizzard et al. 2014, Bicket et al. 2014).

78. The key areas of potential linked to the findings of the palaeogeographical assessment (*Volume 2, Figures 17.2 and 17.3* and *Volume 3, Appendix 17.2,* section 1.3) are broken down chronologically shown in *Table 17.13*.

Table 17.13 Summary of Key Areas of Prehistory Potential

Period	Summary
Lower Palaeolithic (c. 970,000 to 300,000 BP; > MIS 9) & Early Middle Palaeolithic (MIS 9 – 6; c. 350 – 180kBP)	The Yarmouth Roads (YM) Formation is particularly of archaeological interest for the preservation of in situ and reworked Lower and Middle Palaeolithic artefacts, faunal remains and deposits of interest for palaeoenvironmental analysis and palaeogeographical reconstruction (*Volume 3, Appendix 17.2,* section 1.3*, Table 1.9*). A number of geological units related to this period have been identified in the East Anglia THREE Study Area (see *Appendix 17.2,* section 1.3 and *Appendix 17.3,* section 1.4), relating to channel features, possibly organic materials relating to extensive estuarine and delta landscape of the earlier Middle Pleistocene. A seismic data example of the YM Formation is provided in *Volume 2, Figure 17.4*.
Late Middle Palaeolithic (MIS 3; c. 60kBP)	The Brown Bank Formation (BNB), Eem Formation (EE) and other identified geological units (*Appendix 17.2,* section 1.3 and *Appendix 17.3,* section 1.4) which may date to MIS 5 to 3 have the potential to characterise the palaeogeography of the region and protect underlying archaeology of older date; archaeology which is absent or sparsely preserved in onshore contexts. These units have potential to contain Middle Palaeolithic archaeological material in situ or in secondary contexts as well as palaeoenvironmental archives. Seismic data examples of the BNB and EE are provided in *Figures 17.5*.
Upper Palaeolithic (MIS 3 – 2; 34,000 – 10,500BP) & Mesolithic (10,500 – 6,000BP)	Potential for encountering in situ or reworked Upper Palaeolithic and Mesolithic archaeology and sediments of palaeoenvironmental interest exist within pre-transgression, possibly Holocene fluvial sediments dating to MIS 2 to 1 (*Appendix 17.2,* section 1.3, *Table 1.7*). Seismic data examples of Holocene Pre-Transgression Channels are provided in*, Figures 17.6* and *17.7*.

79. In the East Anglia THREE site there are eight features of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material (P1, see section 17.3.3 *Table 17.14*). Three channel features of likely post-Devensian age (WA 75454, 75511 and 75517) may be contemporary with Late Upper Palaeolithic and Mesolithic periods. Five high amplitude reflectors possibly indicative of preserved organic material (WA 75529, 75530, 75532, 75533 and 75534) are of likely pre-Anglian age, and contemporary with Lower Palaeolithic archaeological industries (*Table 17.12* and *Appendix 17.3,* section 1.4). A seismic data example of a high amplitude reflector (WA 75532) is provided in *Figure 17.8*.

80. In the offshore cable corridor there are 31 features of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material (P1, see section 17.3.3, *Table 17.15*). Seventeen channel features of likely Devensian, post-Devensian or uncertain origin have been identified.

81. In the East Anglia THREE site there are a further 77 features of possible archaeological interest (P2) and a further 21 such features in the Offshore Cable Corridor, comprising a range of palaeolandscape features such as channels, cut and fill features, gas blanking, and erosion surfaces (*Appendix 17.3,* section 1.3 and, *Figures 17.9* to *17.11*).

Table 17.14 Known Prehistory Receptors: The East Anglia THREE site

WA ID	Receptor Summary		Age	Archaeological Discrimination
75454	Channel	Small but distinct cut and fill feature cut into the surface of BNB, single phase of acoustically unstructured fill. Identified on a number of survey lines and possibly a small fluvial channel. Depth Range: 4.7 to 11.3m BSB.	Post-Devensian	P1
75511	Channel	North-west to south-east trending channel feature cut into top layers of BNB. Basal reflector often poorly defined, and feature generally identified by break in base BNB reflector. Generally a single phase of acoustically unstructured fill, though a possible second fill characterised by sub-parallel internal reflectors identified on one line. Possible fluvial feature. Depth Range: 1.0 to 22.8m BSB.	Post-Devensian	P1
75517	Channel	North-east to south-west trending channel feature cut into top layers of BNB. Basal reflector often poorly defined, and feature generally identified by break in base BNB reflector. Single phase of acoustically unstructured or chaotic fill. Possible fluvial feature. Depth Range: 3.1 to 13.7m BSB.	Post-Devensian	P1
75529	High Amplitude Reflector	Area of intermittent high amplitude reflectors, possibly within YM though this is unclear. Possibly indicative of preserved organic material. Depth Range: 10.1 to 20.9m BSB.	Pre-Anglian	P1
75530	High Amplitude Reflector	Area of intermittent high amplitude reflectors, possibly within YM though this is unclear. Possibly indicative of preserved organic material. Depth Range: 8.7 to 14.6m BSB.	Pre-Anglian	P1
75532	High Amplitude Reflector	Area of intermittent high amplitude reflectors, possibly within YM though this is unclear. Possibly indicative of preserved organic material. Depth Range: 8.3 to 13.3m BSB.	Pre-Anglian	P1
75533	High Amplitude Reflector	Area of intermittent high amplitude reflectors, possibly within YM though this is unclear. Possibly indicative of preserved organic material. Depth Range: 8.7 to 11.8m BSB.	Pre-Anglian	P1
75534	High Amplitude Reflector	Area of intermittent high amplitude reflectors, possibly within YM though this is unclear. Possibly indicative of preserved organic material. Depth Range: 9.5 to 11.3m BSB.	Pre-Anglian	P1

Table 17.15 Known Prehistory Receptors: Offshore Cable Corridor

WA ID	Receptor Summary		Age	Archaeological Discrimination
75303	Channel	Large-scale, broad complex channel feature orientated north to south. Fill interpreted as BNB Formation. Feature is overlain by small sand waves, boundary between the feature and overlying Holocene not always clear. Depth Range: 1.5m to 15.1m BSB.	Devensian	P1
75304	Channel	Simple cut and fill with single fill phase. Fill probably BNB Formation up to 7m thick associated with larger channel feature (75303).	Devensian	P1
75318	Simple cut and fill	Cut feature (between 51.1 to 60.3m below LAT) infilled with up to 13.9m sediment (transparent unit) overlain by up to 4m Holocene sediment. Possible cut at base of YR.	Pre-Anglian	P1
75319	Simple cut and fill	Indistinct simple cut and fill feature with basal reflector observed between 5.1 to 10.0m sub-seabed. Fill appears to be bright reflectors. Overlain by sandwaves up to 5m high. Probable BNB Formation infill.	Devensian	P1
75320	Simple cut and fill	Broad shallow cut and fill (possible depression). Base cut into transparent unit between 3.1 to 7.3m sub-sea bed. Fill interpreted as BNB Formation.	Devensian	P1
75321	Simple cut and fill	Small simple cut and fill feature between 3.3 and 6.2m sub-sea bed. Fill up to 5m thick and overlain by veneer of sea bed sediments with occasional sandwaves up to 6m high.	Devensian	P1
75324	Simple cut and fill	Cut and fill feature observed between 1 and 12.1m sub-sea bed. Fill transparent and probably consists of BNB Formation fill. Fill up to 10m thick and overlain by veneer of sea bed sediments and sandwaves up to 6m high. Overlain by sandwaves up to 3m.	Devensian	P1
75325	Simple cut and fill	Simple cut and fill feature with undulating basal reflector observed between the sea bed and 4m sub-sea bed. Fill indistinguishable and overlain by veneer (ripples) of sea bed sediment with occasional sandwaves up to 6m high.	Devensian	P1
75326	Complex cut and fill	Moderately distinct cut observed between 2.2 and 7.3m sub-sea bed. Fill interpreted as BNB Formation. Southern end of cut is cut across by later cut observed between 1.6 and 5.9m sub-sea bed. Secondary fill interpreted as later post-Devensian fill.	Devensian and post-Devensian	P1
75327	Simple cut and fill	Shallow, simple cut and fill between 2.8 and 6.0m sub-sea bed. Fill comprises up to 4m sub-parallel reflectors, probable BNB Formation overlain by sandwaves up to 3m high.	Devensian	P1
75328	Simple cut and fill	Southern edge of simple cut and fill feature observed between 4.2 and 8.0m sub-sea bed. Overlain by sandwaves up to 6m. Infill is BNB Formation.	Devensian	P1
75330	Simple cut and fill	Cut marked by strong basal reflector between the sea bed and 10.9m sub-sea bed. Large sandwave at S end, 8m high.	Devensian or post-Devensian	P1

WA ID	Receptor Summary		Age	Archaeological Discrimination
75332	Simple cut and fill	Undulating basal cut between 1.4 and 9.4m sub-sea bed. Fill overlain by sandwaves up to 7m high.	Devensian or post-Devensian	P1
75333	Complex cut and fill	Indistinct simple cut and fill feature, probably internal YR channel cut between 2.9 and 8.6m sub-sea bed. Fill cut by secondary cut. Base of secondary cut between 2.2 and 5.0m sub-sea bed. Fill appears up to 4m thick overlain by sandwaves up to 4.5m high.	Pre-Anglian and Devensian or post-Devensian	P1
75336	Simple cut and fill	Shallow cut between 1.6 to 6.6m sub-sea bed. Fill possible BNB Formation.	Devensian or post-Devensian	P1
75337	Simple cut and fill	Shallow cut between 1.5 to 9.3m sub-sea bed. Fill overlain by sandwave up to 11m high. Fill possible BNB Formation.	Devensian or post-Devensian	P1
75403	Channel	Small section of a N-S trending channel. Age of fill unknown. Depth Range: 1.2m to 8.9m BSB.	Unknown	P1
75404	Channel	Small section of a N-S trending channel. Fill overlain by a thin veneer of sea bed sediment. Age of fill unknown. Depth Range: 1.6m to 10.0m BSB.	Unknown	P1
75405	Channel	Small section of a N-S trending channel. Fill only overlain by a thin veneer of sea bed sediment. Age of fill unknown. Depth Range: 1.7m to 15.6m BSB.	Unknown	P1
75406	Channel	Small but continuous sinuous channel cut into London Clay and trending generally NNW-SSE. Interpreted as a tributary of the northern route of the Thames - Medway system, originally Cromerian but re-activated during subsequent lowstands. Depth Range: 1.2m to 10.8m BSB.	Pre-Anglian and Devensian	P1
75409	Channel	Small, generally E-W trending channel feature. Single phase of acoustically transparent and unstructured fill. Possibly a tributary of the northern route of the Thames - Medway system, originally Cromerian but re-activated during subsequent lowstands. Could have been an extension of the present day River Ore/River Alde during the Mesolithic. Depth Range: 1.6m to 10.0m BSB.	Pre-Anglian and Devensian	P1
75410	Channel	Small, generally NNW-SSE trending channel feature. Possibly a tributary of the northern route of the Thames - Medway system, originally Cromerian but re-activated during subsequent lowstands. Depth Range: 0.7m to 5.8m BSB.	Pre-Anglian and Devensian	P1

WA ID	Receptor Summary		Age	Archaeological Discrimination
75594	Channel	Generally poorly defined approximately NNE-SSW trending channel feature cut into WK. Possible channel feature filled with BNB sediment. Depth Range: 0.4m to 13.4m BSB.	Devensian	P1
75598	Channel	Small but generally well defined channel feature cut into BNB. Possible Post-Devensian fluvial channel. Depth Range: 0.2m to 6.1m BSB.	Post-Devensian	P1
75604	Channel	Cut and fill feature at base of BNB cut into WK/YM. Possible remnant of an eroded channel feature filled with BNB sediment. Depth Range: 0.9m to 10.3m BSB.	Devensian	P1
75606	Channel	Cut and fill feature at base of BNB cut into WK/YM. Possible remnant of an eroded channel feature filled with BNB sediment. Depth Range: 4.7m to 14.3m BSB.	Devensian	P1
75612	Channel	Large, distinct cut and fill feature trending approximately N-S. Possible remnant of an eroded channel feature filled with BNB sediment. Depth Range: 0.7mm to 16.6m BSB.	Devensian	P1
75616	Channel	Shallow cut and fill feature cut into YM. Possible fluvial feature though date is uncertain. Depth Range: 0.8m to 8.4m BSB.	Unknown	P1
75617	Channel	Large, distinct cut and fill feature cut into YM. Possible remnant of an eroded channel feature filled with BNB sediment. Depth Range: 0.4m to 12.0m BSB.	Devensian	P1
75618	Channel	Large, distinct cut and fill feature cut into YM. Possible remnant of an eroded channel feature filled with BNB sediment. Depth Range: 0.4m to 12.0m BSB.	Devensian	P1
75639	Channel	Shallow, NW-SE trending cut and fill feature cut into YM. Possible channel feature filled with BNB sediments. Depth Range: 1.2m to 10.5m BSB.	Devensian	P1

17.5.2 Maritime

17.5.2.1 Introduction

82. Following the inundation of the Study Area by rising sea levels, any human activity could be expected to be of a maritime nature. Maritime sites may include both wrecks and material accidentally or deliberately lost overboard.

83. The "known" maritime resource, comprising the actual remains of wrecks on the sea bed or associated finds, presents the marine archaeological existing baseline conditions within the Study Area. However, due to the biased nature of the records available which represent the "known" maritime resource (see *Appendix 17.1*); there is the potential for hitherto unknown wrecks to exist within the Study Area.

84. The "potential" maritime resource is therefore also considered in order to facilitate the identification of the likelihood for hitherto unknown material and sites to exist which relate to our maritime past. The "potential" maritime resource relates to vessels which have been lost in the past but whose remains have yet to be located. An assessment of the "potential" maritime resource also depends on an understanding of the variable survivability and visibility of wrecks on the sea bed. This is dictated by a combination of factors explored in *Appendix 17.1.*

85. The known maritime receptors within the Study Area are discussed below. The offshore cable corridor covers areas previously assessed as part of the East Anglia ONE ES (East Anglia ONE 2012). It therefore follows that a number of known wrecks summarised in this ES have been identified as part of the East Anglia ONE ES, which contains within it a detailed review of the geophysical archaeological assessment. Additional known wrecks within the offshore cable corridor but beyond the East Anglia ONE assessment area have been assessed as part of a review of the 2012 geophysical survey area, detailed in full in *Volume 3, Appendix 17.2.* The discussion of known maritime receptors is followed by a summary of documented losses in the region and a subsequent overview of the "potential" maritime baseline environment (*Figure 17.12*).

17.5.2.2 Known Maritime Receptors: The East Anglia THREE site

86. There are 12 known wrecks within the East Anglia THREE site located during the archaeological assessment of geophysical data (*Figures 17.13* to *17.15*). One such wreck is designated by Schedule 1 of the *Protection of Military Remains Act 1986*; the HMS *Fitzroy* (WA 71012) (*Figure 17.16*).

87. Details of these wrecks are included in the gazetteer in *Appendix 17.3* (section 1.3), with illustrated examples in *Figures 17.16* to *17.23* and summarised in *Table 17.16*.

The results of the geophysical assessment are presented in full in *Appendix 17.2*. These wrecks are categorised in *Table 17.16* as A1 receptors (wrecks seen in the archaeologically assessed geophysical data) or A3 receptors (charted sites not seen in the geophysical data). A3 receptors therefore include historical records which either remained unverified because no geophysical signature was noted at their charted location or because their charted location lies beyond the area assessed as part of the geophysical review, as shown in *Figures 17.13* to *17.15*.

88. Those wrecks recorded by the UKHO are detailed as being either 'Live' or 'Dead' in *Table 17.16*. Live wrecks are those considered to exist at their charted location by the UKHO whereas a dead wreck is a wreck not detected by repeated surveys and therefore considered not to exist at their charted location. Dead wrecks include both records based on the reported sinking location of a vessel with no subsequent verification of remains detected and those whose remains have once been observed, but have since been dispersed or not located following subsequent surveys perhaps due to sediment or the degradation of remains. Although classified as dead, the potential for fragmentary or buried remains to exist at the latter recorded locations cannot be discounted.

Table 17.16 Known Wreck Receptors: the East Anglia THREE site

WA ID	Receptor Summary		Archaeological Receptor Category
70911	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (31.3 x 8.1m) (UKHO Live Wreck)	Height 1.1m, discrete wreck remains which appear to be partially buried by mobile sands, medium-large magnetic anomaly indicating the presence of ferrous material.	A1
71008	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (33 x 10.3m) (UKHO Live Wreck)	Height 3.0m, large expanse of broken up and dispersed wreck remains, possibility of some hull structure being intact with smaller structural elements spread around this, wreck surrounded by debris / cargo, possibly partially buried, large magnetic anomaly suggests ferrous construction and / or cargo, wreck lying on its side in an area of sandwaves.	A1
71012	Wreck of the minesweeper HMS *Fitzroy* recorded by the UKHO and seen in geophysical data (70.5 x 15.3m) (UKHO Live Wreck)	Height 5.5m, hull and deck structures present, one end of vessel looks reasonably well intact, some scattered debris surrounding the wreck, large scouring to the north and south with a maximum depth of 5m, large magnetic anomaly indicating ferrous hull.	A1
71016	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (23.3 x 8.5m) (UKHO Live Wreck)	Height 4.5m, very well preserved wreck remains, hull and deck structure very intact with individual structural elements visible, large scouring to north-east of wreck, large magnetic anomaly indicating ferrous construction or cargo.	A1
71017	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (112.2 x 38.1m) (UKHO Live Wreck)	Height 1.7m, large area of seafloor disturbance, possibly representing buried wreck remains, medium magnetic anomaly suggests the presence of some ferrous material.	A1
71020	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (58.7 x 24.7m) (UKHO Live Wreck)	Height 1.6m, medium-large very dispersed wreck in an area of sandwaves, plank-like anomalies visible as part of broken up remains, small height indicates highly broken up, very large magnetic anomaly indicates the presence of ferrous material.	A1

WA ID	Receptor Summary		Archaeological Receptor Category
76056	Wreck of an unknown vessel not recorded by the UKHO but seen in geophysical data (17.5 x 12.8m)	Height 0.8m, wreck debris with structural elements distinguishable, possible partially buried.	A1
76145	Wreck of an unknown vessel not recorded by the UKHO but seen in geophysical data (10.1 x 7.8m)	Height 1.8m, small spread of possible wreck remains, buried by sandy sea bed sediments, possible structural elements remain, slight scouring observed to the north of the remains.	A1
71005	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	The record of an unknown wreck, first detected in 1968 when the mast was thought visible 5ft above water, last detected in 1972 but subsequent surveys have been unable to locate the wreck. This record is classified as 'dead' by the UKHO.	A3
71013	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	The record of an unknown wreck, first detected in 1921, last detected in 1926, subsequent surveys failed to locate the wreck despite intensive echo sounder and sonar searches. This record is classified as 'dead' by the UKHO.	A3
71014	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	The record of an unknown wreck, first reported in 1972, the mast of the wreck was thought to have been visible above water but may have represented a floating spar, subsequent attempts to locate the wreck were unsuccessful. This record is classified as 'dead' by the UKHO.	A3
71015	Possible wreck of unknown vessel identified by Gardline but not seen in geophysical data	Possible wreck, located in ZEA corridor assessed by Gardline but not observed in latest geophysics dataset.	A3

17.5.2.3 Known Maritime Receptors: offshore cable corridor

89. There are 43 known wrecks within the offshore cable corridor (*Figures 17.13* to *17.15*). Details of these wrecks are included in the gazetteer in*, Appendix 17.3*, with examples illustrated in *Figures 17.6* to *17.23* and summarised in *Table 17.16*. The results of the geophysical assessment are presented in full in *Appendix 17.2*. These wrecks are categorised in *Table 17.17* as A1 receptors or A3 receptors.

90. Those wrecks recorded by the UKHO are detailed as being either 'Live' or 'Dead' in *Table 17.17*. Live wrecks are those considered to exist at their charted location by the UKHO whereas a dead wreck is a wreck not detected by repeated surveys and therefore considered not to exist at their charted location, as discussed above in section 17.5.2.2.

91. The known wrecks summarised in *Table 17.17* relate to those located within the offshore cable corridor and include sites identified as part of the 2012 Survey Area assessment and those reviewed as part of the East Anglia ONE ES (East Anglia ONE 2012). Of the 43 known wrecks within the interconnector cable corridor, 42 are located within areas previously considered as part of the existing East Anglia ONE ES (East Anglia ONE 2012). The mitigation proposed for these sites will be as per that outlined in the East Anglia ONE ES. Further details relating to those previously identified as part of the East Anglia assessment can be found within the relevant ES (East Anglia ONE 2012). Details of wrecks identified in the review of the 2012 survey area data are provided in *Appendix 17.2.*

Table 17.17 Known Wreck Receptors: 2012 Survey Area within Offshore Cable Corridor

WA ID	Receptor Summary		Archaeological Receptor Category
70523	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (44.9 x 19.6m). Considered as part of the existing East Anglia ONE ES.	Height 4.8m, poor condition and broken up into at least two large sections, large magnetic anomaly indicating modern wreck with a metallic hull, possibly partially buried	A1
70611	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (41.2 x 11.1m). Considered as part of the existing East Anglia ONE ES.	Height 0.9m, upright though not level, sand has buried much of the wreck, no magnetic anomaly indicating lack of metallic fittings or cargo	A1
70616	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (54 x 16.1m). Considered as part of the existing East Anglia ONE ES.	Height of 7.8m, upstanding but quite broken up and in at least two sections, slight sediment build up noted on the eastern side, magnetic anomaly indicating the presence of some metallic elements	A1
70619	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (93 x 14m). Considered as part of the existing East Anglia ONE ES.	Height of 6m, intact and upright, partially buried, large magnetic anomaly indicates that the wreck is metallic	A1
70620	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (30.3 x 13m). Considered as part of the existing East Anglia ONE ES.	Height of 1.2m, indistinct oval area of seafloor disturbance, some visible outlines of structure, large magnetic anomaly, indicating the presence of some metallic elements	A1
70621	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (24 x 8m). Considered as part of the existing East Anglia ONE ES.	Height of 1.9m, upstanding object between two areas of disturbed seafloor, large magnetic anomaly indicating the presence of some metallic elements	A1
72360	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (14.5 x 6m). Considered as part of the existing East Anglia ONE ES.	Probable buried wreck. Large magnetic anomaly only (no SSS target) indicating an object with a large amount of steel in its structure. Suspected completely buried.	A1

WA ID	Receptor Summary		Archaeological Receptor Category
72389	Wreck, possibly the steamship *Grenadier*, recorded by the UKHO and seen in geophysical data (85.4 x 11.5m). Considered as part of the existing East Anglia ONE ES.	Height 5.5m, appears very well preserved with only some possible damage visible at one end, upright with intact parts of the superstructure visible, large piece of debris visible 150m from the wreck (WA72388), magnetic anomaly indicating a metallic hull.	A1
72390	Wreck, possibly the steamship *Petshenga* recorded by the UKHO and seen in geophysical data (127.6 x 27.4m). Considered as part of the existing East Anglia ONE ES.	Height 6.8m, upright in one piece but the superstructure and parts of the hull appear damaged, magnetic anomaly indicating a metallic hull.	A1
72410	Wreck, possibly the steamship *Disa,* recorded by the UKHO and seen in geophysical data (52.0 x 14.0m). Considered as part of the existing East Anglia ONE ES.	Height 7.0m, well preserved with an intact hull, superstructure not visible, possibly upside down, sparse debris field close to wreck, magnetic anomaly indicating a metallic hull.	A1
72437	Wreck, possibly the steamship *Tergestea*, recorded by the UKHO and seen in geophysical data (67.0 x 16.0m). Considered as part of the existing East Anglia ONE ES.	Height 5.0m, upright and very well preserved, superstructure partially damaged, magnetic anomaly indicating a metallic hull.	A1
72439	Wreck of the steamship *Brixton* recorded by the UKHO and seen in geophysical data (88.1 x 20.9m). Considered as part of the existing East Anglia ONE ES.	Height 5.4m, partially broken up and partially buried, magnetic anomaly indicating a metallic hull.	A1
72443	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (30.7 x 5.8m). Considered as part of the existing East Anglia ONE ES.	Height 0.7m, well preserved with visible structural detail although partially buried, no visible superstructure, magnetic anomaly indicating strong metallic component.	A1
72455	Wreck, probably the steamship *Dagmar*, recorded by the UKHO and seen in geophysical data (72.7 x 16.8m). Considered as part of the existing East Anglia ONE ES.	Height 4.3m, upright and well preserved, leaning to one side and intact hull, very large magnetic anomaly indicating metallic hull and possible iron ballast.	A1
72471	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (53.5 x 17.1m). Considered as part of the existing East Anglia ONE ES.	Height 2.6m, partially buried and partially dispersed although some intact structure visible, debris field 22.4 x 19.6m, magnetic anomaly indicating strong metallic component.	A1

WA ID	Receptor Summary		Archaeological Receptor Category
72474	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (57.3 x 13.8m). Considered as part of the existing East Anglia ONE ES.	Height 3.4m, upright and well preserved although superstructure not fully intact, partially buried, magnetic anomaly indicating metallic component.	A1
72482	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (14.1 x 13.0m). Considered as part of the existing East Anglia ONE ES.	Height 1.2m, very small intact hull with some upstanding structure partially buried and surrounded by sparse debris field, magnetic anomaly indicating metallic component.	A1
72490	Unknown charted obstruction, possibly a wreck, recorded by the UKHO and seen in geophysical data (22.2 x 8.7m). Considered as part of the existing East Anglia ONE ES.	Height 0.6m, no clear structure and almost totally buried, no magnetic anomaly.	A1
72492	Wreck, possibly the steamship *Friargate*, recorded by the UKHO and seen in geophysical data (46.5 x 8.4m). Considered as part of the existing East Anglia ONE ES.	Height 3.1m, intact hull but little visible structural detail, magnetic anomaly indicating metallic component.	A1
72497	Wreck of an unknown vessel recorded by the UKHO and seen in geophysical data (97.0 x 36.0m). Considered as part of the existing East Anglia ONE ES.	Height 4.9m, appears dispersed with no clear hull shape visible, magnetic anomaly indicating strong metallic component.	A1
72506	Wreck of the steamship *Carica Milica* recorded by the UKHO and seen in geophysical data (153.0 x 105.0m). Considered as part of the existing East Anglia ONE ES.	Height 5.7m, broken up with no clear hull visible, partial burial, debris visible a short distance from the wreck, large magnetic anomaly indicating a metallic hull.	A1
72606	Wreck of an unknown and uncharted vessel seen in geophysical data (7.6 x 17.1m). Considered as part of the existing East Anglia ONE ES.	Height 0.2m, sub-oval shaped spread associated with magnetic anomaly indicating metallic component, buried wreck or significant concentration of ferrous debris.	A1
72651	Wreck of an unknown and uncharted vessel seen in geophysical data (83.7 x 32.1m). Considered as part of the existing East Anglia ONE ES.	Height 2.0m, broken up slightly dispersed and partially buried, magnetic anomaly indicating metallic component.	A1

WA ID	Receptor Summary		Archaeological Receptor Category
72665	Wreck of an unknown and uncharted vessel seen in geophysical data (17.0 x 8.3m). Considered as part of the existing East Anglia ONE ES.	Height 1.3m, partially buried with small associated magnetic anomaly, small uncharted wreck or large articulated piece of debris.	A1
72790	Possible wreck of an unknown and uncharted vessel seen in geophysical data (19.3 x 7.0m). Considered as part of the existing East Anglia ONE ES.	Small, poorly defined contact without height and without associated magnetic anomaly, possibly a mostly-buried, non-ferrous wreck.	A1
72826	Possible wreck of an unknown and uncharted vessel seen in geophysical data (47.0 x 24.9m). Considered as part of the existing East Anglia ONE ES.	Height 2.6m, large scatter of debris without associated magnetic anomaly, possibly a badly degraded, non-ferrrous wreck.	A1
72827	Wreck of an unknown and uncharted vessel seen in geophysical data (20.3 x 8.0m). Considered as part of the existing East Anglia ONE ES.	Height 0.4m, sub-rectangular anomaly appearing structural with small associated magnetic anomaly.	A1
72958	Wreck of an unknown and uncharted vessel seen in geophysical data (32.0 x 9.0m). Considered as part of the existing East Anglia ONE ES.	Height 0.5m, elliptical shape with suggested structure, mostly buried.	A1
72999	Wreck of the minesweeper HMS *Ludlow* recorded by the UKHO and seen in geophysical data (60.1 x 30.2m). Considered as part of the existing East Anglia ONE ES.	Height 3.0m, partially broken up with some intact structure, partially buried, numerous strong magnetic anomalies.	A1
73073	Wreck of the sailing barge *Sunbeam* recorded by the UKHO and seen in geophysical data (11.9 x 8.6m). Considered as part of the existing East Anglia ONE ES.	Height 3.3m, wreck obscured by shadow, little visible detail and associated debris field, magnetic anomaly indicating metallic component.	A1
73078	Wreck of the light cruiser HMS *Arethusa* recorded by the UKHO and seen in geophysical data (140.5 x 32.4m). Considered as part of the existing East Anglia ONE ES.	Height 5.2m, upright and partially broken in two, associated debris field, magnetic anomaly indicating strong metallic component.	A1

WA ID	Receptor Summary		Archaeological Receptor Category
73205	Unknown wreck recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Last seen in 1973 when rocky pinnacles were located by survey. The record was reclassified as a rock and the record amended to dead.	A3
73206	Wreck of *Bradwell* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Entire wreck recorded by the UKHO. In 1921 the wreck was reported as dispersed level with the ground and deleted.	A3
73207	Unknown wreck recorded as dead by the UKHO and not seen in geophysical data. Possibly associated with debris field WA72767. Considered as part of the existing East Anglia ONE ES.	Notable debris recorded by the UKHO described as a small metallic object. Nothing found during survey in 1985 and amended to dead.	A3
73208	Unknown wreck recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Wreck reported at this location in 1916 but nothing was found during surveys in 1965 and 1985. The record was amended to dead.	A3
73209	Unknown wreck recorded as live by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Entire wreck first recorded by the UKHO in 1965. Ferrous material considered to be a wreck within a sandwave was reported in 1977. The wreck was last seen as a ridge during survey in 1985 and is probably buried within a sandwave	A3
73217	Wreck of the steamship *Rubio* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	The wreck was dispersed in 1918. Nothing has been found at this location during subsequent surveys and the record has been amended to dead. A magnetic anomaly may be associated with this wreck (WA72485).	A3
73220	Loss location of the steam tug *Numitor* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Location has never been verified by survey and it is possible that no remains are present.	A3
73221	Loss location of the steamship *Gannet* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Location has never been verified by survey and it is possible that no remains are present.	A3

WA ID	Receptor Summary		Archaeological Receptor Category
73223	Loss location of the steamship *Lonada* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Location has never been verified by survey and it is possible that no remains are present.	A3
73228	Debris recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Anchor and 6 shackles slipped by motor vessel *Foka Gas I* in an emergency situation in 1991. Not located in 1995 and amended to dead.	A3
73242	Loss location of the *Dominion* recorded as dead by the UKHO and not seen in geophysical data. Considered as part of the existing East Anglia ONE ES.	Wreckage presumed to form part of the wreckage of HMS *Arethusa* (WA73078).	A3
78160	Wreck of an unknown vessel recorded by the UKHO but not seen in geophysical data (UKHO Dead Wreck)	The record of an unidentified wreck, first detected in 1969. The initial survey data of the wreck indicated the presence of notable debris in this area, represented by a good sonar contact, considered to represent a small piece of wreckage lying under a ridge.	A3

92. The known wrecks discussed above relate to those located within the 2012 Survey Area alone. For the remaining area of the East Anglia THREE offshore cable corridor, data assessed as part of the East Anglia ONE ES has been reviewed. As part of the East Anglia ONE ES (East Anglia ONE 2012), a further 70 known wrecks were identified within the East Anglia ONE offshore cable corridor study area. Of these maritime sites, 27 A1 receptors and 26 A3 receptors are located within the East Anglia THREE offshore cable corridor area not covered by the 2012 geophysical survey area. Details relating to these 53 wrecks are included in the East Anglia ONE ES. They are illustrated in *Figure 17.24* and their details are summarised in *Table 17.17*. These wrecks are categorised in *Table 17.17* as A1 receptors or A3 receptors. As they are considered as part of the existing East Anglia ONE ES, these maritime sites have already been mitigated for and are not considered as part of the impact assessment assessed in this ES.

17.5.2.4 Additional Anomalies in the Study Area

93. An additional 400 anomalies and 1876 anomalies were identified in the East Anglia THREE site and the Export and Interconnector cable corridor respectively that are of uncertain origin and may be of archaeological interest (classified as A2). These anomalies are ambiguous and will require further investigation before a natural or anthropogenic origin could be determined. The locations of these anomalies are displayed in *Figures 17.15, 17.16* and *17.17*. It is worth noting that although represented by a 'dot' on the figure, some anomalies (i.e. debris fields and rope / chains) cover a large area of sea bed. Two of these anomalies represent charted obstructions recorded by the UKHO, both of which are classified as live (WA 71018 and WA 71019). Further details of the anomalies within the Study Area can be found in *Appendix 17.2,* section 1.2. The anomalies are summarised in *Table 17.18.*

94. Of the 1876 anomalies within the offshore Export and Interconnector cable corridor, 1413 were identified and assessed as part of the East Anglia ONE ES (East Anglia ONE 2012), and more details regarding these anomalies could be found therein. The remaining 463 were identified as part of the archaeological assessment of the geophysical data within the 2012 survey area and are detailed in *Volume 3, Appendix 17.2,* section 1.2. All anomalies identified within the offshore cable corridor are summarised in *Table 17.18.*

Table 17.18 Number of Anomalies Presented by Classification

Anomaly Classification	Number of Anomalies: East Anglia THREE site	Number of Anomalies: Offshore Cable Corridor	Anomaly Classification Description
Debris	70	144	Objects on the sea bed regarded as exhibiting anthropogenic appearance and characteristics due to their height or because they are considered to represent some form of structure.
Debris Field	27	42	Groups of objects of anthropogenic origin on the sea bed which generally have height or which indicate the presence of structure.
Bright Reflector	1	13	Areas of low reflectivity, as seen on sidescan sonar data. They indicate areas where little or no acoustic energy is returned and can be characteristic of material that absorbs the acoustic energy such as waterlogged wood.
Dark Reflector	72	647	Areas of high reflectivity as seen on sidescan sonar data.
Rope / Chain	7	15	Objects on the sea bed which are usually linear. They are clearly of anthropogenic origin as their form is distinctive.
Sea floor Disturbance	4	57	Sea floor disturbances may indicate the presence of a buried or partially buried wreck, or debris of archaeological interest.
Magnetic Anomaly	217	908	Anomalies with a magnetic signature, signifying the presence of metallic remains.
Mound	2	2	Features visible on bathymetric data which exhibit height and are not considered to represent a natural feature. Mounds may form over wrecks or other debris, either on the sea floor or partially buried.
Linear	0	48	Features generally noted as dark reflectors, seen as areas of high reflectivity. They may be objects with or without height and may have hard edges or be diffuse.
Total	**400**	**1876**	

95. *Figure 17.25* provides an example of anomalies identified within the Study Area which represent a variety of the anomaly classifications listed in *Table 17.18* above (debris, debris field, bright reflectors, dark reflectors, rope / chain and seafloor disturbance).

96. It is possible that any of the above anomalies may be associated with material of a maritime origin, although the potential for such anomalies to represent material associated with crashed aircraft must also not be discounted (see section 17.5.3).

17.5.2.5 Documented Losses

97. Records of documented losses (historical accounts of vessels lost at sea) provide an indication on the type and number of wrecks that may be present within an area. Documented losses are not currently associated with tangible remains on the sea bed. Further information relating to the nature of this source could be found in *Appendix 17.1*.

98. As the East Anglia THREE site is located beyond the remit of the NRHE (12 nautical mile limit of UK territorial waters), there are no Named Locations (NLOs) within or near to the East Anglia THREE site. This does not mean that loss events did not occur within the East Anglia THREE site; only that NRHE records for this area are not available.

99. Within the offshore cable corridor there are 88 records at four NLOs represented by GIS polygons at arbitrary points on the sea bed (*Figure 17.12*). These have been collated into a gazetteer (*Appendix 17.3,* section 1.1) and have retained their original NRHE identification number to aid cross-referencing. These locations do not (except by chance) relate to actual wreck remains.

100. The significance of these documented losses is considered as part of the discussion on potential maritime receptors, summarised below and evaluated in detail in *Appendix 17.1*.

17.5.2.6 Potential Maritime Receptors

101. The potential for further wrecks to be discovered within both the East Anglia THREE site (i.e. currently represented as an unidentified geophysical anomaly of anthropogenic origin) and offshore cable corridor is discussed in *Appendix 17.*1 and illustrated in *Figure 17.12*.

102. There is potential for the presence of archaeological material of a maritime nature spanning from the Mesolithic period to the present day within the East Anglia THREE site and offshore cable corridor. The key areas of potential are summarised in *Table 17.19*.

Table 17.19 Summary of Key Areas of Maritime Potential

Period	Summary
Pre-1508AD	Potential for material associated with prehistoric maritime activities. Prehistoric maritime activities include coastal travel, fishing and the exploitation of other marine and coastal resources. Vessels of this period include rafts, hide covered watercraft and log boats. Such remains, if present, are likely to be concealed and protected by the extensive Holocene alluvium associated with the fairly rapid post-Devensian rise in sea level.
	Potential for material associated with later prehistoric maritime activities, including watercraft suitable for cross channel voyages to facilitate trade and the exploitation of deep water resources. Such remains are likely to comprise larger boat types, including those representing new technologies such as the Bronze Age sewn plank boats which are associated with a growing scale of seafaring activities.
	Potential for material of Romano-British date, associated with the expansion and diversification of trade with the Continent. Watercraft of this period, where present, may be representative of a distinct shipbuilding tradition known as 'Romano-Celtic' shipbuilding, often considered to represent a fusion of Roman and northern European methods.
	Potential for material associated with coastal and seafaring activity in the 'Dark Ages', associated with the renewed expansion of trade routes and Germanic and Norse invasion and migration. Vessels of this period may be representative of new shipbuilding traditions such as the technique.
	Potential for material associated with medieval maritime activity, including that associated with increasing trade between the UK and Europe, the development of established ports around the southern North Sea and the expansion of fishing fleets and the herring industry. Vessels of this period are representative of a shipbuilding industry which encompassed a wide range of vessel types (comprising both larger ships and vernacular boats). Such wrecks may also be representative of new technologies (e.g. The use of flush-laid strakes in construction), developments in propulsion, the development of reliable navigation techniques and the use of ordnance.
1509 to 1815AD	Increasing potential for post-Medieval shipwrecks representative of continuing technological advances in the construction, fitting and arming of ships, and in navigation, sailing and steering techniques. Vessels of this period continued to variously represent both the clinker techniques and construction utilising the flush-laid strakes technique.
	Increasing potential for post-Medieval shipwrecks associated with the expansion of transoceanic communications and the opening up of the New World.
	Increasing potential for post-Medieval shipwrecks associated with the establishment of the Royal Navy during the Tudor period and the increasing scale of battles at sea, such as those of the Anglo-Dutch wars (particularly those fought off the East Anglian coast).
	Increasing potential for post-Medieval shipwrecks associated with continuing local trade and marine exploitation including the transport of goods

Period	Summary
	associated with the agricultural revolution.
1816 to 1913AD	Increasing potential for the discovery of shipwrecks associated with the introduction of iron and later steel in shipbuilding techniques. Such vessels may also be representative of other fundamental changes associated with the industrial revolution, particularly with regards to propulsion and the emergence of steam propulsion and the increasing use of paddle and screw propelled vessels
	Potential for the discovery of shipwrecks demonstrating a diverse array of vernacular boat types evolved for use in specific environments
	Potential for wrecks associated with large scale worldwide trade, the fishing industry or coastal maritime activity including marine exploitation
1914 to 1945AD	Potential for the discovery of shipwrecks associated with the two world wars including both naval vessels and merchant ships. Wrecks of this period may also be associated with the increased shipping responding to the demand to fulfil military requirements. A large number of vessels dating to this period were lost as a result of enemy action.
Post 1946	Potential for wrecks associated with a wide range of maritime activities, including military, commerce, fishing and leisure. Although ships and boats of this period are more numerous, loses decline due to increased safety coupled with the absence of any major hostilities. Vessels dating to this period are predominantly lost as a result of any number of isolated or interrelated factors including human error, adverse weather conditions, collision with other vessels or navigational hazards or mechanical faults.

17.5.3 Aviation

17.5.3.1 Introduction

103. Since the advent of powered human flight in the early 20th century, thousands of military and civilian aircraft have been lost around the UK. Aircraft remains at sea thus span the entire period of aviation history, from the introduction of flight to the post-WWII period. They are not only regarded as having significance for remembrance and commemoration, they are also regarded as having an implicit cultural value as historic artefacts, providing information on the aircraft itself and also the circumstances of its loss (English Heritage 2002). All aircraft that crashed while in military service are automatically protected under the *Protection of Military Remains Act 1986*.

104. Although records of aircraft losses are extensive, data regarding their location is limited. Correspondingly, while the potential resource for aircraft crash sites is large, to date aircraft crash sites which are known and charted are by comparison relatively few.

17.5.3.2 Known Aviation Receptors: The East Anglia THREE site and the Offshore Cable Corridor

105. There are no known aircraft remains recorded in the East Anglia THREE site. There is one charted aircraft crash site some 140m south of the offshore cable corridor boundary (*Figure 17.24*) that was assessed as part of the East Anglia ONE ES (East Anglia ONE 2012). This record comprises the recorded location of the remains of a Piper Comanche aircraft (73231), lost in March 1971. The recorded location of this aircraft remains is based on the reported loss location of the aircraft. This recorded location was within the geophysical survey area assessed as part of East Anglia ONE. However, to date, no remains have been identified in this charted location. This record represents an A3 receptor and was not considered to pose a statutory constraint upon the proposed project.

106. Of the geophysical anomalies observed within the Study Area, none have been conclusively identified as representing aircraft remains. However, with the exception of those identified as possible rope / chain, it is possible that any of the remaining 393 anomalies within the East Anglia THREE site and 1861 anomalies within the offshore cable corridor may represent material associated with crashed aircraft. Should the remains of the Piper Comanche aircraft be confirmed within offshore cable corridor or the presence of hitherto unknown aircraft remains, they may pose statutory constraints upon development. All aircraft lost whilst in military service are afforded automatic protection under the *Protection of Military Remains*

Act 1986. Civilian aircraft may also be designated due to the relative paucity of known aircraft remains in the archaeological record.

17.5.3.3 Documented Losses

107. Records of documented losses (historical accounts of aircraft lost at sea) provide an indication on the type and number of aircraft that may be present within an area. Documented losses are not currently associated with tangible remains on the sea bed. As the remit of the NRHE only extends to the 12 nautical mile limit of UK territorial waters, there are no documented aircraft losses recorded in the East Anglia THREE site. This does not mean that loss events did not occur within the East Anglia THREE site; only that NRHE records for this area are not available.

108. There are 12 aircraft losses recorded in the offshore cable corridor, located at one arbitrary location (*Volume 2, Figure 17.12*). Each of these aircraft represents WWII losses, dating between 1940 and 1945. They comprise 11 British aircraft (seven fighters, two bombers and two fighter bombers) and one German bomber.

109. It is possible that the physical remains of these aircraft, and others that are undocumented, lie within the East Anglia THREE site and the offshore cable corridor. Aircraft remains may be currently represented as an unidentified geophysical anomaly of anthropogenic origin or may not currently be visible in geophysical survey data as a result of being buried or fragmentary. This potential is summarised below and evaluated in full in *Volume 3, Appendix 17.1*.

17.5.3.4 Potential Aviation Receptors

110. The survivability and identification of aircraft remains is variable and depends on a number of factors. These factors are not yet fully understood, although the nature of loss and marine environment undoubtedly play a key role (see *Volume 3, Appendix 17.1*).

111. The key areas of potential are summarised in *Table 17.20*.

Table 17.20 Summary of Key Areas of Aviation Potential

Period	Summary
Pre-1939	Minimum potential for material associated with the early development of aircraft. Aircraft of this period may represent early construction techniques (e.g. those constructed of canvas covered wooden frames) or may be associated with the mass-production of fixed wing aircraft in large numbers during WWI.
	Minimum potential for material associated with the development of civil aviation during the 1920s and 1930s, associated with the expansion of civilian flight from the UK to a number of European and worldwide destinations.
1939 to 1945	Very high potential for WWII aviation remains, particularly as the East Anglian region acted as a hub for hostile activity. Aircraft of this period are likely to be representative of technological innovations propelled by the necessities of war which extended the reliability and range of aircraft. This potential is signified by the recorded location of WWII Air / Sea Rescue operations within East Anglia THREE and offshore cable corridor (*Volume 2, Figure 17.12*), a potential which is explained in greater detail in *Volume 3, Appendix 17.1*.
Post-1945	Potential for aviation remains associated with military activities dominated by the Cold War, the evolution of commercial travel and recreational flying and the intensification of offshore industry (including helicopter remains). Aircraft of this period may be representative of advances in aerospace engineering and the development of the jet engine.

17.5.4 England's Historic Seascapes

17.5.4.1 Introduction

112. HSC maps an understanding of the cultural processes that have shaped the present landscape in coastal and marine areas and forms part of a national HSC programme commissioned by English Heritage. The whole of offshore cable corridor and the majority of the East Anglia THREE site (save the northern-most extent) fall within the Newport to Clacton HSC (Oxford Archaeology 2011).

113. The project addresses the multi-level character of the sea by splitting the marine zone into four tiered levels; the sea surface, the water column, the sea floor and the sub-sea floor. The characterisation is GIS-based, enabling key characteristics of the Study Area to be identified and summarised below.

114. The known and potential prehistoric, maritime and aviation receptors that form part of the Historic Seascape Character has been discussed in the relevant baseline characterisations above. The character descriptions below refer only to the cultural processes which have shaped the historic seascape of the Study Area.

17.5.4.2 Historic Seascape Characterisation

115. The primary cultural processes which characterise the East Anglia THREE site are shown in *Table 17.21*.

Table 17.21 HSC: Primary Cultural Processes in the East Anglia THREE site

Present Broad Character Types	Present Character Sub-Types
Fishing	Fishing Ground
Navigation	Navigation Activity: Navigation Route
	Navigation Activity: Ferry Crossing
Industry	Shipping Industry: Commercial Shipping Route

116. *Table 17.22* illustrates the character sub-types present within the East Anglia THREE site according to the four tiered levels assessed as part of the HSC project.

Table 17.22 HSC: Character Sub-Types by Level in the East Anglia THREE site

Broad Character Types	Levels			
	Sea Surface	**Water Column**	**Sea Floor**	**Sub-Sea Floor**
Fishing	Fishing Ground	Longlining	Bottom Trawling	-
		Bottom Trawling		
Navigation	Navigation Route	Navigation Route	-	-
	Ferry Crossing			
Industry	Commercial Shipping Route	Ferry Crossing	-	-
Other	-	-	Fine Sediment Plains	Palaeolandscape Component
			Shoals and Flats	

117. Previous Character Sub-Types within the East Anglia THREE site are WWII Defence Area and Palaeolandscape component.

118. The primary cultural processes which characterise offshore cable corridor are shown in *Table 17.23*.

Table 17.23 HSC: Primary Cultural Processes in the Offshore Cable Corridor

Present Broad Character Types	Present Character Sub-Types
Industry	Shipping Industry: Commercial Shipping Route
Navigation	Navigation activity: Ferry Crossing
	Navigation activity: Navigation Route
	Navigation Hazard: Hazardous Water
	Navigation Hazard: Water Turbulence
	Maritime Safety: Buoyage
Fishing	Fishing Ground
	Demersal Trawling
	Longlining
	Potting
	Drift Netting
	Pelagic Trawling
Recreation	Leisure Fishing
	Leisure Sailing

119. *Table 17.24* illustrates the character sub-types present within the offshore cable corridor according to the four tiered levels assessed as part of the HSC project.

Table 17.24 HSC: Character Sub-Types by Level in the Offshore Cable Corridor

Broad Character Types	Levels			
	Sea Surface	**Water Column**	**Sea Floor**	**Sub-Sea Floor**
Industry	Commercial Shipping Route	-	-	-
Navigation	Ferry Crossing	Ferry Crossing	Navigation Channel (Active)	-
	Navigation Route	Navigation Route		
	Hazardous Water	Hazardous Water		
	Water Turbulence	Water Turbulence	Wreck Hazard	
	Buoyage	Buoyage		
		Harbour Pool		
		Navigation Channel (Active)		
Fishing	Fishing Ground	Demersal Trawling	Demersal Trawling	-
	Demersal Trawling			
	Longlining	Longlining		
	Potting	Potting	Bottom Trawling	
	Drift Netting	Drift Netting		
	Pelagic Trawling	Pelagic Trawling		
		Bottom Trawling		

Broad Character Types	Levels			
	Sea Surface	**Water Column**	**Sea Floor**	**Sub-Sea Floor**
Recreation	Leisure Fishing	Leisure Fishing	-	-
	Leisure Sailing			
Other	-	-	Submarine Telecommunications Cable	Submarine Telecommunications Cable
			Hydrocarbon Pipeline	Hydrocarbon Pipeline
			Ordnance Dumping	Mud Plains
			Mixed Sediment Plains	Sand Banks with Sand Waves
			Coarse Sediment Plains	
			Mud Plains	Palaeolandscape Component
			Fine Sediment Plains	
			Sand Banks with Sand Waves	Palaeochannel
			Shoals and Flats	

120. Previous Character Sub-Types within the offshore cable corridor are WWII Defence Area, Naval Battlefield, Palaeolandscape component and Palaeochannel.

121. As part of the Newport to Clacton HSC project, Oxford Archaeology (2011) assessed the values and perceptions associated with the identified character types. Such values with regards to the Character Types identified within the Study Area are summarised in the following paragraphs.

122. **Navigation Activity**: Navigation Activity has always been important to the East Anglian region economy and coastal character. For centuries communities have made their living from their proximity to the North Sea and its connecting routes, linking East Anglia to other parts of Britain and to the continent. Navigation activities are deeply ingrained in the psyche of the local communities. The Navigation Activity Character Type is present both within the East Anglia THREE site and offshore cable corridor. Navigation Activity across the East Anglia THREE site as recorded in the Newport to Clacton HSC project (Oxford Archaeology 2011) comprises ferry crossings (Harwich-Esbjerg Ferry and Hull-Rotterdam Ferry) and navigation routes. Navigation Activity across the offshore cable corridor as recorded in the Newport to Clacton HSC project comprises ferry crossings (Hull-Rotterdam Ferry, Rosyth-Zebrugge Ferry, Harwich-Esbjerg Ferry and Kingston-upon-Hull-Zeebrugge Ferry) and navigation routes (see Chapter 15 Shipping and Navigation).

123. **Navigation Hazards**: Navigation Hazards are often prominent in the consciousness of coastal communities as a result of the loss of lives they can cause. The fact that all the sandbanks in the wider area are named and the names well-known locally illustrates their significance in people's perceptions. These features are also known for other reasons including the presence of battles. Shipwrecks also provoke strong feeling among the maritime community and within the general public. Navigation Hazards within the Study Area are confined to the shoreward extent of offshore cable corridor and comprise wreck hazards and sand waves.

124. **Maritime Safety**: Maritime safety features are considered both invaluable and locally characteristic of this area, although those wholly offshore will only be known to small sectors of the community. The coastal landscape is dotted with daymarks and lighthouses which are now seen as particularly iconic. Maritime safety features within the Study Area are confined to the shoreward extent of offshore cable corridor and comprise buoyage and the Sledway Channel.

125. **Shipping Industry**: The traditional hubs of the shipping industry (e.g. Ipswich) provide an important sense of place for the local community and an important economic resource. Awareness of the importance of the medieval and post-

medieval ship building industry for the area provides an important sense of historical identity. Shipping Industry forms part of the primary character of both the East Anglia THREE site and the northernmost extent of offshore cable corridor (in the form of commercial shipping routes). Further information on this is presented in Chapter 15 Shipping and Navigation.

126. **Fishing**: Commercial fishing has long been important to the region and the industry remains a distinctive element of the East Anglian coastal character. Fishing forms part of the primary character of both the East Anglia THREE site and the central and shoreward extent of offshore cable corridor. Fishing in the East Anglia THREE site is summarised as comprising fishing grounds associated with longlining. Conversely, fishing activities within offshore cable corridor include drift netting, pelagic trawling, potting, longlining, demersal trawling and fishing grounds. Further information on this is presented in Chapter 14 Commercial Fisheries.

127. **Recreation**: Recreation is crucial to the coastal region in East Anglia, particularly from an economic perspective. Recreation comprises a character type observed within the shoreward extent of offshore cable corridor, and comprises recreational sailing and recreational fishing. Further information on this is presented in Chapter 15 Shipping and Navigation.

128. The results of the Newport to Clacton HSC (Oxford Archaeology 2011) thus suggest that the primary historic character value of the East Anglia THREE site could be summarised as being associated with fishing, navigation activity and the shipping industry, with previous character sub-types associated with palaeolandscapes and WWII defences.

129. The HSC project (Oxford Archaeology 2011) suggests that the primary historic character value of offshore cable corridor could be summarised as being associated with fishing, navigation activity, navigation hazard, maritime safety, shipping industry and recreation, with previous character sub-types associated with palaeolandscapes, palaeochannels, naval battlefields and WWII defences.

17.5.5 Archaeological Receptor Value

130. There are 39 palaeogeographic receptors of probable archaeological interest (P1) and a further 98 receptors of possible archaeological interest (P2) within the Study Area. The value of these features in archaeological, palaeogeographical and palaeoenvironmental terms is difficult to define without specific geoarchaeological assessment; in general, the value for prehistoric receptors is outlined in *Table 17.25.*

Table 17.25 Value of Prehistory Receptors

Receptor	Definition	Value
Potential in situ Prehistoric sites	Primary context features and associated artefacts and their physical setting (if found)	High
	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	Medium
Potential derived Prehistoric finds	Isolated discoveries of Prehistoric archaeological material discovered within secondary contexts	Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material	Low

131. On the basis of their age and rarity in a marine context, all in situ Palaeolithic and Mesolithic material will be of high archaeological value. The guidance on *Identifying and Protecting Palaeolithic Remains for planning authorities and developers* (English Heritage 1998) notes that sites containing certain forms of Palaeolithic material are so rare in Britain that they should, whenever possible, remain undisturbed.

132. In the event that prehistoric archaeological material discovered offshore is found in situ it should be considered of particularly high archaeological importance. As such, the features and deposits which have the potential to contain within them in situ material should be considered as high value receptors.

133. Prehistoric archaeological material discovered within secondary contexts also has the potential to provide valuable information on patterns of human land use and demography in a field of study which is still little understood and rapidly evolving (Hosfield and Chambers 2004). They are, however, by their very nature derived and, as such, isolated prehistoric finds should be regarded as medium value receptors.

134. Palaeoenvironmental evidence in the context of an in situ prehistoric site (if found) will be of high value. However, as there are no known prehistoric sites within the Study Areas, isolated discoveries of palaeoenvironmental material should be considered of low value for the purpose of impact assessment. Although the scientific potential of this material, in association with the assessment of palaeogeographic features and palaeolandscapes is high, its sensitivity as a heritage asset in itself is low.

135. There are 55 known wrecks within the Study Area. The potential also exists for previously unknown wreck sites or wreck-related material to exist within the Study Areas. The values assigned to these receptors are outlined in *Table 17.26*.

Table 17.26 Value of Maritime Receptors

Receptor	Definition		Value
Known Wrecks	Named wrecks identified in geophysical assessment	Designated Wrecks: HMS *Fitzroy* (WA 71012)	High
		Wrecks in active service at their time of loss: *Tergestea* (WA72437), HMS *Ludlow* (WA72999) and HMS *Arethusa* (WA73078)	High
		Average vessel examples, wrecks with surviving structural components: *Grenadier* (WA72389), *Petshenga* (WA72390), *Disa* (WA72410), *Brixton* (WA72439), *Dagmar* (WA72455), *Friargate* (WA72492) and *Sunbeam* (WA73073)	Medium
		Average vessel examples, wrecks with limited surviving structural components: *Carica Milica* (WA72506)	Low
	Unidentified wrecks identified in geophysical assessment (WA 70523, 70611, 70616, 70619, 70620, 70621, 72360, 72443, 72471, 72474, 72482, 72497, 72606, 72651, 72665, 72790, 72826, 72827, 72958, 78160, 70911, 71008, 71016, 71017, 71020, 76056 and 76145)		Unknown (High)
	Unidentified obstructions identified in geophysical assessment (WA2490)		Unknown (High)
	Named wrecks not identified in geophysical assessment	Wrecks in active service at their time of loss: *Numitor* (WA73220),	High
		Loss locations without substantiated remains recorded as UKHO 'dead' wrecks: *Ryna* (WA 70775), Greenland (WA78163)	Low
		Dispersed or possible buried wrecks not found during repeated surveys: *Bradwell* (WA73206), *Rubio* (WA73217)	Unknown (High)
		Loss locations without substantiated remains recorded as UKHO 'live' wrecks: *Gannet* (WA 73221), *Lonada* (WA73223), *Dominion* (WA73242)	Unknown (High)
	Unidentified wrecks not identified in geophysical assessment (WA 71005, 71013, 71014, 71015, 73205, 73207, 73208 and 73209)		Unknown (High)
	Unidentified obstructions not identified in geophysical assessment (WA73228)		Unknown (High)
Potential Wrecks	Wrecks within the Study Areas 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

136. The value assigned to an individual wreck site is, to a large degree, site specific. A vessel may be considered of special interest on the basis of any number of interrelating integral and relative factors (see discussion on significance criteria methodology in section 17.4). Those regarded as being of special interest may further be designated under the Protection of Wrecks Act 1973 (such as the HMS *Fitzroy*) or the Protection of Military Remains Act 1986.

137. For all unidentified wrecks and obstructions (A1 and A3), there is insufficient data to assess the value of each individual wreck. Therefore, all wreck sites must be considered to have archaeological value, to a greater or lesser degree and, in accordance with the precautionary approach, must be considered as high value receptors.

138. The wrecks identified as being in active service at their time of loss are considered of high value due to their association with the two world wars and the commemorative and historical value of remains. Any vessel that was in active service at time of loss could potentially be protected under the Protection of Military Remains Act 1986.

139. The designated HMS *Fitzroy* (WA71012) is considered to be a high value receptor by virtue of being designated.

140. The late 19th century (*Dagmar* WA72455 and *Grenadier* WA72389) and early 20th century steamship wrecks (*Brixton* WA72439, *Disa* WA72410, *Friargate* WA72492) appear to be average examples of vessel construction with structure surviving. As such, these sites are considered of medium value. Although little is recorded about the wreck of the steamships *Petshenga* (WA72390), including the date of build, this wreck is also considered to be of medium importance.

141. The dispersed spread of material that represents the remains of the steamship *Carica Milica* (WA72506) may be considered of low archaeological value. Vessel has been identified as average example of 20th century construction, which sank without recorded loss of life, and the high levels of dispersal at the site suggest that this type of vessel will be better represented by other wrecks. The *Carica Milica* has not been identified as being a rare vessel type, or the only surviving example. It is possible that further structural remains may be present buried in the sand, although the presence of substantial cohesive remains are considered unlikely.

142. The sailing barge *Sunbeam* (WA73073) is judged to be of medium archaeological value. Although there is minimal information available for this wreck, particularly regarding the vessel's build and use, it appears to be a fairly well preserved, yet average example of a sailing barge lost during the interwar years.

143. Records charted by the UKHO which appear to relate to the recorded loss location of the vessel are considered to represent loss locations only. The absence of remains is considered likely if the presence of a wreck has not been substantiated by survey since the record was created. As such, such records charted as 'dead' by the UKHO are considered of low archaeological value. However, while it is possible that there are no structural remains present at these locations, material may be buried. The value of such records charted as 'live' by the UKHO is unclear. As such, these receptors are considered as high value receptors in accordance with the precautionary approach.

144. As the value of potential wrecks cannot be evaluated until they are discovered, potential wrecks of all periods should be expected to be of high value.

145. Derived artefacts are likely to be of limited archaeological importance as individual discoveries. However, the occurrence of a number of seemingly isolated artefacts within a particular area have the potential to indicate historical shipping routes or maritime battlegrounds, for example, or may indicate the presence of a hitherto unknown wreck site. Isolated maritime finds are, therefore, regarded as medium value receptors.

146. There are no known aircraft recorded within the Study Area. The potential nonetheless exists for hitherto unknown aircraft remains or aircraft-related debris to exist. The values assigned to these receptors are outlined in *Table 17.27.*

Table 17.27 Value of Aviation Receptors

Receptor	Definition	Value
Potential Aircraft	Aircraft within the 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

147. As with maritime receptors, the value of aircraft is largely site specific. The importance of aircraft crash sites is outlined in Military Aircraft Crash Sites (English Heritage 2002). They not only have significance for remembrance and commemoration, but also have an implicit heritage value as historic artefacts, providing information on the aircraft itself and also the circumstances of its use and loss (English Heritage 2002:2). The remains of aircraft lost whilst in military service attain additional significance insofar as they are warranted automatic designation under the Protection of Military Remains Act 1986. On this basis, all potential aircraft sites are considered to be high value receptors.

148. As with isolated maritime finds, the archaeological potential for isolated aircraft finds to provide insight into patterns of historical aviation across the Study Area or to indicate the presence of a recorded but uncharted aircraft crash site should not be disregarded. Nonetheless, as derived finds, isolated aircraft remains should be considered as medium value receptors.

149. The assessment of geophysical data revealed 400 further anomalies of potential anthropogenic origin that cannot be definitively identified.

150. It is currently not clear whether these anomalies are archaeological based on the interpretation of geophysical data, although the precautionary approach is to assume that they are. As their nature and therefore value is unknown, the precautionary approach is to assume that they are of high value. As a result, their significance *may* be over assessed.

17.6 Potential Impacts

151. Impacts to archaeology and cultural heritage in an offshore context could include direct and indirect impacts and changes to historic seascape character.

152. Direct impacts, as stated in the NPS for Renewable Energy Infrastructure (EN-3) (Department of Energy and Climate Change 2011:49) encompass direct effects from the physical siting of the development. Potential direct impacts thus comprise both direct damage to archaeological deposits and material and the disturbance or destruction of relationships between deposits and material and their wider surroundings (i.e. the physical setting of an archaeological receptor). This may include material buried within sea bed deposits and / or material lying on the sea floor. Consequently, all aspects of the proposed East Anglia THREE project which cut through sea bed deposits or make contact with the sea floor have the potential to directly impact archaeological receptors. If an archaeological receptor exhibits height above the sea bed, such as a wreck or crashed aircraft, then any activity above the sea floor may also have the potential to damage or destroy a receptor (*Table 17.26*).

153. Direct impacts to known archaeological receptors (see section 17.5) are not expected to occur as these receptors will be avoided (as set out in section 17.3.3). It is not possible, however, to avoid direct impacts to potential archaeological receptors (see section 17.5) as the locations of such sites are not known. The effect of unavoidable direct impacts to potential receptors would be significant, although agreed measures (see section 17.3.3) to address these impacts, if they should occur, allow such effects to be deemed acceptable.

154. Indirect impacts, as stated in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (Department of Energy and Climate Change 2011:49) encompass indirect changes to the physical marine environment. Potential indirect impacts may occur as a result to changes to the prevailing hydrodynamic and sedimentary regimes caused by the proposed project. The survival of archaeological receptors within the marine environment is dependent upon the chemical, biological and physical processes acting upon them. Any changes to the hydrodynamic regime which alter these processes may impact the survival of archaeological receptors. Alternatively, aspects of the proposed East Anglia THREE project which result in changes to the sedimentary regime may ultimately result in the increased exposure of receptors. Exposure to marine processes may result in the accelerated deterioration of archaeological receptors lying on or extending above the seabed compared with those buried within sea bed sediments, thereby causing a negative effect. Conversely, changes to the sedimentary regime may result in increased sediment cover thus affording additional protection to receptors, thereby causing a positive effect.

155. The effect of indirect impacts from changes to the hydrodynamic and sedimentary regimes which lie outside the range of natural variation would be significant.

156. Impacts to the historic seascape character may occur with the introduction of new elements which cause a change in that character.

17.6.1 Potential Impacts during Construction

157. Under the Single Phase approach the magnitude of effects of unavoidable direct impacts to potential archaeological receptors would be high.

158. Under the Two Phased approach an extra foundation would be required for one offshore platform, three additional platform link cables would be installed and an addition two trenches would be excavated to accommodate interconnector cables. This would slightly increase the magnitude of the impact which would remain as high.

159. As a result of embedded mitigation, direct impacts to known archaeological receptors would not occur, as such, the Single Phase approach and Two Phased approach are considered jointly with respect to Direct and Indirect Impacts below (17.6.1.1 and 17.6.1.2). Irrespective of which phased approach is taken unavoidable direct impacts to potential, unknown archaeological receptors may occur at any point where development and related activities disturb the sea floor.

160. Increased deterioration of, or protection to, known and potential receptors may occur as a result of changes to the hydrodynamic and sedimentary regimes associated with construction activities.

161. Construction activities may also change the character of the historic seascape as a result of the installation of windfarm components, inter-connectors and ancillary structures.

17.6.1.1 Impact 1: Direct Impacts

162. Activities undertaken within the East Anglia THREE site and offshore cable corridor as part of construction works have the potential to directly impact potential archaeological receptors on or under the sea bed resulting in their loss or to disturb relationships between receptors and their wider surroundings.

163. Impacts resulting in these potential effects as part of construction work are:

- Sea bed preparation prior to foundation installation (including the deposition of dredged material, particularly associated with the dynamic phase of the plume – see Chapter 7 Marine Geology, Oceanography and Physical Processes);
- Installation of wind turbine foundations;
- Placing of scour protection around wind turbine foundations;
- Installation of substations, accommodation platforms and collector and converter stations;
- Sea bed preparation prior to cable laying;
- Installation of inter-array, platform link and export cables;
- Installation of cable protection; and
- Sea bed contact by the legs of jack-up vessels and / or anchors of other vessels.

164. All direct impacts to archaeological receptors are permanent. Once archaeological deposits and material, and the relationships between deposits, material and their wider surroundings have been damaged or disturbed, it is not possible to reinstate or reverse those changes. As such, direct impacts to the fabric or physical setting would represent a total loss of a receptor, or part of it, and the character, composition or attributes of the receptor would be fundamentally changed or lost from the site altogether.

165. However, the immediate application of agreed measures to deal with such impacts if they should occur, as set out as embedded mitigation (section 17.3.3) and implemented in accordance with the WSI are expected to adequately address and minimise the effect of such impacts (e.g. *Figures 17.26* and *17.27*).

166. Significant impacts have been evaluated according to defined parameters expressed as a matrix which sets receptor sensitivity against magnitude of effect.

167. The application of embedded mitigation means that all direct impacts to known receptors would be avoided and, hence, significance would be **negligible**.

168. It is not possible to mitigate impacts to potential receptors through avoidance, only to develop measures to offset or remedy the effect of these impacts if they should occur.

169. As high and medium value receptors, the sensitivity of potential in situ prehistoric sites, potential submerged landscape features, potential derived prehistoric finds, potential wrecks, potential derived maritime finds, potential aircraft and potential derived aviation finds is also considered to be high to medium. In the absence of appropriate mitigation, direct impacts upon these receptor types as a result of construction activities would result in a major significance of effect. As a low value receptor, direct impacts upon potential palaeoenvironmental evidence would result in a moderate significance of effect. However, the application of embedded mitigation (section 17.3.3) which incorporates agreed measures to address direct impacts to potential receptors, if they should occur, reduces the significance of the effects of such impacts to acceptable levels. Consequently, where measures are agreed and implemented, the significance of effects of direct impacts upon potential archaeological receptors would be of **minor adverse** significance in accordance with the criteria set out for impact assessment.

17.6.1.2 The information provided by chance discoveries may also be considered to contribute to a greater understanding of the offshore archaeological resource. As such, unavoidable impacts upon potential archaeological receptors and the data and records produced in mitigating their effects may be regarded as a beneficial effect upon the marine historic environment. However, any positive effect must be demonstrated by the completion of studies to professional archaeological standards, and the results produced would be made publicly available.

17.6.1.3 Impact 2: Indirect Impacts

170. Activities undertaken within the Study Area as part of construction works have the potential to alter the prevailing hydrodynamic and sedimentary regimes, resulting in potential indirect impacts upon both known and potential archaeological receptors on or under the sea bed. Such impacts cause effects which afford increased protection to, or deterioration of, archaeological receptors.

171. Impacts resulting in these potential effects as part of construction work are:

- Sea bed preparation and the dumping of spoil at the agreed disposal site;
- Installation of foundations;
- Installation of cables; and
- The deployment of large construction vessels.

172. Changes to the physical baseline environment as a result of the Study Area are assessed as part of Chapter 7 Marine Geology, Oceanography and Physical Processes. Those identified as having an impact upon marine archaeological and cultural heritage receptors are associated with changes in bed levels as a result of component installation associated with the windfarm and the offshore cable corridor. The worst case scenario with respect to the deposited sediment layer is associated with foundation installation during the construction phase associated with a 50m basal diameter gravity base structure in water depths of 45 to 49m. Chapter 7 states that worst case changes to bed levels due to foundation installation are likely to result in effects of low magnitude and are confined to a small area (i.e. near-field). Effects further afield are considered to be of **negligible significance**.

173. On this basis, it could be considered that archaeological and cultural heritage receptors located near-field of installation activities may be subject to minor increased sediment cover. The magnitude of effect is therefore considered to be low.

174. The application of embedded mitigation means that all direct impacts to known receptors would be avoided and, hence, significance would be **negligible**.

175. It is not possible to mitigate impacts to potential receptors through avoidance, only to develop measures to offset or remedy the effect of these impacts if they should occur.

176. As high value receptors, the sensitivity of potential in situ prehistoric sites, potential wrecks and potential aircraft is also considered to be high. In the absence of

appropriate mitigation, indirect impacts upon these receptor types as a result of construction activities would result in a moderate significance of effect. However, the application of embedded mitigation (section 17.3.3) which incorporates agreed measures to address impacts to potential receptors, if they should occur, reduces the significance of the effects of such impacts to effects of **minor adverse/beneficial** significance.

177. As medium value receptors, potential derived prehistoric, potential submerged landscape features and potential derived maritime and aviation finds are considered to have medium sensitivity. As such all indirect impacts to these receptors would result in effects of **minor adverse/beneficial** significance**.**

178. Moreover, as archaeological and cultural heritage receptors subject to greater levels of burial are often afforded higher levels of preservation, it may be considered that in the event of an effect taking place, this may be considered to be beneficial.

179. Information provided by chance discoveries may contribute to a greater understanding of the offshore archaeological resource and is further regarded as beneficial in this respect, assuming that studies are completed to professional archaeological standards and the results produced made publically available.

17.6.1.4 Impact 3: Changes to the historic seascape character

180. A change will occur during construction as a result of activities associated with the installation of the windfarm and associated infrastructure. This change, however, will be temporary and transitory and the activities will cease once the construction phase is complete. This would be the case with either the Single Phase or Two Phased approaches.

17.6.2 Potential Impacts during Operation

181. As a result of embedded mitigation, direct impacts to known archaeological receptors would not occur. Unavoidable direct impacts to potential archaeological receptors may occur at any point at which maintenance activities disturb the sea floor.

182. Increased deterioration of, or protection to, known and potential receptors may occur as a result of changes to the hydrodynamic and sedimentary regimes associated with the presence of the windfarm components and associated infrastructure.

183. The presence of the windfarm may also change the character of the historic seascape.

17.6.2.1 Direct Impacts

184. Activities undertaken within the Study Area as part of maintenance works have the potential to directly impact potential archaeological receptors on or under the sea bed resulting in their loss or to disturb relationships between receptors and their wider surrounding.

185. Impacts resulting in these potential effects during operational phase are:

- Anchors of vessels deployed during periodic overhauls and scheduled and unscheduled maintenance; and
- Use of jack-up crane vessels in the event of wind turbine component, cable or foundation replacement or repair.

186. The magnitude of effects of unavoidable direct impacts to potential archaeological receptors would be high.

187. All direct impacts to archaeological receptors are permanent. Once archaeological deposits and material, and the relationships between deposits and material and their wider surroundings, have been damaged or disturbed it is not possible to reinstate or reverse those changes. As such, direct impacts to the fabric or physical setting would represent a total loss of a receptor, or part of it, and the character, composition or attributes of the receptor would be fundamentally changed or lost from the site altogether.

188. However, the immediate application of agreed measures to deal with such impacts if they should occur, as set out as embedded mitigation (section 17.3.3) and within the WSI are expected to adequately address and minimise the effect of such impacts.

189. Significant impacts have been evaluated according to defined parameters expressed as a matrix which sets receptor value against magnitude of effect.

190. The application of embedded mitigation means that all direct impacts to known receptors would be avoided and, hence, significance would be **negligible**.

191. It is not possible to mitigate impacts to potential receptors through avoidance, only to develop measures to offset or remedy the effect of these impacts if they should occur.

192. As high and medium value receptors, the sensitivity of potential in situ prehistoric sites, potential submerged landscape features, potential derived prehistoric finds, potential wrecks, potential derived maritime finds, potential aircraft and potential derived aviation finds is also considered to be high to medium. In the absence of

appropriate mitigation, direct impacts upon these receptor types as a result of maintenance activities would result in a major significance of effect. As a low value receptor, direct impacts upon potential palaeoenvironmental evidence would result in a moderate significance of effect. However, the application of embedded mitigation (section 17.3.3) which incorporates agreed measures to address direct impacts to potential receptors, if they should occur, reduces the significance of the effects of such impacts to acceptable levels. Consequently, as long as the agreed measures are implemented, the significance of effects of direct impacts upon potential archaeological receptors would be of **minor adverse** significance in accordance with the criteria set out for impact assessment.

193. As discussed in relation to impacts associated with construction activities, unavoidable impacts upon potential archaeological receptors and the data and records produced in mitigating their effects may be regarded as a beneficial effect in contributing towards a greater understanding of the offshore archaeological resource. However, any positive effect must be demonstrated by the completion of studies to professional archaeological standards, and the results produced must be made publicly available.

17.6.2.2 Impact 2: Indirect Impacts

194. The presence of the windfarm array and associated components have the potential to alter the prevailing hydrodynamic and sedimentary regimes of the East Anglia THREE site, resulting in potential indirect impacts upon both known and potential archaeological receptors on or under the sea bed. Such impacts cause effects which afford increased protection to, or deterioration of, archaeological receptors.

195. Impacts resulting in these potential effects during the operational phase are:

- Changes to the tidal regime due to the presence of the foundations;
- Changes to the wave regime due to the presence of the foundations;
- Changes to the sediment transport regime due to the presence of the foundations;
- Introduction of scour effects due to the presence of the foundations; and
- Introduction of scour effects due to the exposure of inter-array cables.

196. Changes to the physical baseline environment as a result of the proposed East Anglia THREE project are assessed as part of Chapter 7 Marine Geology, Oceanography and Physical Processes. Those identified as having an impact upon marine archaeological

and cultural heritage receptors are associated with changes to the sea bed morphology due to the formation of scour pits as a result of the presence of foundation structures. The worst case scenario is considered to be associated with the maximum foundation sizes associated with 12MW wind turbines. Chapter 7 states that changes to sea bed morphology are considered to be of high magnitude near-field. Far-field effects are considered to be negligible. In the absence of scour protection, scour pits may extent a few hundred metres away from each wind turbine location. As such, it follows that the magnitude of this impact upon archaeological and cultural heritage receptors located near-field to such structures will also be of high magnitude as the formation of scour pits has the potential to expose archaeological material and increase the potential for decay and damage to occur to such receptors.

197. Known receptors assessed as part of this review have been afforded archaeological values ranging between Low to High (section 17.6.1), and are therefore considered of Low to High sensitivity respectively. On this basis, indirect impacts arising as a result of scour formation have the potential to result in effects of moderate to major significance. However, the application of embedded mitigation ensures the implementation of buffer zones surrounding known sites thus lowering the likeliness for such an impact to occur. While the potential for scour pits to encroach upon these buffers cannot be discounted, AEZs necessarily incorporate a cautionary buffer which should lower the risk of any such encroachment impacting upon the marine archaeological and cultural heritage receptors themselves. As such, the effects of scour formation upon marine and cultural heritage receptors would be regarded as being of **minor adverse** significance.

198. It is not possible to mitigate impacts to potential receptors through avoidance, only to develop measures to offset or remedy the effect of these impacts if they should occur.

199. As high to low value receptors, the sensitivity of potential in situ prehistoric sites, potential submerged landscape features, potential derived prehistoric finds, potential wrecks, potential derived maritime finds, potential aircraft and potential derived aviation finds and potential palaeoenvironmental evidence is also considered to be high to low respectively (see section 17.6.1). In the absence of appropriate mitigation, the indirect effects of scour formation would result in a moderate to major significance of effect. However, the application of embedded mitigation (section 17.3.3) which incorporates agreed measures to address impacts to potential receptors, if they should occur, reduces the significance of the effects of such impacts to acceptable levels. Consequently, where measures are agreed and

implemented, the significance of effects of these indirect impacts upon potential archaeological receptors would be of **minor adverse** significance.

200. During the detailed engineering stages should it be decided that scour protection be required, effects upon sea bed morphology would be confined to the direct footprint of the scour protection material further reducing this significance. However, this would result in a greater direct impact footprint during the construction phase.

201. Furthermore, information provided by chance discoveries may contribute to a greater understanding of the offshore archaeological resource and is further regarded as beneficial in this respect, assuming that studies are completed to professional archaeological standards and the results produced made publicly available.

17.6.2.3 Impact 3: Changes to the historic seascape character.

202. The presence of the proposed East Anglia THREE project would result in a change to the current historic seascape character of the area to include a character associated with offshore renewables.

17.6.3 Potential Impacts during Decommissioning

203. As a result of embedded mitigation, direct impacts to known archaeological receptors would not occur. However, unavoidable direct impacts to potential archaeological receptors may occur at any point at which decommissioning activities disturb the sea floor.

204. Increased deterioration of, or protection to, known and potential receptors may occur as a result of changes to the hydrodynamic and sedimentary regimes associated with decommissioning activities.

205. Decommissioning activities may also change the character of the historic seascape as a result of the removal of windfarm components and ancillary structures.

17.6.3.1 Impact 1: Direct Impacts

206. Activities undertaken within the Study Area as part of decommissioning works have the potential to directly impact potential archaeological receptors on or under the sea bed resulting in their loss or to disturb relationships between receptors and their wider surrounding.

207. Impacts resulting in these potential effects during decommissioning phase of the windfarm are:

- Removal of cables, foundations, wind turbines, collector stations and converter stations and associated scour protection; and

- Use of jack-up crane vessel and / or anchors of other vessels deployed during decommissioning.

208. The magnitude of effect of direct impacts to archaeological receptors from the removal of foundations, scour protection or cables during decommissioning would be **negligible** if provision is made for methods of removal which minimise further impact to the wider area. It is reasonable to assume that, as a result of construction activities, any potential damage would have already occurred.

209. The magnitude of the effect of new and discrete impacts to potential sites, for example from vessel anchors, would be high. Each impact may affect archaeological material which has not been subject to any damage in the construction phase.

210. However, the immediate application of agreed measures to deal with such impacts if they should occur, as set out as embedded mitigation (section 17.3.3) and within the WSI are expected to adequately address the effect of such impacts.

211. Significant impacts have been evaluated according to defined parameters expressed as a matrix which sets receptor value against magnitude of effect.

212. The application of embedded mitigation means that all direct impacts to known receptors would be avoided and, hence, would be **negligible**.

213. Assuming that provision is made for methods of removal which minimise further impact to a wider area, direct impacts to potential archaeological receptors from the removal of foundations, scour protection or cables during decommissioning would be not significant.

214. As high and medium value receptors, the sensitivity of potential in situ prehistoric sites, potential submerged landscape features, potential derived prehistoric finds, potential wrecks, potential derived maritime finds, potential aircraft and potential derived aviation finds is also considered to be high. In the absence of appropriate mitigation, direct impacts upon these receptor types as a result of the use of jack-up crane vessel and / or anchors of other vessels deployed during decommissioning would result in a major significance of effect. As a low value receptor, direct impacts upon potential palaeoenvironmental evidence would result in a moderate significance of effect. However, the application of embedded mitigation (section 17.3.3) which incorporates agreed measures to address direct impacts to potential receptors, if they should occur, reduces the significance of the effects of such impacts to acceptable levels. Consequently, as long as the agreed measures are implemented, the significance of effects of direct impacts upon potential

archaeological receptors would be of **minor adverse** significance in accordance with the criteria set out for impact assessment.

215. As discussed in relation to direct impacts associated with construction and maintenance activities above, unavoidable impacts upon potential archaeological receptors and the data and records produced in mitigating their effects may be regarded as a beneficial effect in contributing towards a greater understanding of the offshore archaeological resource. However, any positive effect must be demonstrated by the completion of studies to professional archaeological standards, and the results produced must be made publicly available.

17.6.3.2 Impact 2: Indirect Impacts

216. Decommissioning activities have the potential to alter the prevailing hydrodynamic and sedimentary regimes within the Study Area, resulting in potential indirect impacts upon both known and potential archaeological receptors on or under the sea bed. Such impacts cause effects which afford increased protection to, or deterioration of, archaeological receptors.

217. Impacts resulting in these potential effects as part of decommissioning works are:

- New changes to hydrodynamic and sedimentary regimes resulting from the removal of foundations, cables, wind turbines, collector stations and converter stations and associated scour protection; and
- The deployment of large vessels during decommissioning.

218. Changes to the physical baseline environment as a result of the decommissioning phase of the proposed East Anglia THREE project are assessed as part of Chapter 7 Marine Geology, Oceanography and Physical Processes. Those identified as having an impact upon marine archaeological and cultural heritage receptors are comparable with the indirect impacts identified as part of the construction phase and are therefore associated with near-field changes in bed levels as a result of component removal associated with the windfarm and the offshore cable corridor.

219. The significance of these effects is thus considered to be no greater that that identified as part of the construction phase. As such, due to the application of embedded mitigation, all indirect impacts to known and potential receptors would be **negligible** and of **minor adverse** significance respectively.

220. Moreover, as archaeological and cultural heritage receptors subject to greater levels of burial are often afforded higher levels of preservation, it may be considered that in the event of an effect taking place, this may be considered to be beneficial.

221. Information provided by chance discoveries may contribute to a greater understanding of the offshore archaeological resource and is further regarded as beneficial in this respect, assuming that studies are completed to professional archaeological standards and the results produced made publically available.

17.6.3.3 Impact 3: Changes to the historic seascape character.

222. A change will occur with the decommissioning of the windfarm with the removal of the windfarm; wind turbines and associated infrastructure, resulting in further change to the character, reminiscent of the pre-windfarm character.

17.7 Cumulative Impacts

223. As defined for the purposes of this impact assessment, cumulative impacts are those which arise from the interaction of the proposed East Anglia THREE project with other known plans or projects (*Table 17.28*, *Table 17.29*). Other known plans or projects considered as part of this CIA are as follows:

- East Anglia ONE Offshore Windfarm;
- Greater Gabbard Offshore Windfarm;
- Galloper Offshore Windfarm; and
- Marine Aggregates Extraction (licence areas in the vicinity of the offshore cable corridor), including;
    - Area 430 (Licenced Aggregates Area - Cemex UK Marine Ltd., Lafarge Tarmac Marine Ltd.);
    - Area 447 (Licenced Aggregates Area - Cemex UK Marine Ltd., Hanson Aggregates Marine Ltd. and Lafarge Tarmac Marine Ltd.);
    - Areas 507/1 to 507/6 (Application Areas – Cemex UK Marine Ltd.); and
    - Area 498 (Application Area – Britannia Aggregates Ltd.).

224. Mitigation strategies relating to the archaeological and cultural heritage environment are known to have been developed for the Greater Gabbard and Galloper Offshore Windfarms, as well as for the marine aggregate licence areas 430, 447, and 498. The MMO scoping response in relation to Application Areas 507/1 to 507/6 states that an EIA will be required as part of the planning process for these areas with due consideration afforded to matters relating to the marine

archaeological and cultural heritage environment[1] . The footprint of East Anglia ONE, to the south, has been subjected to EIA and mitigation strategies developed (EA ONE 2012, Chapter 17: Archaeology and Cultural Heritage).

225. Known archaeological receptors within the East Anglia THREE site will not be subject to direct impacts from other known plans or projects as there is no geographical overlap. Where there is potential for geographical overlap with future planned projects, it is expected that such projects will be subject to EIA and direct impacts will therefore be avoided or subject to appropriate mitigation. Although there is geographical overlap between the East Anglia THREE offshore cable corridor and the Greater Gabbard and Galloper windfarms as a result of cable crossings, direct impacts to known receptors should be avoided due to appropriate mitigation.

226. Significant cumulative impacts are restricted to direct impacts upon the potential archaeological resource from the proposed East Anglia THREE project with other plans and projects across the wider region that will have an indirect impact upon receptors within the Study Area (*Table 17.28*). This is particularly likely to be the case where potential receptors are within the Study Area as well as being in close proximity to other plans and projects, as it is often the case that indirect impacts are heightened near-field. Cumulative impacts may therefore occur to the potential archaeological resource where there is geographical overlap between the proposed East Anglia THREE project and other plans and projects (e.g. the cable crossings with Greater Gabbard). However, the significance of cumulative impacts upon potential receptors is considered to be reduced on the basis that mitigation strategies have been or are likely to be developed for all of the planned and existing projects listed above. In the event that potential archaeological receptors are encountered, the implementation of micrositing will reduce this significance to an acceptable level.

227. Significant cumulative impacts to potential archaeological receptors within the East Anglia Zone may occur as a result of multiple unavoidable impacts to potential archaeological receptors across a region as a result of the proposed and existing developments listed above.

228. Individual sites at specific locations are not only archaeological receptors in themselves; they are also part of the archaeological resource as a body of data and as collective heritage. As such, it is necessary to consider how a number of impacts on the specific aspect of the collective heritage may result in a significant cumulative impact.

[1] http://www.marinemanagement.org.uk/licensing/public_register/marine/minerals/507.htm

229. Potential archaeological receptors are equally as likely to be found outside the Study Area as within them. For example, although palaeolandscapes are largely unmapped, a number of features identified in the palaeogeographic assessment are cut by the boundary of the East Anglia THREE site (see *Figures 17.2* and *17.3*). As such, palaeogeographic features of archaeological potential may extend beyond the bounds of the Study Area. Similarly, records of documented losses and regional maritime activities signify that there is the potential for maritime and aviation receptors to exist beyond the bounds of the project.

230. If potential archaeological receptors are present, and if they are directly impacted by other projects, there would be an indirect impact upon the archaeological resource throughout the region and hence, upon the receptors Study Area. However, while the cumulative effect of these direct impacts would be significant on a regional scale, the application of appropriate mitigation (e.g. ORPAD) allows for the significance to be reduced these effects to **minor adverse** significance.

231. It is possible that other plans and projects across the region may alter the hydrodynamic and sedimentary regimes across the region, which may impact archaeological receptors indirectly on a regional scale, however assessments in support of this project and ZEA (compiled in Chapter 7 Marine Geology, Oceanography and Physical Processes) indicate that indirect physical impacts resulting in far-field effects are unlikely to induce significant adverse impacts to archaeology and cultural heritage receptors. Indeed, the positive, effects from sediment plumes to increase sediment cover on receptors and potential receptors are beneficial.

232. A further positive cumulative effect of offshore projects is the accumulation of archaeologically interpreted geophysical and geotechnical data alongside the information provided by chance discoveries. Such data may be considered to contribute significantly to a greater understanding of the offshore archaeological resource. However, this is dependent on the demonstration that the studies have been completed to professional archaeological standards. In addition, the results produced must be made publicly available.

Table 17.28 Potential cumulative impacts

Impact	Potential for cumulative impact	Data confidence	Rationale
Construction 1: Direct disturbance to archaeological receptors and / or their physical setting	No (Known Receptors) Yes (Potential Receptors)	Medium	The spatial distribution of geotechnical borehole data and the quality of geophysical datasets is such that data confidence is variable between sensors and between areas of the proposed project (see section 17.3 Data Sources for full discussion of data quality)
Construction 2: Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	No	High	Data which informs the assessment of this impact has been afforded high confidence as part of the Marine Geology, Oceanography and Physical Processes assessment (Chapter 7 Marine Geology, Oceanography and Physical Processes).
Construction 3: Impacts to the historic seascape character	No	High	Data compiled from existing national assessment (Tapper and Johns (2008) and Oxford Archaeology (2011)). Changes to historic seascape character (HSC) induced by East Anglia ONE result in 'Offshore Renewables' becoming part of the HSC i.e. there is no cumulative change to HSC; it occurs once.
Operation 1: Direct disturbance to archaeological receptors and / or their physical setting	No (Known Receptors) Yes (Potential Receptors)	Medium	The spatial distribution of geotechnical borehole data and the quality of geophysical datasets is such that data confidence is variable between sensors and between areas of the proposed project (see section 17.3 Data Sources for full discussion of data quality)
Operation 2: Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	No	High	Data which informs the assessment of this impact has been afforded high confidence as part of Chapter 7 Marine Geology, Oceanography and Physical Processes.
Operation 3: Impacts to the historic seascape character	No	High	Data compiled from existing national assessment (Tapper and Johns (2008) and Oxford Archaeology (2011)). Changes to HSC induced by East Anglia ONE result in 'Offshore Renewables' becoming part of the HSC i.e. there is no cumulative change to HSC; it occurs once.
Decommissioning 1: Direct disturbance to archaeological	No (Known	Medium	The spatial distribution of geotechnical borehole data and the quality of geophysical

Impact	Potential for cumulative impact	Data confidence	Rationale
receptors and / or their physical setting	Receptors) Yes (Potential Receptors)		datasets is such that data confidence is variable between sensors and between areas of the proposed project (see section 17.3: Data Sources for full discussion of data quality)
Decommissioning 2: Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	No	High	Data which informs the assessment of this impact has been afforded high confidence as part of Chapter 7 Marine Geology, Oceanography and Physical Processes.
Decommissioning 3: Impacts to the historic seascape character	No	High	Data compiled from existing national assessment (Tapper and Johns (2008) and Oxford Archaeology (2011)). Changes to HSC induced by East Anglia ONE result in 'Offshore Renewables' becoming part of the HSC i.e. there is no cumulative change to HSC; it occurs once.

Table 17.29 Summary of Projects considered for the CIA in Relation to Offshore Archaeology and Cultural Heritage

Project	Status	Development period	[2]Distance from East Anglia THREE site (km)	[3]Distance from East Anglia THREE offshore Export and Interconnector cable route(km)	Project definition	Project data status	Included in CIA	Rationale	
East Anglia ONE	Consented	Long-term Licence	c. 22km	Directly adjacent	Offshore Windfarm	Full Assessment	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage receptors	Installation or decommissioning of cabling including landfall location
Greater Gabbard Offshore Windfarm	Operational	Long-term Licence	c. 80km	c. 15km	Offshore Windfarm	Full Assessment	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage	Cable crossings

[2] Shortest distance between the considered project and East Anglia THREE– unless specified otherwise.

Project	Status	Development period	[2]Distance from East Anglia THREE site (km)	[3]Distance from East Anglia THREE offshore Export and Interconnector cable route(km)	Project definition	Project data status	Included in CIA	Rationale	
								receptors	
Galloper Offshore Windfarm	Consented	Long-term Licence	c. 75km	c. 15km	Offshore Windfarm	Full Assessment	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage receptors	Cable crossings
Marine Aggregates Extraction Area 430	Licenced	Long-term Licence	c.0.9km	c. 53km	Marine Aggregate Extraction Area	Full Assessment	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage receptors	Installation or decommissioning of OFTO cabling.

Project	Status	Development period	[2]Distance from East Anglia THREE site (km)	[3]Distance from East Anglia THREE offshore Export and Interconnector cable route(km)	Project definition	Project data status	Included in CIA	Rationale	
Marine Aggregates Extraction Area 447	Licenced	Long-term Licence	c. 9km	c. 110km	Marine Aggregate Extraction Area	Full Assessment	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage receptors	Installation or decommissioning of OFTO cabling.
Marine Aggregates Extraction Areas 507/1 to 507/6	Application	Application for Long-term Licence	c. 83km	c. 4km	Marine Aggregate Extraction Area	Full Assessment in line with similar Marine Aggregates licence applications	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage receptors	Installation or decommissioning of OFTO cabling.

Project	Status	Development period	[2]Distance from East Anglia THREE site (km)	[3]Distance from East Anglia THREE offshore Export and Interconnector cable route(km)	Project definition	Project data status	Included in CIA	Rationale	
Marine Aggregates Extraction Area 498	Application	Application for Long-term Licence	c. 76km	c. 8km	Marine Aggregate Extraction Area	Full Assessment	Yes	Direct physical impacts to prehistoric receptors Indirect physical impacts to archaeology and cultural heritage receptors	Installation or decommissioning of OFTO cabling.

17.8 Transboundary Impacts

233. *Table 17.30* lists the European Union (EU) member states considered in this assessment.

Table 17.30 List of Other EU Member States Retained in the Transboundary Impact Assessment in Relation to Offshore Archaeology and Cultural Heritage

EU member state	Commentary
Austria	Military & non-military vessels and aircraft of any date
Belgium	Military & non-military vessels and aircraft of any date
Czech Republic	Military & non-military vessels and aircraft of any date
Denmark	Military & non-military vessels and aircraft of any date
Finland	Military & non-military vessels and aircraft of any date
France	Military & non-military vessels and aircraft of any date
Germany	Military & non-military vessels and aircraft of any date
Greece	Military & non-military vessels and aircraft of any date
Italy	Military & non-military vessels and aircraft of any date
Latvia	Military & non-military vessels and aircraft of any date
Netherlands	Military & non-military vessels and aircraft of any date
Poland	Military & non-military vessels and aircraft of any date
Sweden	Military & non-military vessels and aircraft of any date

234. As the implementation of AEZs will prevent direct impacts to known archaeological receptors, transboundary impacts to known wrecks and aircraft are not expected to occur during the lifetime of the project.

235. Transboundary impacts may be relevant to archaeology and cultural history where wrecks of non-British, European nationality are subject to impact from development. Non-British wrecks may fall within the jurisdiction of another country. An example of the types of wrecks that may be considered as subject to transboundary impacts as a result of the proposed project are foreign warships lost in UK waters. However, the remains of other such non-British vessels may also be important to other countries as a representation of a non-military aspect of a maritime nation's history. Foreign aircraft remains are also considered to be relevant in relation to transboundary impacts. All military aircraft remains, regardless of their nationality, are automatically protected under the Protection of Military Remains Act 1986. There are no identified non-British known wrecks within the East Anglia THREE site.

236. There are four vessels of non-British nationality located within the offshore Export and Interconnector cable corridor (all of which have been classified as A1 receptors), comprising one Danish vessel (WA72455), one Romanian vessel (WA72390), one Swedish vessel (WA72410) and one former-Yugoslavian vessel (72506). One further vessel classified as an A1 receptor (WA72437) was originally Austro-Hungarian in nationality, although it was recorded as a British steamship at its time of loss. These wrecks were also considered as part of the East Anglia ONE ES. On the basis that all direct impacts were to be prevented through the implementation of AEZs, no transboundary impacts were identified in association with these known wreck sites.

237. It is possible that potential wrecks and aircraft of foreign nationality within East Anglia THREE and the offshore cable corridor may be impacted. However, the archaeological assessment of pre-construction geophysical survey reduces this likelihood and embedded mitigation (ORPAD) will address unexpected discoveries, thus reducing the significance of this impact to an acceptable level. If wrecks or aircraft from other EU member states are discovered during the course of the proposed project, further advice would be sought regarding the legal status of the remains in their country of origin.

238. The predicted changes to the baseline physical environment are not anticipated to be of sufficient magnitude or geographical extent to result in any indirect transboundary impacts upon archaeology and cultural heritage receptor groups.

17.9 Inter-relationships

239. The construction, operation and decommissioning phases of the proposed East Anglia THREE project would cause a range of effects on offshore archaeology and cultural heritage. The magnitude of these effects has been assessed using expert, data-led assessments drawing from a wide science base that includes project-specific surveys, specialist assessments and desk based research.

240. These effects have the potential to directly affect the identified cultural heritage receptors but may manifest as impacts upon receptors other than those considered within the context of offshore archaeology and cultural heritage. How the inter-relationships relate to impacts on other receptors in other chapters are listed in *Table 17.31*.

241. Inter-relationships exist between offshore archaeology and cultural heritage and the assessments undertaken for Chapter 7 Marine Geology, Oceanography and Physical Processes and Chapter 10 Benthic Ecology. These chapters inform this assessment in

terms of providing additional information regarding specific impacts, as detailed below and summarised in *Table 17.31*.

Table 17.31 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter
Direct disturbance to archaeological receptors and / or their physical setting	7 - Marine Geology, Oceanography and Physical Processes (Effects on sea bed) 10 – Benthic Ecology (temporary habitat loss)	Section 17.6 Section 17.7
Indirect disturbance of archaeological receptors and / or their physical setting from changes to hydrodynamic and sedimentary regimes	7 - Marine Geology, Oceanography and Physical Processes (Effects on physical processes)	Section 17.6 Section 17.7

17.10 Summary

242. The construction, operation and decommissioning phases of the proposed East Anglia THREE project will result in a range of effects upon the marine archaeological and cultural heritage environment. The significance of these effects has been assessed based on best practice, consultation and professional judgement. The effects that have been assessed are anticipated to be reduced to a minor residual significance or are considered to be negligible on the basis of embedded mitigation, as summarised in *Table 17.32* and section 17.6 above.

243. Known archaeological receptors are not considered to be subject to significant cumulative impacts on the basis that they should be avoided due to appropriate mitigation; for example AEZs around selected maritime archaeology receptors, *Figures 17.26* and *17.27*). These effects are therefore considered to be negligible. This chapter has also demonstrated that whilst there is the potential for cumulative impacts to occur to potential archaeological receptors, this potential and the significance of any such effects is also considered to be reduced on the basis of the embedded mitigation implemented as part of the proposed East Anglia THREE project as well as the mitigation strategies outlined or anticipated for the existing and future plans and projects reviewed as part of this chapter. Cumulative effects upon potential archaeological receptors are therefore considered to be of minor residual significance. While these effects are essentially adverse, the benefits associated with mitigation geared towards chance discoveries (i.e. the accumulation of archaeologically interpreted geophysical and geotechnical data and an overall

contribution to a greater understanding of the offshore archaeological resource) represents a positive cumulative effect that cannot be discounted. However, this is dependent on the demonstration that the studies have been completed to professional archaeological standards and on the basis that any results produced must be made publically available.

244. This chapter has further demonstrated that through the implementation of AEZs, direct transboundary impacts to known archaeological receptors are not expected to occur during the lifetime of the proposed project. Whilst it is possible that potential wrecks and aircraft of foreign nationality within Study Area may be impacted, the archaeological assessment of pre-construction geophysical survey reduces this likelihood and embedded mitigation (ORPAD) will address unexpected discoveries, thus reducing the significance of this impact to an acceptable level. If wrecks or aircraft from other EU member states are discovered during the course of the proposed project, further advice would be sought regarding the legal status of the remains in their country of origin. Indirect transboundary impacts upon archaeological and cultural heritage receptor groups are not anticipated to occur.

Table 17.32 Potential Impacts Identified for Offshore Archaeology and Cultural Heritage

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction and Decommissioning						
Impact 1: Direct Impacts	Potential in situ Prehistoric sites	High	High	Major	Reporting Protocol Geoarchaeological Assessment Methods of removal minimising further impact (decommissioning)	Minor adverse
	Potential submerged landscape features	Medium	High	Major	Reporting Protocol Geoarchaeological Assessment Methods of removal minimising further impact (decommissioning)	Minor adverse
	Potential derived Prehistoric finds	Medium	High	Major	Reporting Protocol Geoarchaeological Assessment Methods of removal minimising further impact (decommissioning)	Minor adverse
	Potential palaeoenvironmental evidence	Low	High	Moderate	Reporting Protocol Geoarchaeological Assessment Methods of removal minimising further impact (decommissioning)	Minor adverse

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
	Known Wrecks	Low to High, Unknown (High)	High	Moderate to Major	AEZs	Negligible
	Potential Wrecks	High	High	Major	Reporting Protocol AEZs Methods of removal minimising further impact (decommissioning)	Minor adverse
	Potential derived maritime finds	Medium	High	Major	Reporting Protocol Methods of removal minimising further impact (decommissioning)	Minor adverse
	Potential Aircraft	High	High	Major	Reporting Protocol AEZs Methods of removal minimising further impact (decommissioning)	Minor adverse
	Potential derived aviation finds	Medium	High	Major	Reporting Protocol Methods of removal minimising further impact (decommissioning)	Minor adverse
Impact 2: Indirect Impacts	Potential in situ Prehistoric sites	High	Low	Moderate	Reporting Protocol Geoarchaeological Assessment	Minor beneficial

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
	Potential submerged landscape features	Medium	Low	Minor	Reporting Protocol Geoarchaeological Assessment	Minor beneficial
	Potential derived Prehistoric finds	Medium	Low	Minor	Reporting Protocol Geoarchaeological Assessment	Minor beneficial
	Potential palaeoenvironmental evidence	Low	Low	Minor	Reporting Protocol Geoarchaeological Assessment	Minor beneficial
	Known Wrecks	Low to High, Unknown (High)	Low	Minor to Moderate	AEZs	Negligible
	Potential Wrecks	High	Low	Moderate	Reporting Protocol AEZs	Minor beneficial
	Potential derived maritime finds	Medium	Low	Minor	Reporting Protocol	Minor beneficial
	Potential Aircraft	High	Low	Moderate	Reporting Protocol AEZs	Minor beneficial
	Potential derived aviation finds	Medium	Low	Minor	Reporting Protocol	Minor beneficial

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Operation						
Impact 1: Direct Impacts	Potential in situ Prehistoric sites	High	High	Major	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Potential submerged landscape features	Medium	High	Major	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Potential derived Prehistoric finds	Medium	High	Major	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Potential palaeoenvironmental evidence	Low	High	Moderate	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Known Wrecks	Low to High, Unknown (High)	High	Moderate to Major	AEZs	Negligible
	Potential Wrecks	High	High	Major	Reporting Protocol AEZs	Minor adverse
	Potential derived maritime finds	Medium	High	Major	Reporting Protocol	Minor adverse
	Potential Aircraft	High	High	Major	Reporting Protocol AEZs	Minor adverse

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
	Potential derived aviation finds	Medium	High	Major	Reporting Protocol	Minor adverse
Impact 2: Indirect Impacts	Potential in situ Prehistoric sites	High	High	Major	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Potential submerged landscape features	Medium	High	Major	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Potential derived Prehistoric finds	Medium	High	Major	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Potential palaeoenvironmental evidence	Low	High	Moderate	Reporting Protocol Geoarchaeological Assessment	Minor adverse
	Known Wrecks	Low to High, Unknown (High)	High	Moderate to Major	AEZs	Minor adverse
	Potential Wrecks	High	High	Major	Reporting Protocol AEZs	Minor adverse

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
	Potential derived maritime finds	Medium	High	Major	Reporting Protocol	Minor adverse
	Potential Aircraft	High	High	Major	Reporting Protocol AEZs	Minor adverse
	Potential derived aviation finds	Medium	High	Major	Reporting Protocol	Minor adverse
	Potential submerged landscape features	Medium	Low	Minor	Reporting Protocol Geoarchaeological Assessment	Minor beneficial
	Potential derived Prehistoric finds	Medium	Low	Minor	Reporting Protocol Geoarchaeological Assessment	Minor beneficial
	Potential palaeoenvironmental evidence	Low	Low	Minor	Reporting Protocol Geoarchaeological Assessment	Minor beneficial
	Known Wrecks	Low to High, Unknown (High)	Low	Minor to Moderate	AEZs	Negligible
	Potential Wrecks	High	Low	Moderate	Reporting Protocol AEZs	Minor beneficial
	Potential derived maritime finds	Medium	Low	Minor	Reporting Protocol	Minor beneficial

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
	Potential Aircraft	High	Low	Moderate	Reporting Protocol AEZs	Minor beneficial
	Potential derived aviation finds	Medium	Low	Minor	Reporting Protocol	Minor beneficial

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