Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Environmental Statement Volume 2

Chapter 13: Offshore Archaeology and Cultural Heritage

June 2018, Revision A

Document Reference: 6.2.13

Pursuant to: APFP Reg. 5(2)(a)

Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Volume 2

Chapter 13: Offshore Archaeology and Cultural Heritage

June 2018

Drafted By:	Wessex Archaeology
Approved By:	Helen Jameson
Date of Approval	June 2018
Revision	A

Vattenfall Wind Power Ltd

First Floor

1 Tudor Street

London

EC4Y 0AH

T +44 207 451 1150

www.vattenfall.co.uk

Table of Contents

13 OFFSHORE ARCHAEOLOGY AND CULTURAL HERITAGE 13-1
13.1 Introduction 13-1
13.2 Statutory and policy context 13-1
13.3 Consultation and scoping 13-5
13.4 Scope and methodology 13-11
Study area 13-11
Sources 13-13
Desk-based assessment methodology 13-13
Archaeological assessment of Setting 13-14
Archaeological assessment of geophysical survey data methodology 13-15
Archaeological assessment of geotechnical survey data methodology 13-16
Cumulative impact methodology 13-16
Transboundary effect methodology 13-17
13.5 Assessment criteria and assignment of significance 13-17
13.6 Uncertainty and technical difficulties encountered 13-19
13.7 Existing environment 13-20
The array 13-20
The offshore export cable corridor 13-31
13.8 Overview of project development 13-55
13.9 Key parameters for assessment 13-56
13.10 Embedded mitigation 13-65
13.11 Environmental assessment: construction phase 13-65
13.12 Environmental assessment: Operational and Maintenance phase 13-68
13.13 Environmental assessment: decommissioning phase 13-70
13.14 Environmental assessment: cumulative effects 13-71
Tier 1 13-71
Tier 2 13-71
Tier 3 13-71
13.15 Inter-relationships 13-79
13.16 Mitigation 13-79
13.17 Transboundary statement 13-83
13.18 Summary of effects 13-83
13.19 References 13-87

Figure 13.1: Thanet Extension location, offshore site boundary, cable route offshore and coverage of Nemo Link data. 13-12
Figure 13.2: Palaeogeographic features of archaeological potential. 13-22
Figure 13.3: Seabed features of archaeological potential in Thanet Extension Site Area. ..13-23
Figure 13.4: Seabed features of archaeological potential in Thanet Extension Site Area. ..13-24
Figure 13.5: Seabed features of archaeological potential in Thanet Extension Site Area. ..13-25
Figure 13.6: Seabed features of archaeological potential in Thanet Extension Site Area ...13-26
Figure 13.7: Seabed features of archaeological potential in Thanet Extension Site Area. ..13-27
Figure 13.8: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-33
Figure 13.9: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-34
Figure 13.10: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-35
Figure 13.11: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-36
Figure 13.12: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-37
Figure 13.13: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-38
Figure 13.14: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-39
Figure 13.15: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-40
Figure 13.16: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-41
Figure 13.17: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-42

Figure 13.18: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-43
Figure 13.19: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-44
Figure 13.20: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-45
Figure 13.21: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-46
Figure 13.22: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-47
Figure 13.23: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-48
Figure 13.24: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-49
Figure 13.25: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-50
Figure 13.26: Seabed features of archaeological potential in in the Thanet Extension OECC. 13-51
Figure 13.27: Approximate position of B-17 aircraft. 13-52
Figure 13.28: Cumulative Impact Assessment – 100 km radius. 13-76

Table 13.1: Legislation and policy context 13-2
Table 13.2: Summary of consultation relating to Offshore Archaeology and Cultural Heritage 13-5
Table 13.3: Criteria discriminating relevance of seabed features to proposed scheme 13-16
Table 13.4: Criteria discriminating relevance of palaeogeographic features to proposed scheme ... 13-16
Table 13.5: Sensitivity/ importance of the environment 13-18
Table 13.6: Magnitude of impact 13-19
Table 13.7: Significance of potential effects 13-19
Table 13.8: Anomalies of archaeological potential within the Thanet Extension array area 13-28
Table 13.9: Summary of maritime potential by period 13-29
Table 13.10: Anomalies of archaeological potential within the Thanet Extension OECC area 13-53
Table 13.11: Maximum design scenario assessed 13-58
Table 13.12: Embedded mitigation relating to offshore archaeology and cultural heritage 13-65
Table 13.13: Projects for cumulative assessment 13-72
Table 13.14: Cumulative Rochdale Envelope 13-75
Table 13.15: Sites recommended for AEZs in the array area 13-80
Table 13.16: Sites recommended for AEZs in the OECC 13-80
Table 13.17: Summary of predicted impacts of Thanet Extension 13-84

13 OFFSHORE ARCHAEOLOGY AND CULTURAL HERITAGE

13.1 Introduction

13.1.1 This Chapter of the Environmental Statement (ES) presents the results of the Environmental Impact Assessment (EIA) of the offshore elements of the Thanet Extension Offshore Wind Farm (Thanet Extension) relevant to offshore archaeology and cultural heritage during its construction, Operation & Maintenance (O&M) and decommissioning. It follows on from the Preliminary Environmental Information Report (PEIR) that was undertaken and distributed for comments from key stakeholders. A separate assessment has been undertaken for the onshore development, as detailed in Volume 3, Chapter 7: Onshore Historic Environment (Document Ref: 6.3.7). The other Chapter in the ES that is closely linked to this one is Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2). This chapter should be read in conjunction with the scheme description provided in Volume 2, Chapter 1: Project Description - Offshore (Document Ref: 6.2.1) and Volume 1, Chapter 3: Approach to EIA (Document Ref: 6.1.3).

13.1.2 The Thanet Extension Marine Archaeological Desk-Based Assessment Technical Report (Wessex Archaeology 2017a) (hereafter the marine archaeological technical report) is included in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and should be read in conjunction with this chapter. The marine archaeological technical report comprised a desk-based study of the environmental baseline for offshore archaeology within the study area, which encompasses the proposed development footprint.

13.1.3 The Thanet Extension Archaeological Review of Geophysical and Geotechnical Data (Wessex Archaeology, 2018a) (hereafter the geophysical technical report) is included as Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2), and should be read in conjunction. It comprises assessments of sidescan sonar, multi-beam and subbottom profiler data.

13.1.4 This chapter provides a summary of the technical reports, and covers the submerged cultural heritage resource, including palaeogeography, shipwrecks, aircraft, geophysical anomalies, Historic Seascape Characterisation, and the potential for previously unknown sites. It provides an assessment of the value and setting of the resource, as well as potential impacts and significance of effects. The marine element comprises the area offshore up to the Mean High Water Spring (MHWS). The onshore elements of the proposed development have been assessed in Volume 3, Chapter 7: Onshore Historic Environment (Document Ref: 6.3.7).

13.1.5 The following sections of this chapter include:

- A summary of relevant legislation and planning policy;
- A description of the methodology for the assessment, including details of the study area and the approach to the assessment of effects;
- A summary of consultation with stakeholders;
- A review of baseline (existing) conditions;
- Details of the measures proposed as part of the project to avoid or reduce environmental effects, including mitigation and design measures that form part of the project (embedded mitigation);
- An assessment of the likely effects for the construction, O&M and decommissioning phases of the project, taking into account the measures proposed;
- Identification of any further mitigation measures or monitoring required in relation to likely significant effects; and
- Assessment of any cumulative effects with other proposed developments.

13.2 Statutory and policy context

13.2.1 A detailed description of the applicable legislation and national policy can be found in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1). This section provides a brief overview.

13.2.2 Thanet Extension is located in the English territorial sea (up to 12 nautical miles (nm) from the coast). Within the English territorial sea, Historic England (HE) is responsible for the archaeological resource. The Marine Management Organisation (MMO) is responsible for licencing, regulating, and planning marine activities in the areas around England, to ensure they are carried out in a sustainable way.

13.2.3 The Government's policy for the delivery of major energy infrastructure is set out in the *Overarching National Policy Statement for Energy* (EN-1) (Department of Energy & Climate Change (DECC), 2011a), and the *National Policy Statement for Renewable Energy Infrastructure* (EN-3) (DECC, 2011b). These include statements about potential effects on cultural heritage.

13.2.4 Relevant legislation and policy is outlined in Table 13.1.

Table 13.1: Legislation and policy context

Policy/ legislation	Key provisions	Section where provision addressed
Marine and Coastal Areas Act 2009 - Marine Policy Statement (MPS), 2011	Marine licensing and marine planning made the responsibility of the MMO. England's inshore and offshore waters have been divided into 11 plan areas.	The MMO is responsible for licensing, regulating and planning marine activities. paragraph 13.2.2 of this chapter.
Protection of Wrecks Act 1973: Section One and Two	This Act allows the Secretary of State (SoS) to designate a restricted area around a wreck to prevent uncontrolled interference.	There are no protected wrecks within the study area. paragraphs 13.7.55 and 13.7.53 of this chapter. The mitigation measures have been designed to protect any marine archaeological receptors of interest. paragraphs 13.16.1 - 13.16.25 of this chapter.
Ancient Monuments and Archaeological Areas Act 1979 (as amended)	Under this Act, the SoS for Digital, Culture, Media and Sport (DCMS) can schedule any site which appears to be of national importance because of its historic, architectural traditional, artistic or archaeological interest. Additional controls are placed upon works affecting Scheduled Monuments and Areas of Archaeological Importance under the Act.	There are no Scheduled Monuments or designated Areas of Archaeological Importance within the study area. Paragraphs 13.7.17, 13.7.47 and 13.7.55, of this chapter.
Protection of Military Remains Act 1986	This Act provides protection for designated military vessels and for and for all aircraft that crashed while in military service. The Act provides two types of protection: Protected Places (wrecks designated by name even if the location is not known) and Controlled Sites (sites designated by location). It is illegal to disturb or remove anything from sites. For Controlled Sites, it is illegal to conduct any operations (including diving or excavation) within the Controlled Site unless licensed to do so by the Ministry of Defence.	There is one aircraft crash site within the Offshore Export Cable Corridor (OECC), and a second reported within the OECC, but confirmed in the intertidal zone to the south. As they were lost while in military service, both would be protected under this Act. Paragraphs 13.7.52, 13.7.53. In addition, aircraft material from an unidentified aircraft was discovered during the Nemo Link pre-disturbance survey (paragraph 13.7.54). Until the identity of the aircraft can be confirmed, it should be assumed to be military, and therefore would be protected under this Act. The mitigation measure of Archaeological Exclusion Zones (AEZs) has been designed to protect the aircraft crash site with a confirmed location. paragraph 13.10.3, 13.16.8, and 13.16.9 and Table 13.15 and Table 13.16. Further fieldwork was undertaken to confirm the location of the second aircraft crash site. paragraph 13.7.53, 13.16.10
Merchant Shipping Act 1995	This Act sets out the procedures for determining ownership of underwater finds that turn out to be 'wreck', including ship, aircraft, hovercraft, parts of these, their cargo or equipment. Any recovered material must be reported to the Receiver of Wreck.	The mitigation measures have been designed to protect any marine archaeological receptors of interest. All wreck sites have been recommended for AEZ Paragraphs 13.10.3, 13.16.4 - 13.16.9, Table 13.15 and Table 13.16. Any discoveries of unexpected material will be reported through the Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) and reported to the Receiver of Wreck. paragraph 13.16.20 of this chapter.
The Planning (Listed Buildings and Conservation Areas Act 1990)	This Act requires the SoS to compile lists of buildings of special architectural or historical interest, on advice from HE. Works affecting Listed Buildings are subject to additional planning controls administered by Local Planning Authorities.	There are no Listed sites within the intertidal zone. Paragraph 13.7.47 of this chapter.

Policy/ legislation	Key provisions	Section where provision addressed
National Policy Statement (NPS) for Energy (EN1)	Paragraph 5.8.8: 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 significance of offshore heritage assets has been discussed in paragraphs 13.7.13 - 13.7.14, 13.7.21-13.7.24, 13.7.52 - 13.7.59, 13.7.64.
NPS-EN1	Paragraph 5.8.9: 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.	A desk-based assessment has been undertaken to assess the archaeological interest of offshore heritage interests (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)) and summarised in section 13.7 of this chapter.
NPS-EN1	Paragraph 5.8.10: 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.	The significance of the offshore heritage assets is included in section 13.7 of this chapter. The impact of the development is discussed in sections 13.11 - 13.14.
NPS-EN3	Paragraph 2.6.32: The Planning Inspectorate (PINS) will need to be satisfied that the foundations will not have an unacceptable adverse effect on marine heritage assets.	In order to address potential adverse effects, mitigation measures have been designed to protect any marine archaeological receptors of interest. With the implementation of the mitigation measures all effects should be reduced to minor negative significance or minor to moderate beneficial significance. Sections 13.5 and 13.16 of this chapter. Table 13.12.
	Paragraph 2.6.139: Heritage assets can be affected by Offshore Wind Farm (OWF) development in two principal ways: from the direct effect of the physical siting of the development itself and from indirect changes to the physical marine environment.	These potential effects have been assessed in sections 13.11 - 13.14 of this chapter.
	Paragraph 2.6.140: Consultation with relevant statutory consultees (including English Heritage (now HE)) should be undertaken by the applicants at an early stage of the development.	Consultation has been undertaken with HE. Table 13.2 of this chapter.
	Paragraph 2.6.141: 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 wind farm design.	An archaeological assessment of geophysical survey data was undertaken and the results for Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) of this ES, and are summarised in Section 13.7.
	Paragraph 2.6.142: Assessment should 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.	Beneficial effects have been identified in paragraphs 13.11.7, 13.11.11, 13.12.5, 13.12.13, 13.14.23, 13.16.13, 13.16.23, 13.17.8 and Table 13.17.
	Paragraph 2.6.143: 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 in EN-1.	The effects have been assessed in paragraphs 13.7.44 - 13.7.47 of this chapter.
	Paragraph 2.6.144: PINS should be satisfied that OWFs and associated infrastructure have been designed sensitively taking into account known heritage assets and their	In order to address potential adverse effects, mitigation measures have been designed to protect any marine archaeological receptors of interest. With the implementation of the mitigation measures all effects should

Policy/ legislation	Key provisions	Section where provision addressed
	status (for example designated features).	be reduced to minor negative significance or minor to moderate beneficial significance. paragraphs 13.16.1 - 13.16.26 of this chapter. Table 13.17.
	Paragraph 2.6.145: Avoidance of important heritage assets, including archaeological sites and historic wrecks, is the most effective form of protection and can be achieved through the implementation of AEZ around such heritage assets which preclude development activities within their boundaries.	Avoidance will be achieved through the recommendation of AEZs, as outlined in the mitigation measures. The AEZs have been designed to protect any marine archaeological receptors of interest. Section 13.16, Table 13.15 and Table 13.16.
	Paragraph 2.6.146: Where requested by applicants, PINS should consider granting consents that allow for micro-siting to be undertaken within a specified tolerance. This allows changing to be made to the precise location of infrastructure during the construction phase so that account can be taken of unforeseen circumstances such as the discovery of marine archaeological remains.	Micro-siting is recommended in the mitigation measures, that have been designed to protect any marine archaeological receptors of interest. paragraph 13.16.11 provides information about micro-siting, and 13.16.20 provides information about the ORPAD, to manage unexpected discoveries.
The National Planning Policy Framework (NPPF)	Section 12 sets out the principle national guidance on the importance, management and safeguarding of heritage assets within the planning process.	The mitigation measures have been designed to protect any marine archaeological receptors of interest. paragraphs 13.16.1 - 13.16.26 of this chapter.

13.2.5 The following guidance also applies:

- The Code of Practice for Seabed Developers (Joint Nautical Archaeology Policy Committee (JNAPC), 2008);
- Our Seas – A shared resource: High level marine objectives (Department for Environment, Food and Rural Affairs (DEFRA, 2009);
- Conservation Principles Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage, 2008);
- Preserving Archaeological Remains: Decision-taking for Sites under Development (HE 2016);
- Managing Significance in Decision-Taking in the Historic Environment: Historic Environment Good Practice Advice in Planning: 2 (HE 2015);
- Ships and Boats: Prehistory to Present: Designation Selection Guide (English Heritage, 2012);
- Wind Energy and the Historic Environment (English Heritage 2005);
- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology with George Lambrick Archaeology and Heritage, 2008);
- Cumulative Impact Assessment Guidelines – Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms (RenewableUK, 2013);
- Model Clauses for Archaeological Written Schemes of Investigation (Wessex Archaeology and The Crown Estate (TCE), 2010);
- Marine Geophysics Data Acquisition, Processing and Interpretation Guidance Notes (Gribble and Leather, 2011);
- Marine Geophysics Data Acquisition, Processing and Interpretation (Plets et al., 2013);
- An Approach to Seascape Character Assessment (Natural England, 2012);
- Identifying and Protecting Palaeolithic Remains: Archaeological Guidance for Planning Authorities and Developers (English Heritage, 1998);
- Managing Lithic Scatters: Archaeological Guidance for planning authorities and developers (English Heritage, 2000);
- Military Aircraft Crash Sites: Guidance on their significance and future management (English Heritage, 2002);
- The Setting of Heritage Assets – Historic Environment Good Practice Advice in Planning: 3 (2nd Edition) (HE, 2017); and
- Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report (Department of Trade and Industry, 2005).

13.3 Consultation and scoping

13.3.1 Consultation has been undertaken with Vattenfall Wind Power Ltd (VWPL), HE, a representative of Kent County Council (KCC) and Wessex Archaeology, discussing the offshore archaeology and cultural heritage and the general approaches to the offshore assessment (Table 13.2).

13.3.2 In addition, responses to scoping were received in February 2017 (PINS 2017a and b) (Table 13.2).

Table 13.2: Summary of consultation relating to Offshore Archaeology and Cultural Heritage

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
28/02/2017 Evidence plan review panel to discuss terms of reference, Evidence Plan process and initial technical discussions on scope and next step	The meeting was attended by VWPL, Stuart Churchley (HE), and Dr. Andrew Bicket (Wessex Archaeology). The main focus of discussion was the marine geophysics assessment. It was identified that the geophysical assessment would not be complete by the PEIR deadline, therefore it will be incorporated at the Environmental Statement (ES) stage. The study area was confirmed as from Mean High Water to the extent of the offshore array. It was agreed the onshore consultant would undertake the assessment of setting for onshore receptors (as is normal practice) and that scope for offshore receptors to have setting impacts was not relevant (i.e. accidental wrecks do not have an inherent setting as they were not there on purpose). Historic Seascape Characterisation (HSC) will be included in the offshore baseline, based on existing regional reports. The Transboundary factors only comprise wrecks and other material of other Nations that is now located within UK waters. The potential for indirect effects on seabed features of high archaeological potential, for example sand banks, will be considered in the ES).	The study area is described in paragraph 13.4.2. The geophysical assessment was completed in time to be incorporated in the PEIR. The results are discussed in Section 13.7. Due to Scoping responses (discussed below), setting of offshore receptors has been considered. paragraphs 13.7.14, 13.7.22,13.7.52, 13.7.53,13.7.55, 13.7.56, 13.7.57, 13.7.58. HSC is discussed in detail in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and summarised in paragraphs 13.7.35 - 13.7.40, 13.7.61 - 13.7.64. Transboundary factors are discussed in paragraphs 13.17.1 - 13.17.9. An assessment of indirect effects has been undertaken in paragraphs 13.11.12 - 13.11.21, 13.12.8 -13.12.18, 13.13.6 - 13.13.7.
Scoping Response (Historic England)	‘We would request that any remaining surveys incorporate archaeological expertise, so that the survey data acquired is to a specification to maximise the potential to inform the assessment exercise within the ES, as aligned with paragraph 2.6.141 of National Policy Statement for Renewable Energy Infrastructure EN-3. This is especially relevant for geotechnical survey work, as the provision of adequate levels of information for the Palaeogeographic assessment and deposit model is essential, in order to understand the significance of the recorded deposits with respect to their past landscape position, and thereby establish a coherent and comprehensive understanding of the stratigraphy of the development area. Furthermore, in the absence of a marine plan for this area, we request that primary reference is made to the UK MPS regarding cultural heritage and seascape. We do however further acknowledge from paragraph 627 that prior to construction a detailed geophysical survey and investigation will take place for Unexploded Ordnance (UXO). As is industry standard we would expect, through the production and agreement of an Offshore Archaeological Written Scheme of Investigation (WSI) – as referenced in paragraph 540 – that this planned survey should also include advice and outline delivery of archaeological objectives for seabed and sub-seabed anomalies. For example, such provision of archaeological advice will be crucial given the export cables’ proposed route	Any remaining surveys will incorporate archaeological expertise, and this will be outlined in the WSI, as discussed in paragraphs 13.16.2, 13.16.14 and 13.16.16. Any planned geotechnical survey work will incorporate archaeological expertise, and will lead to the production of a palaeogeographic assessment and deposit model, as discussed in paragraphs 13.16.15 - 13.16.19 of this chapter. The MPS has been referenced in paragraphs 13.4.9 and 13.5.2. A WSI will include advice and outline delivery objectives for seabed and sub-seabed anomalies. paragraphs 13.16.2, 13.16.11, and 13.16.12.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	is in close proximity to the Goodwin Sands Area and specifically Brake Sand. Additionally, we note that the archaeological information used to inform section 2.11.1 'Baseline' was taken from the Thanet Offshore Wind Farm (TOWF) ES. As such the section reflects now outdated, and limited, account of what archaeological remains exist within the wider region and localised area. This is best exampled through the clear omission of any reference to 20th century global conflicts and the associated remains that may be encountered by this proposed development. We therefore expect a comprehensive archaeological assessment included within the ES, to determine possible impacts accurately. A list of policy, guidance and desk-based sources that should be included and referred to (as a minimum) during the application process has been provided. Whilst we note reference to a project archaeological WSI is included, with specific attention to TCE (2010) *Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects* guidance document, and we accept the statement that the WSI will "clarify the methodologies to address unavoidable impacts associated with the worst-case scenario (project design envelope), we would also recommend however that the Applicant is made aware that this document should function in clearer and broader terms. By way of explanation, an agreed WSI will set out when, how and why (additional) archaeological mitigation measures recommended in the ES are to be implemented through detailed and direct scheme specific method statements.	The baseline has been updated with more recent research. See Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) or summary Section 13.7. The policy, guidance and desk-based sources have been included and referred to in the text. See list in paragraph 13.2.4 and references throughout the ES. The WSI is discussed in the embedded mitigation section (13.10) and in detail throughout Section 13.16. The WSI will set out the archaeological mitigation measures in Sections 13.10 and 13.16.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	Therefore it should include a strategy for monitoring the effects over all phases of the development, and as outlined within paragraph 2.6.142 of the National Policy Statement for Renewable Energy Infrastructure EN-3, through the assessment work, 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", principally through the use of national, regional and local research frameworks. Furthermore, as a final point, specific reference should be made to a Reporting Protocol for Archaeological Discoveries e.g. as demonstrated by TCE (2014) *Protocol for Archaeological Discoveries: Offshore Renewables Projects.* Within section 2.11.2.4 'Potential cumulative impacts' and specifically paragraph 541, we note that potential cumulative impacts exist where the collective heritage value of many individual assets may be impacted, through "multiple impacts upon similar assets". Furthermore we acknowledge the statement that "there is potential for multiple developments to affect the larger-scale archaeological features such as palaeolandscapes and to affect the setting of heritage assets and historic landscapes/ seascapes". Similarly, there is often a connection between the seabed area and the site of some First and Second World War shipping casualties. Therefore given the need to include extensive seabed coverage using geophysical survey techniques and other more prescriptive methods it is possible to illuminate special features within a wider battlefield context and setting. Consequently,	Beneficial effects have been identified in paragraphs 13.11.7, 13.11.11, 13.12.5, 13.12.13, 13.14.23, 13.16.13, 13.16.23, 13.17.8 and Table 13.17 ORPAD is discussed in paragraph 13.16.20. Cumulative effects are addressed in paragraphs 13.14.1 - 13.14.39. Setting of palaeolandscapes is discussed in 13.7.14. Setting of shipwrecks and aircraft is discussed in detail in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1), and summarised in paragraphs 13.7.22,

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	it is also the opinion of HE that the setting with the offshore element of this particular topic of Offshore Archaeology and Cultural Heritage is progressed to EIA for additional consideration. The specific reference in section 2.11.2.5 'Transboundary impact assessment' to cultural heritage associated with wrecks (vessel or aircraft) of non-British, European nationality provides a limited consideration of this factor which must be developed with a sound methodological approach to determine the nature and substance of any transboundary impacts as relevant to this proposed project. Furthermore Table 2.28 'Summary of offshore cumulative and transboundary impacts' is inconsistent to the approach being proposed in this section and subsequent Table 6.1 Summary of potential offshore environment impacts.	13.7.23 13.7.52, 13.7.53, 13.7.56, 13.7.57, 13.7.58. The methodology for assessing transboundary effects is presented in paragraphs 13.4.37 - 13.4.38, and the Transboundary Statement is in paragraphs 13.17.1 - 13.17.9. Cumulative and Transboundary effects are covered in Sections 13.14 and 13.17.
Scoping response (KCC)	The ES should be based on a thorough review of up-to-date information from both desktop sources and geophysical survey works. The baseline data set out in the Scoping Report is derived from the 2005 desk based assessment produced for the initial wind farm development and should therefore be updated using further data from survey works associated with other developments in the area. With regard to paragraph 524, the anchorage of the Kent Downs and the wrecks of Goodwin Sands are of international significance. [Kent] County Council recommends that	Thorough reviews have been undertaken for the ES, and are provided in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2), and summarised in Section 13.7. The significance of the Goodwin Sands is discussed in the marine archaeology technical report and
	consideration is given to the Dover District Heritage Strategy (2013) which sets out an understanding of the significance of maritime features and wrecks in the proposed development area. Whilst paragraph 525 makes reference to the importance of the Wantsum Sea Channel, it should be noted that this area and nearby coastline was the scene of the following most notable events in the early history of England: the invasions of Caesar and Claudius and the emergence of the major port of entry at Richborough. In addition, Ebbsfleet is traditionally the landing place of the Augustinian mission returning Christianity to England, as well as the purported arrival of the Saxons through the tradition of Hengist and Horsa. The Richborough Port was later developed in the First World War to supply the Western Front. In light of this, the County Council recommends that reference is made to the significance of Sandwich as a medieval Cinque Port. KCC supports the approach to using site-specific geophysical and geotechnical evidence, as well as desk-based data to avoid seabed archaeology and features. The County Council also concurs that the assessment should include a modelling of the effects of indirect physical disturbance through sediment moving or scour. Further engagement with the applicant to ensure the appropriate mitigation of the potential direct impacts on unknown remains would be welcomed. With regard to the impact of the proposed development on heritage setting, the extended wind farm will be visible from a wide range of heritage receptors on the Thanet and Dover coast. Therefore, it is recommended that the visual impact of the proposed	summarised in paragraph 13.7.28. The importance of Wantsum Sea Channel is discussed in the marine archaeology technical report and summarised in Table 13.9. Geophysical and geotechnical data has been assessed in Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) and is summarised in Section 13.7. Modelling of the effects of indirect physical disturbance has been undertaken in Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes Document Ref: 6.2.2.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	development on the designated heritage assets is assessed.	Mitigation measures are outlined in Section 13.16 and will be developed in more detail in the WSI and in consultation with KCC. The visual impact on coastal heritage receptors has been assessed in Volume 3, Chapter 7: Onshore Historic Environment (Document Ref: 6.3.7) and Volume 2, Chapter 12: Seascape, Landscape, Visual (Document Ref: 6.2.12).
S42 PEIR response	HE: Volume 2 – Chapter 13: Offshore Archaeology and Heritage Would like to see a WSI produced to draft and outline how mitigation can be effectively completed, and reported upon in good time before any construction is planned, and prior to any consent being formally considered. The rationale for this request is with regard to the current extent, coverage and line spacing of geophysical and geotechnical survey data and its associated capabilities and limitation, weighted against the apparent high potential for archaeological remains within the upper layers of seabed stratigraphy.	A WSI will be produced and will outline how mitigation can be effectively completed, and reported upon in good time before construction is planned. Timing is detailed in paragraphs 13.10.2 and 13.16.2.
	Update Table 13.11 (Maximum design scenario assessed) to include more detail about the maximum burial depth of the export cable, due to high potential along export cable route close to Goodwin Sands and the number of A2 magnetic anomalies without surface expression. The application must consider steps to mitigate impacts to potential heritage assets, and how to effectively position and identify them. Should avoidance of A2s not be possible, a plan can then be formulated to carry out survey, recording and/ or excavation prior to the impact occurring (as detailed in paragraph 13.16.12), at any depth likely to be impacted; such action would reduce the need to depend upon ORPAD. The delivery of mitigation must be planned so that survey commissioning, interpretation and reporting can be completed in order to inform the final engineering design. The WSI must provide a rationale for the discrimination and strategy detailing prescriptive survey and investigation techniques for the large number of A2s. The concentration of anomalies is apparent in the figures in Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2). There is also a requirement for a complete and thorough survey to be undertaken at Pegwell Bay where no geophysical survey data presently exists. The requirement for information to be made publicly available, to support appreciation and enjoyment of the Historic Environment, but also enable further academic research and inform marine plans should be considered more consistently. The potential for effects of minor to moderate beneficial significance needs to be elaborated on to consider how these benefits will be fully achieved. HE welcomes the archaeological assessment of UXO/ROV survey data or diver survey data (directed with archaeological input) for the purposes of characterisation, and subsequent reporting could lead to minor to moderate	Table 13.11 has been updated with details about cable depth. Areas of concern due to cable depth are included in paragraph 13.11.6. Paragraph 13.16.11 has been updated to indicate 'at any depth'. Timing of mitigation is detailed in paragraphs 13.10.2 and 13.16.2. The WSI will include a rationale for the discrimination and strategy detailing prescriptive survey and investigation techniques for the large number of A2s, as noted in paragraph 13.16.11. In areas of data gap, such as in Pegwell Bay, it is expected that further survey work will be undertaken, for example it could be undertaken in conjunction with the UXO survey, and archaeological advice should be sought at the outset. paragraph 13.16.14. The need for information to be made publicly available for there to be beneficial effects has been included in paragraphs 13.11.7, 13.11.11, 13.16.13 This is discussed in paragraph 13.16.13

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	beneficial effects. The dissemination of the results is key.	
	The PEIR states that HSC was not identified within the Scoping summary of potential impacts to be scoped in to the PEIR assessment. Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) attempts to understand the perceptions of character spatially identified across the proposed project development area. In this regard it is important that the assessment seeks to examine how those perceptions of historic seascape could change given the nature of the proposed development. We do not accept the statement regarding the EIA Scoping Report and it is our advice that identifying potential change should be part of any ES prepared for this proposed project.	Paragraphs 13.7.35 – 13.7.40 and 13.7.61 – 13.7.64 have been amended to include HSC in the assessment. The assessment of changes to the HSC is undertaken in paragraphs 13.11.23 - 13.11.27, 13.12.19 and 13.13.8. Mitigation is recommended in paragraph 13.16.26.
S42 PEIR response	HE: Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2). The assessment is reliant on geophysical data and did not essentially form an adequate Stage 1 evaluation of geotechnical logs, and clearer referencing would be necessary to attain a stronger understanding as to the nature of the archaeological potential within the sedimentary deposits found within the offshore study area A figure should be included to delineate survey coverage undertaken by the survey vessels. Detail should be added as to the location of all 12 vibrocores. Clarification is required as to whether a continuous sequence is contained	The technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) has been updated. The technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical
	within the cores, and if these cores have been stored appropriately and not undergone excessive interference and destructive testing.	Annex (Document Ref: 6.4.13.2) has been updated.
	The report should be updated to clarify the assessment of the five phases of Unit 2.	The technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) has been updated.
	HE recognises the high archaeological evidential value of Phases 1, 3, 4 and 5 of Unit 2 (as defined by The Conservation Principles (English Heritage, 2008). These phases therefore need testing by geoarchaeological boreholes during the next phase of geotechnical work. A geoarchaeologist should work with the developer's contracted geotechnical team to select locations for geoarchaeological boreholes (which would be sub-sampled for dating) and used for palaeoenvironmental assessment. Additionally, the interpretation of the sediment sequence from the cable route also needs testing in this way. HE agrees with the comment that further geotechnical sampling should be undertaken within the development site (e.g. vibrocore or borehole), with samples acquired from within identified Pleistocene/ Early Holocene features, and the locations chosen should look to maximise the most continuous sequence possible, and the cores recovered should be managed to ensure subsequent sampling and dating is not compromised. The geotechnical assessment should include the landfall area, and geotechnical material should be acquired from this area and corroborated with geophysical data to generate a full assessment	Unit 2 should be targeted for archaeological assessment in further geoarchaeological work - paragraph 13.16.16. Advice from a geoarchaeologist should be sought at the planning stages - paragraph 13.16.16. Assessment of cores from the OECC has been included - paragraph 13.16.16. The selection of sample locations and retention of material has been updated - paragraph 13.16.16. The landfall area is now included in paragraph 13.16.18, however archaeological potential is

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	of the proposed cable route(s). Historic England would wish to see a Method Statement provided for comment for this geotechnical programme of work, as per the WSI. The vibrocores already taken and recommended for the next stage of geoarchaeological assessment should be kept and used exclusively for geoarchaeological analysis and interpretation.	expected to be relatively low - paragraph 13.16.19. The production of method statements will be covered in the WSI. The state of vibrocores already taken is discussed in paragraph 13.16.15.
	Geoarchaeological input to the ES should include wider consideration of the evolution of the Wantsum Channel and the Stour Valley, plus a consideration of the offshore survival of the Loess and associated buried soil horizons exposed in the cliffs at Pegwell Bay. Potential linkages between the offshore channel network and the drainage pattern, Pleistocene history, and Palaeolithic archaeology of mainland Kent have not been adequately made in the assessment reports produced for this PEIR. It is also important to note that there are complex landscape characteristics that need to be explored and understood in more detail across the proposed development area. There is a need for timetabling liaison meetings with HE's Marine Planning Unit and the South East Science Advisor early and throughout the project, post PEIR, to ensure objectives are maintained and outcomes are achieved such that a suitable WSI is prepared in support of any application to the Planning Inspectorate. The draft WSI should include a log of archaeological work undertaken, samples	The technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) has been updated, and summarised in paragraphs 13.7.7, 13.7.8, 13.7.44. The technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) has been updated. A meeting has been held with HE (31/01/2018) to discuss the production of the WSI. See comments below. This will be included in the WSI.
	collected, and their whereabouts, as well as technical reports produced. This should be appended to each technical report.	
S42 PEIR response	KCC Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) identified a number of deposits of high archaeological potential, as well as deposits that may be of archaeological interest and noted that there is also potential for further significant remains to be present. KCC welcomes the commitment to agree a WSI with KCC and HE, which will include AEZs. A2s will be assessed and agreed on an individual basis as the scheme design develops. KCC welcomes the intention to undertake further sampling of cores from the array area and to agree further works that may be needed based on the analysis of these. KCC agrees that further specialist archaeological input should be included in designing and geotechnical or geophysical survey works proposed especially in those areas that have yet to be surveyed. KCC also supports the implementation of ORPAD for previously unknown material.	No action required The WSI will be produced in agreement with KCC and HE, and the WSI will include a methodology for assessing and agreeing A2s. Further geotechnical assessment is covered in paragraphs 13.16.15 - 13.16.17. ORPAD is covered in paragraph 13.16.20.
31/01/2018 Discussion of PEIR comments with HE	HE requested to review the draft WSI prior to the submission of the ES. The WSI needs to be targeted, focussed, robust and unambiguous to minimise risk, for example detailing recommended options for geotechnical survey. It will also include details about what data has been obtained and what	No change required. This will be incorporated in WSI.

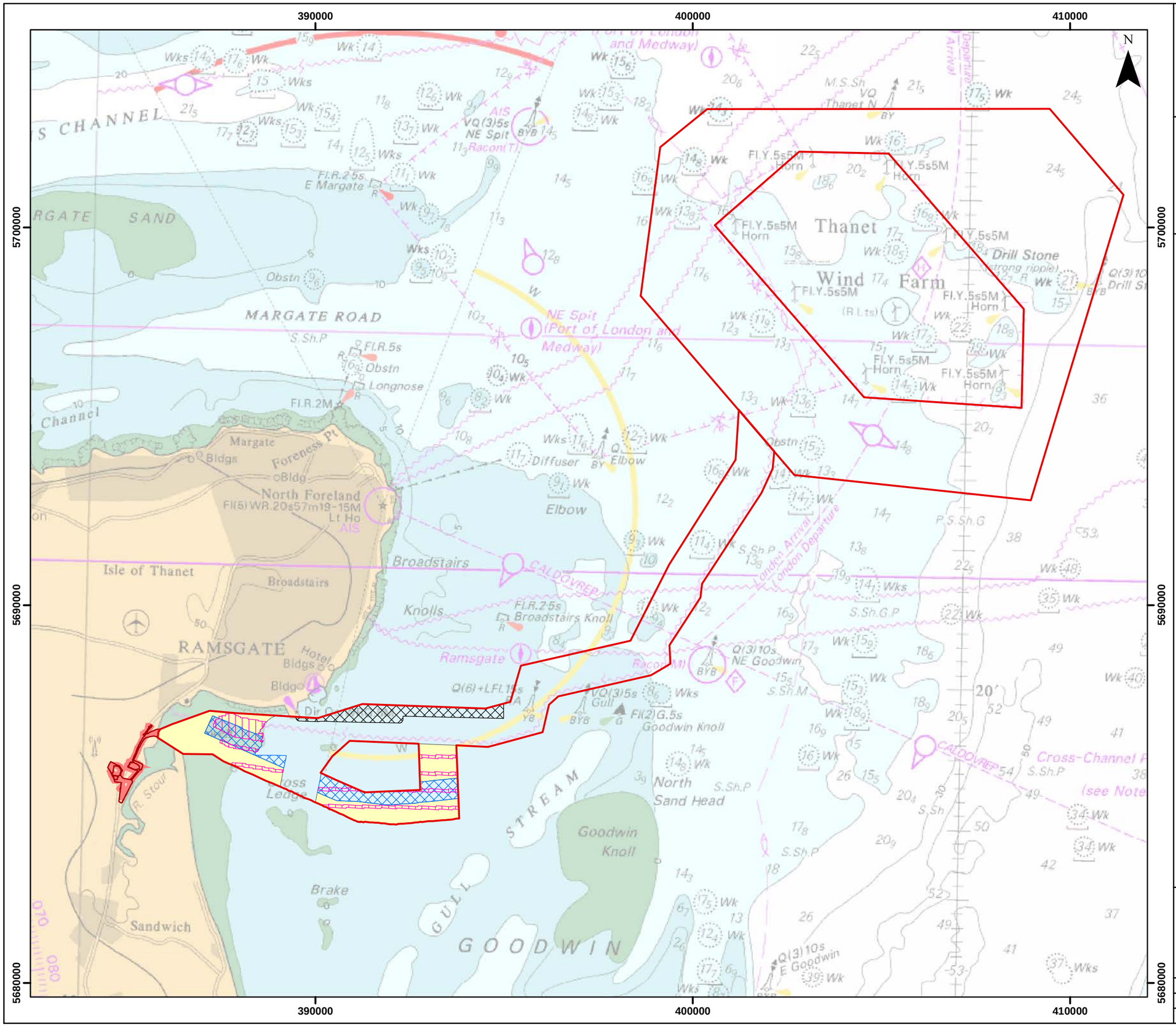
Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	has been secured. It will clearly state what is required for recovered cores. The WSI will detail how further geotechnical work will be undertaken and whether it would be suitable for an archaeologist to be present on-board during survey work. Any areas that have not yet been surveyed, for example in Pegwell Bay, will likely be covered by future surveys, for example the UXO survey. HE recommended that the foreshore/intertidal work regarding geophysics/geotechnical work undertaken by offshore and onshore archaeologists should be joined up. HE recommended liaison with terrestrial stakeholders and academics regarding the landfall. There should be a workshop regarding the WSI, prior to the submission.	This will be incorporated in WSI. No change required. This will be incorporated in WSI. With regards to joined up offshore/ onshore, discussions have been held with the terrestrial archaeological consultants, and the results have been summarised in the technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) and in paragraph 13.16.18. No change required.

13.4 Scope and methodology

13.4.1 The methodology employed during this assessment reflects the requirements of EIA as set out in European Council Directive 85/ 337/ EEC as named by Directive 97/ 11/ EC and follows best practice professional guidance outlined by the Chartered Institute for Archaeologists (CIfA)'s *Standard and guidance for historic environment desk-based assessment* (CIfA, 2017).

Study area

13.4.2 The study area comprises the OECC' and 'Offshore Site Boundary', defined by the applicant in April 2018, which combine to form the 'Offshore Red Line Boundary' (Figure 13.1). The 'Cable Exclusion Area' on Figure 13.1 illustrates where no infrastructure will be installed. However, it remains part of this assessment, as it has been retained within the Red Line Boundary for the purposes of anchor handling and other activities that could potentially impact the seabed. It should be noted that the desk-based assessment (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)) and the geophysical and geoarchaeological assessment (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2)) covered the wider area defined as the 'Site Investigation Boundary', and therefore not all sites covered by these reports are still relevant. Following the amendment of the OECC boundary there are no terrestrial features within the study area.



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

Figure 13.1

Thanet Extension location, offshore site boundary, cable route offshore and coverage of Nemo Link data

Legend

- Offshore Red Line Boundary
- Onshore Red Line Boundary
- Cable Exclusion Area
- Covered by 2005 Thanet data
- Covered by 73390 NEMO data
- No 2016 Coverage

Datum: ETRS 1989
Projection: UTM31N

1:100,000 0 1 2 km 0 0.55 1.1 nm

Drg No	Fig_13.1		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.1

Sources

13.4.3 A number of sources of primary and synthesised information were consulted for the archaeological assessment (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2):

- Geophysical survey datasets acquired by Fugro Survey B.V.; between 29 July and 6 September 2016, the extents of which are illustrated in (Figure 13.1);
- Geotechnical data, also acquired by Fugro (Fugro, 2016);
- The United Kingdom Hydrographic Office (UKHO) data for charted wrecks and obstructions (received 13 April 2017, additional data for extended OECC 11th July 2017);
- The National Record of the Historic Environment (NRHE) maintained by HE, comprising data for marine archaeological sites, find spots and archaeological events (received 16 March 2017, additional data for extended OECC 11th July 2017);
- The Kent Historic Environment Record (KHER), comprising a database of recorded archaeological sites, find spots, and archaeological events within the county (received 16 March 2017, additional data for extended OECC 11th July 2017);
- The National Heritage List for England maintained by HE, comprising data of designated heritage assets including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973;
- Historical maps and Ordnance Survey maps;
- Admiralty Charts and geological charts relevant to the study area;
- Grey literature reports relating to TOWF, listed in full in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1), but summarised here: archaeological assessment (Wessex Archaeology, 2005); archaeological assessments of marine geophysical data (Wessex Archaeology, 2006a, 2008b, 2008c); archaeological assessments of marine geotechnical data (Wessex Archaeology, 2006b, 2007b, 2007c, 2008a); the Written Scheme of Investigation (Wessex Archaeology, 2007d); a walkover survey (Wessex Archaeology, 2007e); a diver investigation of an anomaly (Wessex Archaeology, 2008d); and archaeological watching briefs (Wessex Archaeology, 2009; 2010a and 2010b);
- The archaeological interpretation from Nemo Link, UK-Belgium Electrical Interconnector Richborough to West-Zeebrugge: Archaeological EIA (Wessex Archaeology, 2016);
- Walkover survey conducted in July 2017 on Sandwich Flats to the south of Pegwell Bay to confirm the location of aircraft crash site (1035/ 71209); and
- Other relevant grey literature and published sources.

Desk-based assessment methodology

13.4.4 The data used to compile the marine archaeological technical report (Annex 13-1 (Document Ref: 6.4.13.1)) consisted of secondary information derived from a variety of sources. The assumption made, as with all archaeological assessments in the offshore area, is that the data, and any additional information, are reasonably accurate. The records held by the UKHO, NRHE, KHER and other sources used for the assessment are not a record of all of the surviving cultural heritage assets, but rather a record of those that have been discovered. The information therefore is not complete and does not preclude the subsequent discovery of further elements of the marine historic environment that are, at present, unknown.

13.4.5 The main themes relevant to the offshore archaeological baseline are: palaeogeography; seabed features, including shipwrecks and aviation sites; and historic seascape character.

13.4.6 Where possible, data with positional information were incorporated into a project Geographic Information System (GIS) using ArcGIS 10.2. The data were subsequently compiled into gazetteers of the archaeological resources within the study area. The NRHE and KHER records have been discriminated between records for which there is known material on the seabed, and 'recorded losses' (vessels that are known to have been lost, but do not, except by chance, have material on the seabed at their recorded loss location). Records of terrestrial sites in the intertidal zone, from the NRHE and KHER datasets, were given 1000 numbers, and are compiled in a gazetteer (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1): Appendix 4). The records with known material on the seabed, were given 2000 numbers, and are included in the 'wrecks and obstructions' gazetteer along with data from the UKHO (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1): Appendix 5). The 2000 numbers were then updated to 70000 numbers following the assessment of geophysical survey data. The recorded losses are in a separate gazetteer (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1): Appendix 6), and have been used to assess the potential for further discoveries. Information relating to the archaeological and cultural heritage that did not include location or positional information was used to inform the marine archaeological baseline assessment where relevant.

13.4.7 The baseline for palaeogeography was based on a review of geological mapping of seabed sediments, solid geology and bathymetry from published British Geological Society sources. This has been enhanced with the geophysical and geotechnical data assessed for the TOWF project. For the PEIR, the desk-based assessment was incorporated with the archaeological assessment of geophysical survey data for Thanet Extension. This review, alongside the known archaeological record, formed the basis for assessing the potential for submerged prehistory in the PEIR and ES.

13.4.8 The baseline for terrestrial, maritime and aviation archaeology was assessed by reviewing records of known features, wrecks, casualties and seabed features obtained from the UKHO, NRHE and KHER. The baseline assessment of maritime and aviation archaeology was further supplemented by a review of relevant primary and secondary source material in order to provide an indication on the nature of maritime and aviation activity across the region. It provides a background to assess the potential for further discoveries.

13.4.9 As noted in the MPS (DEFRA, 2011: 21), there is no legal definition of 'seascape' in the UK, but the European Landscape Convention defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/ or human factors', and therefore, seascape is taken to mean landscapes with views of coasts or seas, and coasts and seas with cultural, historical and archaeological links with each other. Historic seascape characterisation has already been undertaken by Cotswold Archaeology in 2012 - 2013, and this assessment is based on that work.

Archaeological assessment of Setting

13.4.10 This ES chapter refers specifically to the setting of offshore assets. The setting of onshore assets are addressed in Volume 3, Chapter 7: Onshore Historic Environment (Document Ref: 6.3.7).

13.4.11 The MPS (DEFRA, 2011: 22) notes that when considering the significance of heritage assets and their setting, 'the particular nature of the interest in the assets and the value they hold for this and future generations' must be taken into account, and this 'understanding should be applied to avoid or minimise conflict between conservation of that significance and any proposals for development'. In addition, it is desirable to sustain and enhance the significance of heritage assets and plans 'should adopt a general presumption in favour of the conservation of designated heritage assets within an appropriate setting.'

13.4.12 EN-1 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' (DECC, 2011a: 91). In addition, when 'considering applications for development affecting the setting of a designated heritage asset, the IPC should treat favourably applications that preserve those elements of the setting that make a positive contribution to, or better reveal the significance of, the asset' (*ibid*: 93).

13.4.13 Although the NPPF (Department for Communities and Local Government (DCLG), 2012) is designed to be applicable to local planning policy and the historic environment onshore, it provides a definition of setting that also applies to the historic environment. The NPPF defines setting as 'the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance, or may be neutral.' Furthermore, the significance of an asset can be harmed or lost through development occurring within its setting. As heritage assets are irreplaceable, any harm or loss to the setting of an asset needs to be justified (*ibid*). With regards to significance for heritage policy, the NPPF notes that the interest of a heritage asset 'may be archaeological, architectural, artistic or historic' (DCLG, 2012).

13.4.14 Currently, there is no specific guidance regarding the assessment of setting for offshore archaeological and cultural heritage assets. However, HE has produced guidance on setting, The Setting of Heritage Assets – Historic Environment Good Practice Advice in Planning 3 (2nd Edition) (2017), which has been updated since the PEIR was submitted. This guidance notes that although setting itself is 'not a heritage asset […] its importance lies in what it contributes to the significance of the heritage asset or the ability to appreciate that significance' (HE, 2017: 4). It provides general guidance on the extent of setting and notes that this is not fixed but can change over time. Submerged heritage assets and buried heritage assets 'may not be readily appreciated by a casual observer […but they…] retain a presence in the landscape and […] may have a setting' (HE, 2017: 5), such as the location and setting of historic battles 'which may include important strategic views, routes by which opposing forces approached each other and topography and landscape features that played a part in the outcome' (*ibid.*).

13.4.15 One aspect that may contribute to the setting of a heritage asset is referred to as 'views', which includes not only views that can contribute to its significance, but also intended views between heritage assets, and planned views. However, the guidance suggests that the appreciation of the setting of a site does not depend on the ability to access it (HE, 2017: 2).

13.4.16 The guidance (HE, 2017) provides a staged approach to proportionate decision-taking, and assessing the significance of settings and views. After the key attributes of the heritage asset itself have been assessed, the following should be considered: the physical surroundings and relationships with other assets; the intangible associations with its surroundings and patterns of use: the contribution made by noise and smells; and the way views allow the significance of the asset to be appreciated (HE, 2017: 10). For offshore archaeology, the two key considerations are the relationship of one asset with another and the intangible associations with its surroundings. The guidance also provides details about assessing potential effects from a development, how to minimise harm or maximise enhancement, and how to document the decision and monitor outcomes.

13.4.17 The assessment of setting in this document follows the guidance discussed in the paragraphs above, is based on the baseline assessment of the palaeogeography, maritime and aviation assets, and is described using the following two factors:

- Physical surroundings relationships with other assets, and views – which includes the physical presence of the asset on the seabed, its surroundings, and relationship with other assets and navigational hazards in the immediate area. Views to and from the asset, and how the asset is experienced in its immediate physical surroundings are also considered; and
- Intangible associations – including the way the asset is appreciated in a broader historical, artistic and intellectual capacity, and the asset's associations.

13.4.18 It should be noted that for heritage assets offshore, sites are generally only experienced by divers, Remotely Operated Vehicle (ROV), or by geophysical survey, and the views to the asset are often very limited due to reduced visibility in the water column. In addition, unlike many terrestrial sites, the position of the asset on the seabed has not been deliberately chosen. However, these sites still have a level of setting, related to their group or historical value. For example, some sites may have reached their position through military action (e.g. hitting a mine within a known minefield or in a battle) or have been lost due to a particular navigational hazard (e.g. hitting a harbour wall or being stranded on a particular sand bank for instance in the Goodwin Sands). Intangible factors may include associations with particular battles, wars, and other historic events, as well as how the wreck can be appreciated in its wider context, for example through well-known trade routes, collisions or local industry. Association between the asset and the local social history is another important aspect of an asset's intangible importance, including rescue attempts or losses occurring within modern memory.

13.4.19 It is not possible to ascertain the setting of currently unidentified marine heritage assets, where limited information is known, for example wrecks that have not been identified or characterised to determine their period of build, use or loss. Similarly, setting cannot be assessed for geophysical anomalies of archaeological potential or potential sites that have not yet been discovered. Subsequently, these features have not been provided with an assessment of setting. In the future, if further relevant information becomes available, then an assessment of the setting of these assets could be developed on a case-by-case basis.

13.4.20 As setting is integral to the understanding of assets and their significance, the assessment of setting is included within the baseline, rather than as a separate section, which would result in a duplication of information.

13.4.21 The effects a development may have on setting can be assessed by reviewing the development's location and siting, form and appearance, additional effects and permanence (*ibid.:* 10). The development should be assessed as to whether the development will enhance or harm the significance of the asset: through the principle of development alone; through the scale, prominence, proximity or placement; or through its detailed design (*ibid*).

13.4.22 This assessment indicates whether the setting (i.e. any relationship between deposits/ material with their wider environment) of offshore archaeological and cultural heritage assets could be altered, which could lead to an overall diminished value.

13.4.23 Should the development be assessed as harming the setting of an asset, potential mitigation measures are outlined in the guidance (*ibid*.: 12).

Archaeological assessment of geophysical survey data methodology

13.4.24 Detailed technical specifications for the acquisition of survey data by Fugro are available in the geophysical technical report (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2)). The data were gathered by three vessels: *Valkyrie* (inshore section of offshore OECC); RV *Discovery* (offshore section of offshore OECC); and MV *Fugro Pioneer* (site) (Figure 13.1). The survey results comprised sidescan sonar data, magnetometer data, multi-beam bathymetry data and sub-bottom profiler data.

13.4.25 The data were assessed for quality and suitability for archaeological purposes, and were rated based on a scale of good, average or variable (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2): Table 1). The quality of the sidescan sonar data have been rated as 'average' to 'variable'. The magnetometer data have been rated as 'average'. The multi-beam bathymetry data have been rated as 'good'. The sub-bottom profiler data has been rated as 'average' to 'good'.

13.4.26 Although the majority of the OECC was covered by 2016 geophysical survey data, there are some gaps. For example, there is no coverage for the 500 m turning areas (the grey boundaries related to the Site Investigation Boundary in Figure 13.1). In addition, there is no 2016 coverage for the amended route to the south (see the black hashed area in Figure 13.1). Where possible interpretation was incorporated from the consenting archaeological assessment of geophysical survey data undertaken for Nemo Link (Wessex Archaeology, 2016) (see orange area in Figure 13.1), however there remain some areas with no recent geophysical coverage. It should also be noted that the 2016 geophysical survey data gathered for Thanet Extension is of a higher resolution than the consenting data acquired for Nemo Link. In spite of these issues, the gaps are considered to be acceptable at this time, as they are relatively small, and further survey data will be acquired in the pre-construction phase, for example in conjunction with the UXO survey (discussed in more detail in the Mitigation Section (paragraph 13.16.14).

13.4.27 Details regarding the processing of geophysical survey data for archaeological assessment can be found in Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2).

13.4.28 The data were assessed and grouped, and provided with a 70,000 number, then a discrimination flag was added to the record in order to discriminate against those potential features which are not thought to be of an archaeological concern. For anomalies located on the seabed, the flags were ascribed as follows (Table 13.3).

Table 13.3: Criteria discriminating relevance of seabed features to proposed scheme

Discrimination	Flag	Description
Non-Archaeological	U1	Not of anthropogenic origin
	U2	Known non-archaeological feature
	U3	Non-archaeological hazard
Archaeological	A1	Anthropogenic origin of archaeological interest
	A2	Uncertain origin of possible archaeological interest
	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly

13.4.29 Similarly, the discrimination flags applied to shallow geological features of possible archaeological potential are ascribed as follows (Table 13.4).

Table 13.4: Criteria discriminating relevance of palaeogeographic features to proposed scheme

Discrimination	Flag	Description
Non-Archaeological	U2	Feature of non-archaeological interest
Archaeological	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material
	P2	Features of possible archaeological interest

13.4.30 The grouping and discrimination is based on all available information; however it is not definitive.

Archaeological assessment of geotechnical survey data methodology

13.4.31 The geotechnical data were provided to Wessex Archaeology as part of the Fugro survey technical report (Fugro, 2016) for Thanet Extension, which contained geotechnical logs for Thanet Extension. This comprised geotechnical logs from 10 locations within the array and one within the OECC, which were used to carry out the geoarchaeological assessment (Figure 13.2). The assessment comprised a Stage 1 assessment, within the five-stage approach developed by Wessex Archaeology (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2)). The Stage 1 assessment comprised a desk-based archaeological assessment of the vibrocore logs to establish the potential for the presence of horizons of archaeological interest, and to broadly characterise them, as the basis for deciding whether and what Stage 2 archaeological recording is required. Stage 2 comprises archaeological recording of selected retained or new core samples; Stage 3 is dependent on the results of Stage 2, and would comprise sub-sampling and palaeoenvironmental assessment; Stage 4 comprises full analysis of pollen, diatoms and/or foraminifera assessed during Stage 3; and Stage 5 comprises a final report for publication, if required. The geotechnical assessment will provide further information about the palaeogeography of the study area.

Cumulative impact methodology

13.4.32 Cumulative environmental assessment has been undertaken in accordance with guidelines issued by RenewableUK, Cumulative Impact Assessment Guidelines – Guiding principles for cumulative impacts assessment in offshore wind farms (2013), the Guidance for Assessment of Cumulative Impacts on the Historic Environment (Oxford Archaeology, 2008), and Advice Note 17: Cumulative Effects Assessment (PINS, 2015). The cumulative environmental assessment has been undertaken in section 13.14.

13.4.33 Cumulative impacts are considered to identify potentially significant impacts of the development in-combination or cumulatively with other projects or activities. Cumulative impacts are defined as those that result from additive impacts caused by other past, present and reasonably foreseeable actions, together with the plan, programme and project itself and in-combination impacts that arise from the reaction between impacts of a development plan, programme or project on different aspects of the environment (RenewableUK, 2013).

13.4.34 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 may be seen individually as minor, but collectively as significant. The emphasis in this assessment is on potentially significant impacts, rather than on any impact that could possibly occur.

13.4.35 The cumulative impact assessment has been undertaken within a three tier approach, based on the current stage of each project within the planning and development process (as discussed in more detail in Section 13.14). The assessment of cumulative impact considered whether impacts on a receptor can occur on a cumulative basis between Thanet Extension and other projects, within a 100 km radius. The boundary for assessment was developed based on best practice and through discussions with HE, as the offshore archaeological curator.

13.4.36 The types of impact assessed include: direct impact to offshore archaeological receptors; indirect impacts arising as a result of changes to sedimentary and erosion regimes; and indirect effects.

Transboundary effect methodology

13.4.37 Transboundary effects are those that extend across international boundaries. For the assessment of potential transboundary effects in relation to offshore archaeological and cultural heritage assets, the following aspects could be applicable: nationality of ship or aircraft, and crews; possible international links regarding the build and use of the vessel or aircraft; and palaeogeographic assets which have existed since before modern international boundaries and may have a level of international interest based on their relative scarcity.

13.4.38 In Scoping, it was determined that the likely hydrodynamic and sedimentary impacts of the proposed wind farm area and offshore OECC would be restricted to near-field only and therefore indirect transboundary impacts on offshore archaeological receptors are unlikely to occur. The assessment undertaken for PEIR and the ES has confirmed that effects will be restricted to near-field only (see Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2..2)), and as any known receptors, including foreign receptors that are now in British waters, have been recommended for AEZs, and as the extent of the AEZ has been developed to take into consideration the limited extent of indirect effects, indirect transboundary impacts are unlikely to occur.

13.5 Assessment criteria and assignment of significance

13.5.1 In order for the significance of any given impact to be fully understood, the sensitivity of any receptors that may be impacted need to be considered. The capability of a receptor to accommodate change and its ability to recover if affected is a function of its sensitivity. Receptor sensitivity is typically assessed via the following factors:

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

13.5.2 The MPS notes that heritage assets are 'a finite and often irreplaceable resource and can be vulnerable to a wide range of human activities and natural processes' (DEFRA, 2011: 21). It goes on to note that in considering the significance of heritage assets and their setting, the assessment 'should take into account the particular nature of the interest in the assets and the value they hold for this and future generations. This understanding should be applied to avoid or minimise conflict between conservation of that significance and any proposals for development' (*ibid:* 22).

13.5.3 As archaeological receptors cannot adapt, tolerate or recover from physical impacts caused by a proposed development, for the purpose of this assessment, the sensitivity of each asset will be quantified only by its value.

13.5.4 The UK Marine Policy also notes that it is desirable to sustain and enhance the significance of heritage assets, and any development should adopt a general presumption in favour of the conservation of designated heritage assets within an appropriate setting (*ibid*).

13.5.5 The *Overarching National Policy Statement for Energy (EN-1)* (DECC, 2011) notes that 'there should be a presumption in favour of the conservation of designated heritage assets and the more significant the designated heritage asset, the greater the presumption in favour of its conservation should be.' However, there are very few designated archaeological sites offshore, and non-designated sites are not necessarily of lesser value. Therefore, non-designated assets that can be demonstrated to be of equivalent value to designated sites are considered to be of equivalent significance to a designated asset for the purpose of this assessment.

13.5.6 There are a number of criteria for assessing a heritage asset's value, and these are considered in detail in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1,section 3.5). The following paragraphs provide a brief summary.

13.5.7 HE's *Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment* (HE 2008: 21) uses the following criteria: evidential value; historical value; aesthetic value and communal value.

13.5.8 Wreck sites can also be assessed using HE's *Designation Selection Guide for Ships and Boats* (English Heritage, 2012) with the following criteria: period; rarity; documentation; group value; survival/ condition; and potential. Wreck sites can also be evaluated using the criteria in *On the Importance of Shipwrecks* (Wessex Archaeology, 2006c), based on: build; use; loss; survival and investigation. To further supplement this approach, the Aggregate Levy Sustainability Fund (ALSF)-funded Marine Class Description and principles of selection for aggregate producing areas project (ALSF 5383), undertaken by Wessex Archaeology (Wessex Archaeology, 2008e), proposed a composite timeline that considers wrecks in five distinct date ranges: pre-1508; 1509 - 1815; 1816 - 1913; 1914 - 1945; post 1945. 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 value in our understanding of maritime activity and shipping movements during these periods. Wrecks that post-date 1816 are more plentiful, and their value can be assessed based on various themes, such as whether they illustrate a key narrative of the period. The perceived value of each marine archaeological asset is generally assessed and assigned on a case-by-case basis, and in line with research such as *Assessing Boats and Ships* (Wessex Archaeology, 2011a - c) and *Early Ships and Boats* (Wessex Archaeology 2013).

13.5.9 The nature of the archaeological resource is such that there is a high level of uncertainty concerning the distribution of potential, unknown archaeological remains on the seabed. It is often the case that data concerning the nature and extent of sites is out of date, extremely limited or entirely lacking. As a precautionary measure, unknown potential cultural heritage receptors are therefore considered to be of high sensitivity and high value.

13.5.10 The sensitivity/ importance of the marine archaeology and cultural heritage is defined in Table 13.5.

Table 13.5: Sensitivity/ importance of the environment

Receptor sensitivity/ importance	Description/ reason
High	Best known or 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 are likely to fall within this category. Wrecked ships and aircraft that are protected under the Protection of Wrecks Act 1973, Ancient Monuments and Archaeological Areas Act 1979 or Protection of Military Remains Act 1986 with an international dimension to their importance, plus as-yet undesignated sites that are demonstrably of equivalent archaeological value. Known submerged prehistoric sites and landscapes with the confirmed presence of largely *in situ* artefactual material. 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 district level 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 moderate potential based on a formal assessment of their importance in terms of build, use, loss, survival and investigation. 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/ district dimension to their importance are likely to fall within this category.
Negligible	Poor example and/ or little or no potential to contribute to knowledge and understanding and/ or outreach. Assets with little or no surviving archaeological interest.

13.5.11 The magnitude of an effect upon known and potential marine archaeological receptors has been considered between very low and very high, and is defined by the following factors:

- Extent – the area over which an effect occurs;
- Duration – the time for which the effect occurs;
- Frequency – how often the effect occurs; and
- Severity – the degree of change relative to existing environmental conditions.

13.5.12 Magnitude of impact is defined in Table 13.6.

Table 13.6: Magnitude of impact

Magnitude	Definition
High	Total or considerable loss of or alteration to key elements or features of the pre-development conditions, such that the post-development character of the archaeological heritage asset would be fundamentally or considerably changed. For beneficial – total or considerable protection and understanding gained from key elements or features above and beyond the pre-development conditions, such that the post-development character of the archaeological heritage asset would be fundamentally better understood.
Medium	Loss of or alteration to key elements or features of the pre-development conditions, such that the post-project character of the archaeological heritage asset would be partially changed. For beneficial – protection and understanding gained from key elements or features above the pre-development conditions, such that the post-development character of the archaeological heritage asset would be considerably better understood.
Low	Minor alteration from pre-development conditions.
Negligible	No or unquantifiable change to pre-development conditions.

13.5.13 Assessment of the significance of potential effects is described in Table 13.7. Evaluations of the magnitude of impacts were combined with evaluations of the sensitivity of receptors in order to provide a resulting significance with clear definition.

13.5.14 Mitigation has only been recommended to reduce significant effects identified within this assessment.

Table 13.7: Significance of potential effects

		Sensitivity			
		High	Medium	Low	Negligible
Negative Magnitude	High	*Major*	*Major*	*Moderate*	*Minor*
	Medium	*Major*	*Moderate*	*Minor*	*Negligible*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*
	Negligible	*Minor*	*Minor*	*Negligible*	*Negligible*
Beneficial Magnitude	Negligible	*Minor*	*Minor*	*Negligible*	*Negligible*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*
	Medium	*Major*	*Moderate*	*Minor*	*Negligible*
	High	*Major*	*Major*	*Moderate*	*Minor*

Note: shaded cells are defined as significant effects with regards the EIA Regulations.

13.5.15 Based on the assessment matrix above, the significance of potential effects has been assessed as either 'beneficial', 'negligible' or 'adverse'.

13.6 Uncertainty and technical difficulties encountered

13.6.1 The offshore archaeology and cultural heritage assessment has been based on secondary information derived from a number of sources, and the assumption made is that the data, and any additional information, are reasonably accurate.

13.6.2 The assessment of geophysical survey data did not cover the 500 m turning circles. In addition, there are data gaps between the geophysical survey data assessed for Thanet Extension and the consenting geophysical survey data acquired from Nemo Link. It should also be noted that the data integrated from Nemo Link is of a lower resolution, and it is possible that additional geophysical anomalies could be discovered in the area. Any further geophysical survey data gathered in these areas should be archaeologically assessed, as per recommendations in section 13.10.

13.6.3 The worst-case scenario has been adopted to cope with uncertainties and reduce risk of later design modifications falling outside of the assessment envelope.

13.7 Existing environment

13.7.1 Two technical reports were produced for the area of the array and the OECC: Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2). A review of the key findings from those studies has been incorporated into the description of the existing environment

13.7.2 The offshore archaeology and cultural heritage baseline was assessed in relation to three themes: palaeogeography; seabed features, including maritime and aviation sites; and historic seascape character.

The array

Palaeogeography

13.7.3 There are no designated sites or known sites within the array. However, there is potential for archaeological material of a prehistoric date to exist within the study area. A detailed description of the geological and prehistoric baselines, and a detailed palaeogeographic assessment can be found in Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2), however this section provides a summary.

13.7.4 Thanet Extension is situated at the southern end of the North Sea basin. The background geology is dominated by Cretaceous chalk bedrock, overlain by early Tertiary (Palaeocene) sands and clays. The Pleistocene history of the southern North Sea is dominated by repeated glacial/ interglacial cycles, and associated rises and falls in relative sea level, which resulted in large areas of the southern North Sea being periodically exposed as a terrestrial environment. The coast off Kent and the English Channel did not directly experience glaciation, and there is potential for currently submerged palaeolandscape features to be well preserved. However, the changing routes of river systems, including the Thames, has resulted in a cyclical deposition of gravel terrace and flood plain deposits (Wessex Archaeology, 2010d), and therefore although some Pleistocene deposits may survive on the seabed, others are likely to have been reworked or removed by the subsequent marine transgressions (Hamblin *et al.*, 1992).

13.7.5 Overlying these sediments is a sequence of Holocene deposits, comprising two sections: the first is a continuation of underlying Pleistocene terrestrial sediments; and the second comprise marine sediments (sands and gravels) (British Geological Survey (BGS), 1990) deposited since the most recent marine transgression (c. 7,000 – 5,000 Before Present (BP)).

13.7.6 The potential for archaeological material and palaeoenvironmental material in the southern North Sea is directly linked to the glacial/ interglacial cycles and associated changes of environment across the region. During periods of relatively low sea level, the exposed landscape would have provided habitable environments for hominins (human ancestors). Archaeological investigations of the North Sea basin have revealed that considerable areas of what is now seabed were once dry land during the Middle and Late Pleistocene and the Holocene (Bicket and Tizzard, 2015; Dix and Sturt, 2011; Gaffney *et al*., 2007; Gupta *et al*., 2004; Momber, 2000; Momber *et al.,* 2012).

13.7.7 The occupation of Britain has now been dated back to almost one million years ago, as the site at Happisburgh has been dated to around 900,000 BP (Parfitt *et al*. 2005, 2010). Closer to the study area, are the Pleistocene Terrace deposits of the River Stour, high-level pre-Anglian terrace deposits at Fordwich, Canterbury and on the Blean plateau, containing rare evidence of early pre-Anglian occupation, dating to 700,000 – 500,000 BP.

13.7.8 The middle-level terraces of the Stour in the vicinity of Canterbury have produced large concentrations of Lower Palaeolithic artefacts, representing evidence of re-settlement in the period after the Anglian Glaciation, from 425,000 – 250,000 BP. However, the primary source of extant Middle Palaeolithic artefacts in the study area is the 'Head/ Brickearth', which has produced numerous handaxes in the Stour Basin, but also evidence of the Neanderthal occupation in the last glaciation c. 80,000 – 50,000 BP. The material also has the potential to contain evidence of final Upper Palaeolithic and Mesolithic remains.

13.7.9 The Mesolithic period began in the early Holocene. Around 10,000 BP, sea levels were still more than 60 m below current levels, and during this period, an extremely large area of the southern North Sea and English Channel was dry land, suitable for human occupation. However, between 7,000 and 5,000 BP, much of the land was inundated by eustatically driven sea level change (Bicket and Tizzard, 2015); by 6,000 BP, sea level was only approximately 7 m below the present level (Cameron *et al.,* 1992).

13.7.10 The palaeogeographic assessment of the array identified a number of palaeogeographic features of archaeological potential. These are discussed in detail in Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2), and summarised here ((Figure 13.2). The shallow geology of the array site can be relatively complex. In the south, the shallow geology is dominated by chalk bedrock overlain by seabed sediment, with a few isolated channel features cut into the chalk. In the north, Tertiary deposits overlay the chalk bedrock, which are in turn cut by an extensive complex of channel deposits. The identified geology has been divided into 4 units during previous phases of work (Wessex Archaeology, 2006a; 2007b): Unit 1 (Holocene – modern seabed sediment sands and gravels, not of potential in itself, but could cover archaeological sites such as wrecks); Unit 2 (subdivided into five phases, but in general, early Holocene/ Pleistocene, complex channel deposits, medium to high potential for *in situ* and derived deposits from within and immediately surrounding features); Units 3 and 4 – Tertiary and Cretaceous, pre-date earliest human occupation of the UK.

13.7.11 The five phases of Unit 2 outline the evolution of the prehistoric landscape, as follows ((Figure 13.2):

- Phase 1 – Initial, large cut of the Thames shortly after its migration south caused by the advancing Anglian ice sheet (75005, 75007, 75008, 75010, and 75014);
- Phase 2 – Large scour feature cut across the Thames channel, potentially caused by the outflowing of an ice-dammed lake and relating to the Lobourg Channel and formation of the Dover Strait. Filled by marine sediment from the subsequent marine transgression (75016);
- Phase 3 – Series of meandering smaller channels cutting across the landscape after silting up of the main Thames channel (75000 - 4, 75006, 75009, 75011, 75017, 75018 and 75019);
- Phase 4 – Deposition of sediment over an erosion surface, possibly the land surface associated with Phase 3, potentially with overbank and/or lacustrine deposits (75012 and 75013); and
- Phase 5 – Delta top complex formed during the Holocene marine transgression, as rising sea levels pushed the Thames estuary towards its current position (75015).

13.7.12 As terrestrial features deposited during periods of known human occupation of the UK, Phases 1, 3, 4 and 5 are considered of high archaeological potential. Phase 2 is interpreted as medium archaeological potential, partly due to the interpreted marine nature of the fill sediments, and partly due to uncertainties about the interpretation.

13.7.13 On the basis of age and the relative rarity of Palaeolithic and Mesolithic finds underwater, if any sites or material were discovered, they would likely be of probably national archaeological importance, and therefore of high value. A guidance note published by English Heritage (now HE) *Identifying and Protecting Palaeolithic Remains: archaeological guidance for planning authorities and developers* (1998) indicated that sites containing Palaeolithic features are so rare in Britain that they should be regarded as of national importance and wherever possible should remain undisturbed.

13.7.14 The setting of palaeolandscape features is integral to their value and importance. Although there are no views to the features nor ways they can be experienced on the seabed, their position is critical to how palaeolandscapes were experienced by past peoples, and their intangible setting includes national and international research into the Palaeolithic and Mesolithic periods across the UK and Europe. If further relevant information regarding these features becomes available in the future, then an assessment of their setting may be undertaken.

13.7.15 If undisturbed by development, the baseline discussed above is likely to remain relatively unchanged for the foreseeable future.

THANET EXTENSION OFFSHORE WIND FARM

Figure 13.2

Palaeogeographic features of archaeological potential

Legend

- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout

Phase 1 Channels
- Acoustic Blanking
- Channel
- Acoustic Blanking

Phase 2 Channels
- Channel

Phase 3 Channels
- Simple Cut and Fill
- Acoustic Blanking
- Channel

Phase 4 Erosion Surfaces
- Erosion Surface

Phase 5 Channel Complex
- Channel Complex

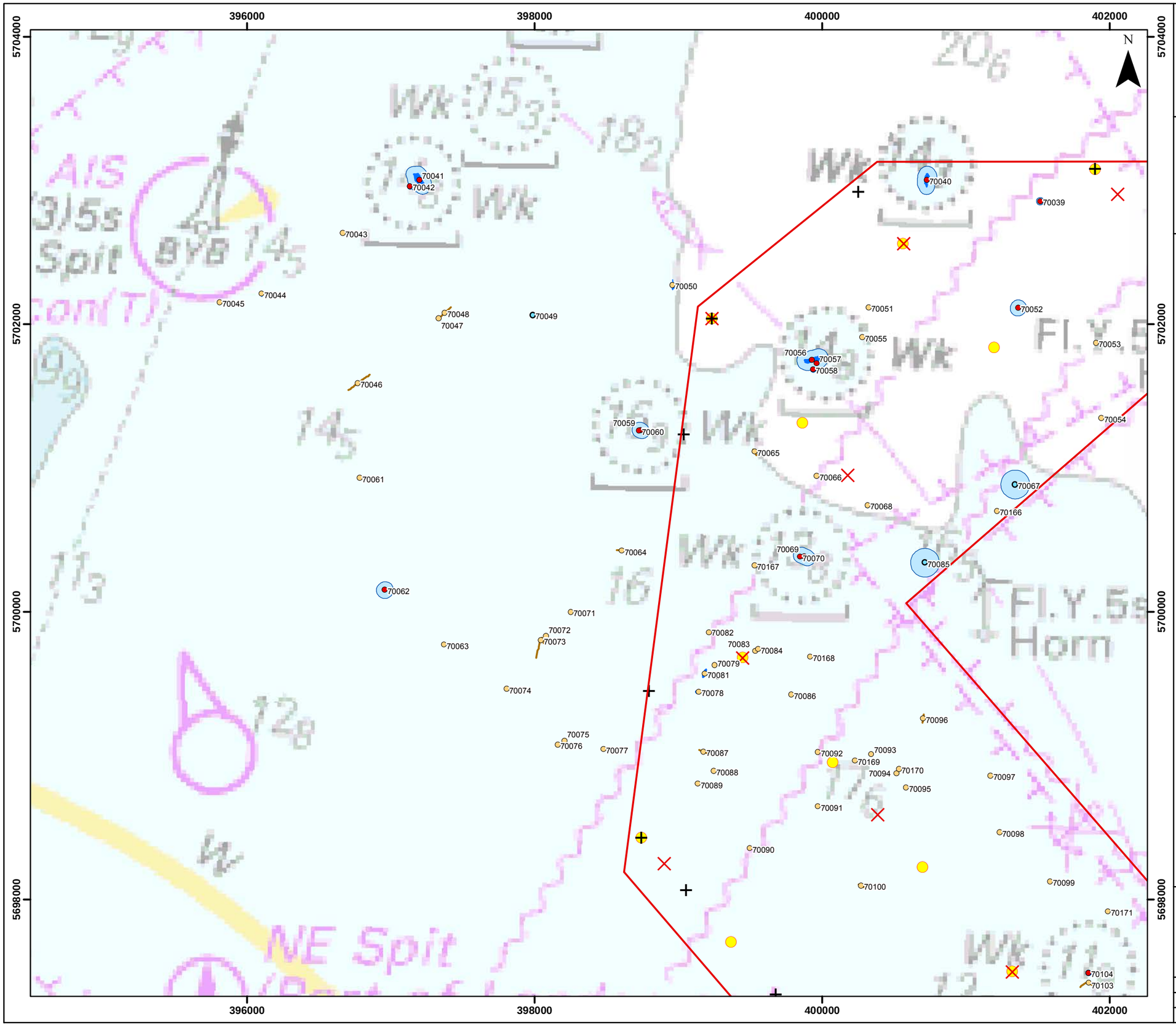
Geotechnical sample locations (Fugro 2016)
- CPT
- CPT and Vibrocore

Datum: ETRS 1989
Projection: UTM31N

1:60,000 0 0.65 1.3 km 0 0.35 0.7 nm

Drg No	Fig_13.2		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.2



THANET EXTENSION OFFSHORE WIND FARM

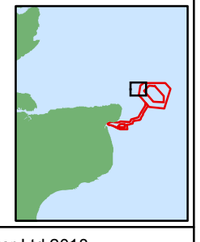
Figure 13.3

Seabed features of archaeological potential in Thanet Extension Site Area

Legend

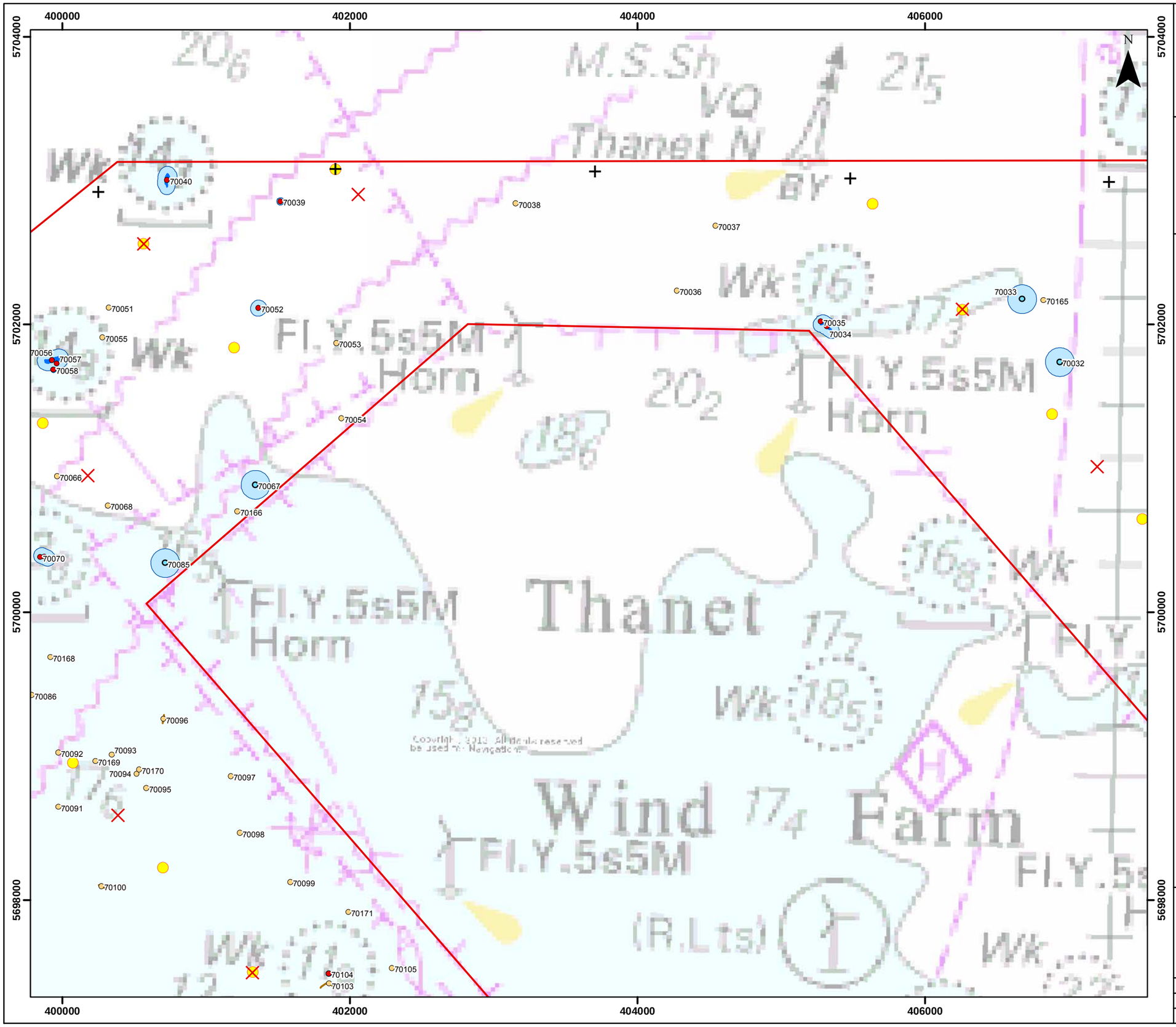
- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended AEZs

Datum: ETRS 1989
Projection: UTM31N



1:26,250 0 0.25 0.5 km 0 0.15 0.3 nm

Drg No	Fig_13.3-7			**Figure 13.3**
Rev	3	Date	24/05/2018	
By	KL	Layout	N/A	



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

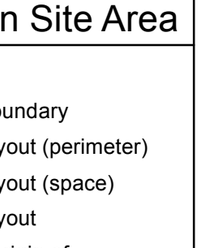
Figure 13.4

Seabed features of archaeological potential in Thanet Extension Site Area

Legend

- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended AEZs

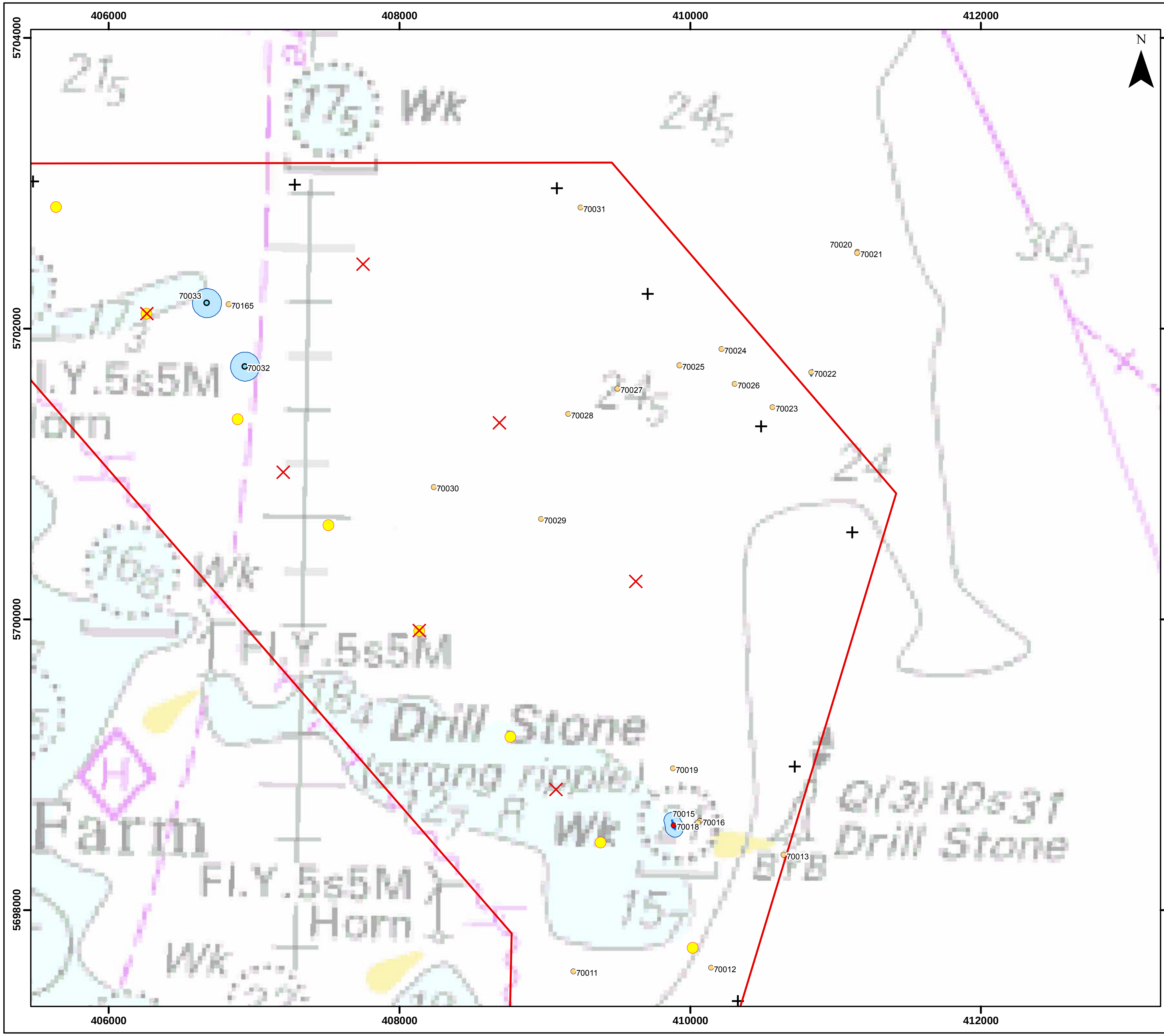
Datum: ETRS 1989
Projection: UTM31N



1:26,250 0 0.25 0.5 km 0 0.15 0.3 nm

Drg No	Fig_13.3-7		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.4



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

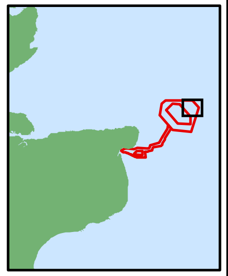
Figure 13.5

Seabed features of archaeological potential in Thanet Extension Site Area

Legend

- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended AEZs

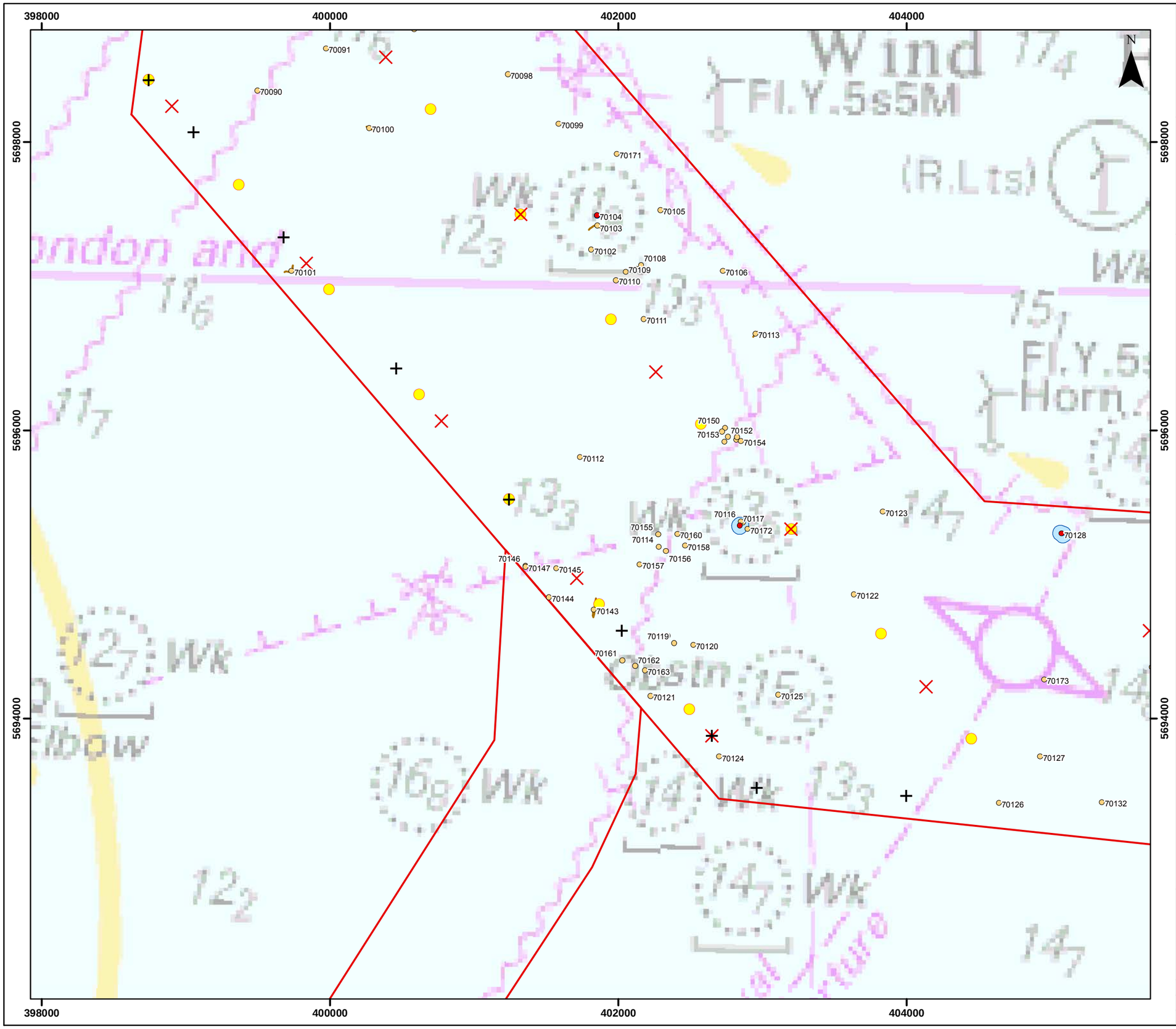
Datum: ETRS 1989
Projection: UTM31N



NOT FOR NAVIGATION

1:26,250 — 0 0.25 0.5 km — 0 0.15 0.3 nm

Drg No	Fig_13.3-7			Figure 13.5
Rev	3	Date	24/05/2018	
By	KL	Layout	N/A	



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

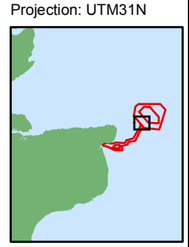
Figure 13.6

Seabed features of archaeological potential in Thanet Extension Site Area

Legend

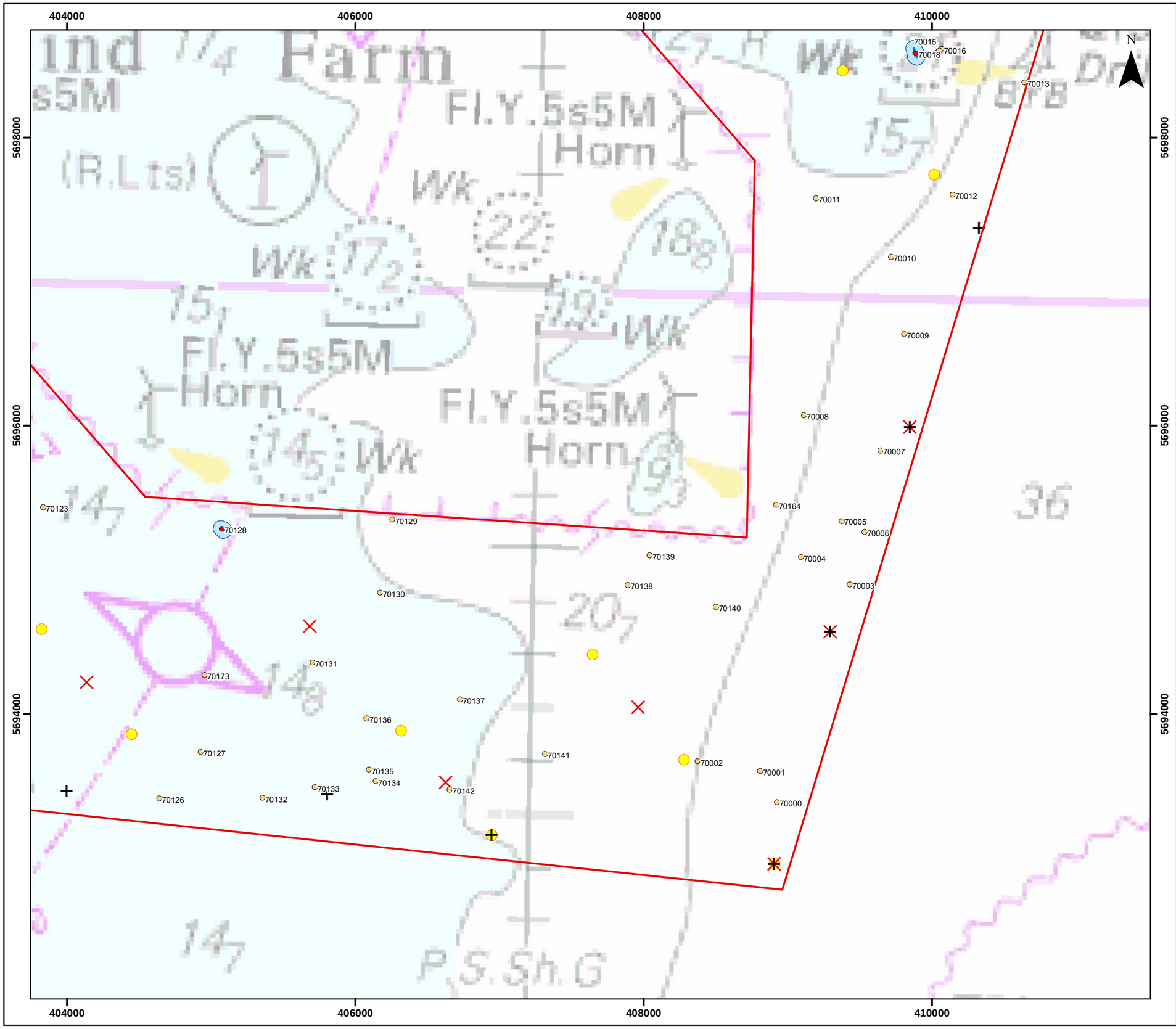
- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- Linear features
- Site extents
- Recommended AEZs

Datum: ETRS 1989
Projection: UTM31N



1:26,250 0 0.25 0.5 km 0 0.15 0.3 nm

Drg No	Fig_13.3-7			**Figure 13.6**
Rev	3	Date	24/05/2018	
By	KL	Layout	N/A	



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

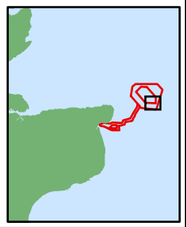
Figure 13.7

Seabed features of archaeological potential in Thanet Extension Site Area

Legend

- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- Site extents
- Recommended AEZs

Datum: ETRS 1989
Projection: UTM31N



1:26,250 0 0.25 0.5 km 0 0.15 0.3 nm

Drg No	Fig_13.3-7		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.7

Seabed features

13.7.16 An archaeological assessment of the 2016 geophysical survey datasets was undertaken by Wessex Archaeology, and where the proposed export cable route deviates from the original study area, interpretation from the 2010 data assessed for Nemo Link (Wessex Archaeology, 2016). Any sites from the previous 2006 and 2008 TOWF assessments (Wessex Archaeology 2006a; 2008b and c), that fall within the current survey areas have been included in the results. The results have been informed by data received from the UKHO, NRHE and KHER. The marine archaeology technical report (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)) and Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2) provide details about the wrecks and obstructions on the seabed, and this section provides a brief summary (Figure 13.3 to Figure 13.7). The ES results are also informed by data from the Nemo Link UXO survey, that were released following the production of the PEIR, regarding aircraft material.

13.7.17 Within the Offshore Red Line Boundary, a total of 150 geophysical anomalies of potential archaeological interest were identified (Table 13.8). Details of the assessment can be found Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2). None of these sites has been designated.

Table 13.8: Anomalies of archaeological potential within the Thanet Extension array area

Archaeological Discrimination	Quantity	Interpretation
A1	14	Anthropogenic origin of archaeological interest
A2	130	Uncertain origin of possible archaeological interest
A3	4	Historic record of possible archaeological interest with no corresponding geophysical anomaly
TOTAL	148	

13.7.18 The 14 anomalies classified as A1, have been classified as possible wrecks, wreck debris, Figure 13.3 to Figure 13.7).

13.7.19 A total of 130 anomalies have an A2 discrimination of features of uncertain origin but possible archaeological interest. These anomalies have been classed as follows: seven items of debris; five debris fields; five mounds; 67 dark reflectors; two bright reflectors (indicating their possible construction of material such as plastic, rubber, wood or fibreglass); 10 lengths of rope/ chain; 7 seafloor disturbances (potential buried or partially buried wreck sites or debris); and 27 magnetic anomalies with no associated visible material on the seabed.

13.7.20 Four anomalies have been classed as A3 anomalies, which are records from the UKHO, NRHE, KHER or other sources for which there is no corresponding geophysical anomaly on the seabed. Two are records of possible wrecks, while the remaining two are historic records of obstructions. It is possible that these features are still present, however have been covered over by mobile sediments, therefore they have been retained as potential archaeology.

13.7.21 Three of the shipwrecks (one A3 anomaly: 70032, and two A1 anomalies: 70040, and 70056) have been named through UKHO survey. For these wrecks it is possible to assess their value based on the date of build, use and loss, and their survival on the seabed. These shipwrecks are assessed as of medium to high value, based on construction pre-1913 (70032, 70040 and 70056), and/ or the fact that they were lost to military action during the First World War (70032, 70040 and 70056).

13.7.22 The setting of known, identified wrecks can also be taken into consideration. All of the wrecks were lost during the First or Second World War, and therefore their setting is within the wider First World War and Second World War military landscape of the study area and beyond. The history of these losses provide a broader understanding of how these incidents fit into these international military events. For instance, two of these vessels (70040 and 70056) were sunk by German submarines UB 10 and UB 6, respectively. Each of these losses is very much a product of its location at the time of loss, even though the position on the seabed was not deliberately selected. The setting of these wrecks is sensitive and could be diminished through impact.

13.7.23 For the wrecks and possible wrecks that have not yet been named or characterised, as the age of these sites is unknown, their value is also presently unknown, and should be treated as high until proven otherwise. It is also not possible to assess the setting of these sites.

13.7.24 For the 130 anomalies with an A2 discrimination, there is presently too little information known about them to assess their value in detail, but they should be considered of high value until proven otherwise. Should further evaluation reveal them to be wreck-related material, they will have to be assessed on a case-by-case basis.

13.7.25 There is potential for the presence of archaeological material of a maritime nature, spanning from the Mesolithic period to the present day within the array and OECC study areas. The potential is summarised by general date ranges, based on the *Selection Guide: Boats and Ships in Archaeological Contexts* (Wessex Archaeology 2008e). in Table 13.9 below, but is discussed in more detail in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1).

Table 13.9: Summary of maritime potential by period

Period	Summary
Pre - 1508	Potential for material associated with prehistoric maritime activities, including coastal travel, fishing and the exploitation of other marine and coastal resources. Vessels of this period include rafts, hide covered watercraft and log boats. The discovery of a dugout canoe thought to date to the Late Neolithic, at Westgate-on-Sea on the north coast of Thanet (Perkins, 1997:7) highlights the potential for early maritime activity.
	Potential for material associated with later prehistoric maritime activities, including seaworthy watercraft suitable for overseas 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, such as the one discovered in Dover (McGrail, 2001), that are associated with a growing scale of seafaring activities. Thanet was an important prehistoric centre of social and economic activity, increasing the potential for discoveries.
	This coastline is where Caesar and Claudius launched the Roman invasion of Britain, and the major port of Richborough was established in *Anno Domini* (AD) 43, which remained important until the early medieval period. Therefore, there is particular potential for discoveries at the mouth of the Wantsum Channel. In addition, there is considerable 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. During the Romano-British period, the importance of the Thames increased, as London became the political and economic centre of Roman Britain, and smaller ports on the coast of Kent may have served as intermediate centres for loading cargo.
	Ebbsfleet is also of historical note, and is said to be the site of the arrival of the Saxons Hengist and Horsa in AD 449, who led the English in their conquest of Britain, and the landing place of the Augustinian mission returning Christianity to England in AD 597. In addition, there is 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 including changes in 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. Potential for vessels involved in military action, such as the One Hundred Years' War (Wessex Archaeology, 2004). 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. The Wantsum Channel was navigable until the beginning of the medieval period. In addition, during the medieval period, Sandwich was one of the Cinque Ports, which also increased the prestige, and volume of traffic, of Ramsgate.
1509 to 1815	Vessels of this period continued to variously represent both the clinker techniques and construction utilising the flush-laid strakes technique. There is increasing potential for post-medieval shipwrecks associated with the expansion of transoceanic communications and the opening up of the New World. There is increasing potential for post-medieval shipwrecks associated with the establishment of the Royal Navy during the Tudor period and increasing scale of battles at sea, such as the Spanish Armada in the 16th century, and the Franco-Spanish and Anglo-Dutch wars in the 17th century (Wessex Archaeology, 2004). There is increasing potential for post-medieval shipwrecks associated with continuing local trade and marine exploitation. In the 18th and early 19th century, Ramsgate had an important fishing fleet, and the harbour was expanded for it and for merchant shipping.
1816 to 1913	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

Period	Summary
	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. Also potential for vessels associated with leisure activities and travel to seaside resorts.
1914 to 1945	Potential for the discovery of shipwrecks associated with the First and Second 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. During the First World War, Ramsgate was taken over as a naval base, and Richborough Port was developed to supply the Western Front.
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, losses 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.

13.7.26 The potential for further discoveries has been explored further through assessments of recorded losses, navigational hazards and potential for preservation. These are summarised here, but discussed in more detail in Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1).

13.7.27 According to the UKHO, NRHE and KHER datasets, there are 226 recorded losses in the study area, these are ships that were reported missing but for which no remains have yet been discovered on the seabed, and their recorded location is somewhat arbitrary. It should be noted that only one of the recorded losses is positioned within the array area, the rest are within the OECC, but this is not surprising, as losses closer to shore were more likely to have been witnessed and recorded. Overall, the recorded losses suggest general potential for the types and character of vessels moving through the general study area over time. They date from the early 15th century to the modern period, cover a wide range of vessel types, and suggest causes of loss from being driven ashore, to loss during storms, stranding and even striking the pier while entering harbour. Very few recorded losses relate to either the First or Second World War, and although many of the loss locations for these wrecks were more precisely recorded and therefore the wreck sites are known, there is still potential for wrecks dating to these periods.

13.7.28 The study area falls within an area of high navigational hazard, as assessed by Bournemouth University (Merrit *et al.,* 2007). This is due to the wide areas of mudflats as well as the proximity to the Goodwin Sands. The *Dover Heritage Strategy 2013* (Heritage Conservation Group, KCC, 2013) notes that the Goodwin Sands have always been a dangerous area for shipwrecks, and that the area contains several hundred wrecks, five of which have been protected. The mobility of the sands posed additional challenges (Cant, 2013). Overall, the Goodwins are considered to have international and localised significance not only as the gateway to the Continent, and as a major navigational hazard, but also for the way they have become embedded in historical narratives of the area and in present consciousness, through art and literature (Cant, 2013).

13.7.29 The potential for preservation is influenced by the composition of the seabed, and areas of deep mud afford far greater protection for organic materials than bedrock (Gregory, 2006; Merritt *et al.,* 2007). Therefore, the mudflats of Pegwell Bay provide an opportunity for high levels of preservation. Areas of sand, and to a slightly lesser extent, areas of gravelly sand, the predominant seabed types of the study area, also provide some degree of protection. The areas of gravel seabed are less likely to afford protection for organic remains, however there is still potential for aluminium and other metal wreckage to be present.

13.7.30 Due to the location of the study area, in a wider landscape of maritime transport and military battles at sea, potential wreck sites could have settings relating to wider events, and therefore be of additional importance.

13.7.31 In the 20th century, there is also potential for aircraft remains (Wessex Archaeology 2008f). Prior to the First World War there was limited commercial civil aviation, however the First World War saw the early development of military aviation and the beginnings of naval aviation. During this period, aircraft were lightweight, and made of wood and other light materials. In the inter-war years, there was increasing cross-channel services to various European and worldwide destinations, and metal largely replaced wood in airframe construction. By the Second World War, airplane technology had developed considerably. Early in the war, there were Luftwaffe attacks on the UK, and these were the predominant reason for flights over the English Channel. By the middle of the war, this emphasis had shifted and the Allies were attacking Continental Europe, principally by bomber fleets based in eastern England, and maritime patrols. There was mass production of aircraft, leading to considerable quantities of aircraft, and a significant amount of flying occurred over the sea. From the end of the war to the present, civilian air travel has increased. Military aircraft was, until the 1990s, dominated by the Cold War. These aircraft crash events are more likely to have been accurately recorded and positioned, however there is still potential for material.

13.7.32 There are 16 recorded losses of aircraft within the study area, and although all of these relate to locations within the OECC, as their remains have not been confirmed on the seabed, their location is not presently known and they could be discovered in the wider area. All 16 aircraft were in military service when they were lost, and therefore all would be protected under the Protection of Military Remains Act 1986 should their remains be discovered. In addition, there are considerable numbers of other recorded losses around the coast of Kent and numerous British Air/ Sea Rescue operations (Wessex Archaeology 2008f), and it is possible that material from these sites could be present in the study area.

13.7.33 Any further shipwreck or aircraft material discovered would have to be assessed on a case-by-case basis, but shipwreck material should be considered to be of high value and aircraft material of very high value until proven otherwise.

13.7.34 If undisturbed by development, the baseline discussed above is likely to remain relatively unchanged for the foreseeable future.

Historic Seascape Characterisation

13.7.35 Scoping identified HSC as a data source, in order to assess the key cultural processes that have shaped the historic seascape within a given area and to understand impacts where proposed development activities result in changes to its character. However, HSC was not identified within the Scoping summary of potential impacts to be scoped in to the PEIR assessment. In the PEIR consultation process, HE indicated that the ES assessment should seek to examine how those perceptions of historic seascape could change due to the development, and therefore the potential impacts have been considered in this ES. This inclusion will ensure a comprehensive assessment of the potential impacts of the development. In order to inform the ES, a review has been undertaken in order to understand the HSC of the study area and to inform the assessment of how the seascape and perceptions of the seascape could change.

13.7.36 As part of the National Heritage Protection Plan (NHPP), HE (formerly English Heritage), commissioned an HSC for the Thames Estuary and Kent. The work was undertaken by Cotswold Archaeology (http://www.cotswoldarchaeology.co.uk/seascape/ , http://www.cotswoldarchaeology.co.uk/seascape-2/ accessed 11/05/2017). The project completed HSC in accord with the national HSC Method that extends and applies the principles already in use for Historic Landscape Characterisation (HLC) to the coast and seas.

13.7.37 The method assesses and defines areas with HSC types that promote an understanding of historic trends and processes, in order to inform the sustainable management of change over time. This is achieved by addressing the multi-level character of the sea, by splitting the marine zone into five tiered levels: the coastal area, the sea surface, the water column, the sea floor and the sub-sea floor. The characterisation is GIS based, enabling key characteristics to be identified.

13.7.38 Within the array area, the seascape character is dominated by the following character types: the seabed consists of coarse sediment plains, fine sediment plains, palaeolandscape components, and palaeochannels. Industrial uses include fixed net fishing, bottom trawling, pelagic trawling, submarine telecommunications cables, submarine power cables, spoil and waste dumping, and the renewable energy wind installation of TOWF. The area is a commercial shipping route. Navigational features include buoys, safety areas, and the area is marked by navigational hazards such as wrecks, maritime debris, water turbulence, and hazardous water. The area is also a military practice area.

13.7.39 The HSC of the array area is considered to be of medium archaeological value, due to the area's important and prolonged maritime history and its continued use today. The nature of HSC is such that it reflects not only the past character of the seascape but also the present, and therefore it will be impacted by the development.

13.7.40 If undisturbed by development, the baseline discussed above is likely to remain relatively unchanged for the foreseeable future.

The offshore export cable corridor

13.7.41 Two technical reports cover the OECC area (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2)). A review of the key findings from those studies has been incorporated into the description of the existing environment (Figure 13.8 -Figure 13.26).

Palaeogeography

13.7.42 There are no designated sites or known sites within the OECC.

13.7.43 The geophysical technical report Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2)) noted that the shallow geology of the export cable route is considerably simpler than that of the wind farm site. Of the stratigraphic units outlined above, only three have been identified along the export cable route: Unit 4, Unit 3 and Unit 1. Both Unit 4 and 3 pre-date the earliest human occupation of the UK, and therefore are not considered to be of archaeological potential. Unit 1 comprises modern seabed sediment and is not of archaeological interest in itself, but it may cover archaeological sites, such as shipwrecks, especially in areas of mobile sand sediment where larger sand waves can form.

13.7.44 Pegwell Bay, the landfall site of the OECC, forms the final drainage point of the basin of the river Stour. The Stour Valley is associated with extensive outcrops of Middle-Late Pleistocene fluvial river terrace deposits, that occur along its length but are best studied upstream of the cable landfall. Onshore, there are deeply buried and little investigated Pleistocene fluvial river deposits in the lower ground (potentially including the intertidal and offshore zone). It is also possible that deposits of 'Head/ Brickearth', complex deposits of Pleistocene slope wash and Holocene colluvium, could be present in localised places in the intertidal and offshore zone, however, it is likely that these have been eroded by subsequent marine transgressions.

13.7.45 Only one geotechnical sample was acquired by Fugro along the OECC, so the palaeogeographic interpretation is mainly based on a combination of the sub-bottom profiler data, BGS charts and the geotechnical samples acquired from the array.

Terrestrial features in the intertidal zone

13.7.46 Following the amendment of the OECC (Offshore Cable Corridor shapefile from 3 January 2018), there are no terrestrial features in the study area. However, the evidence of known terrestrial sites in the wider intertidal zone (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)) highlights the potential for further discoveries. These discoveries would have to be assessed on a case-by-case basis, within the wider landscape framework, but in general, finds from the Neolithic period onwards are likely to provide evidence of the changing coastline over time and of activities in the intertidal zone. The intertidal area has the potential to include material relating to settlement and activity of the margins of the Wantsum Channel, and depending on their nature and preservation, could be of high significance and value. In addition, remnant material from demolished Second World War features could also be present.

13.7.47 If undisturbed by development, the baseline discussed above is likely to remain relatively unchanged for the foreseeable future.

400800 401100 401400 401700 402000 402300

5694900 5694600 5694300 5694000 5693700

N

70174 70175 70177 70176 70178 70179 70180 70181 70183 70182 70185

wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

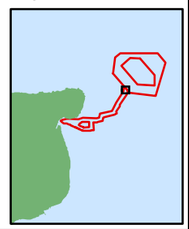
Figure 13.8

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- Indicative 28 WTG layout (perimeter)
- Indicative 28 WTG layout (space)
- Indicative 34 WTG layout
- A2 – Uncertain origin of possible archaeological interest
- Linear features

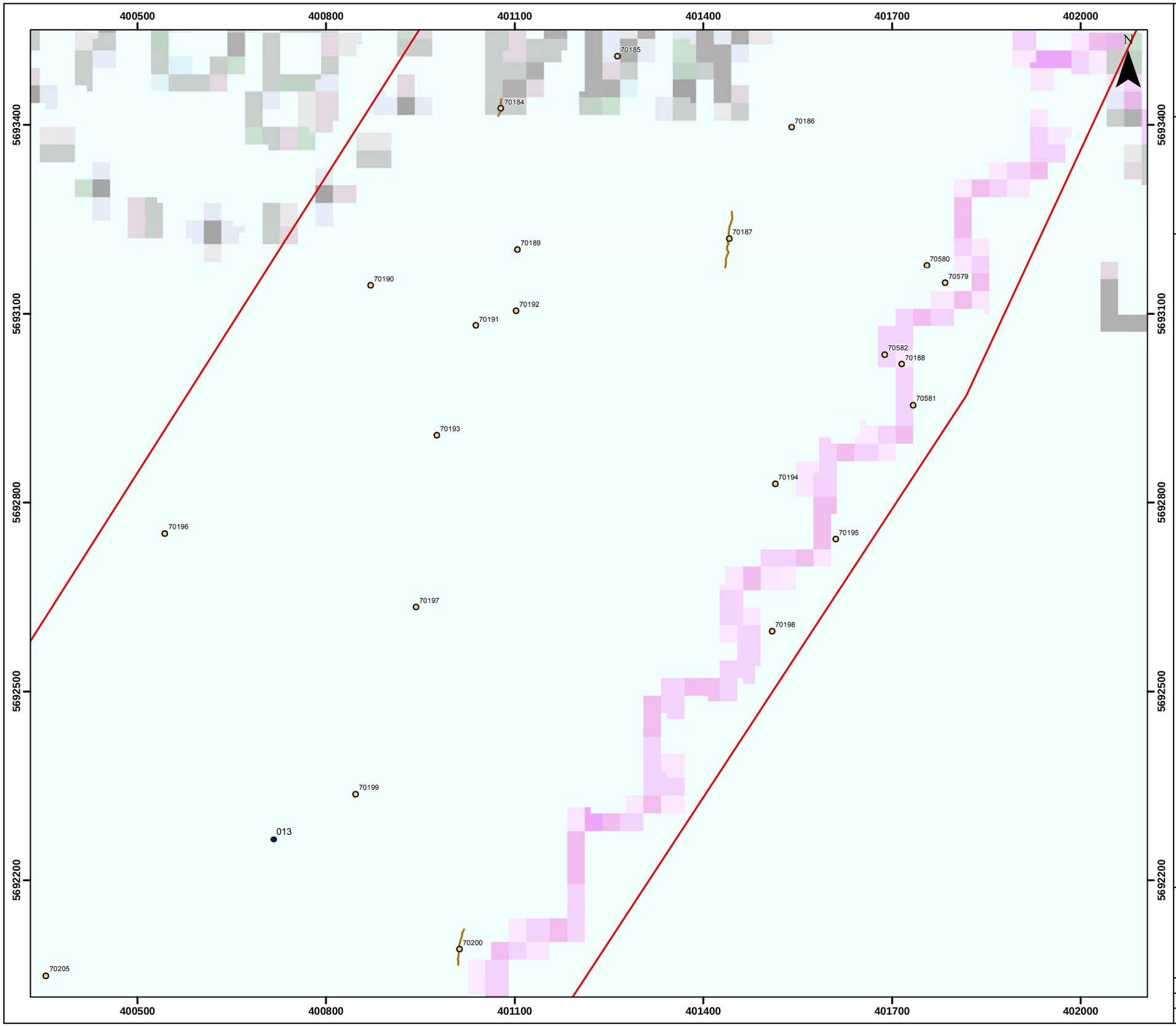
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.8



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

Figure 13.9

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

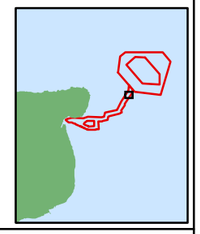
Legend

- Offshore Red Line Boundary

Geotechnical sample locations (Fugro 2016)

- CPT and Vibrocore
- A2 – Uncertain origin of possible archaeological interest
- Linear features

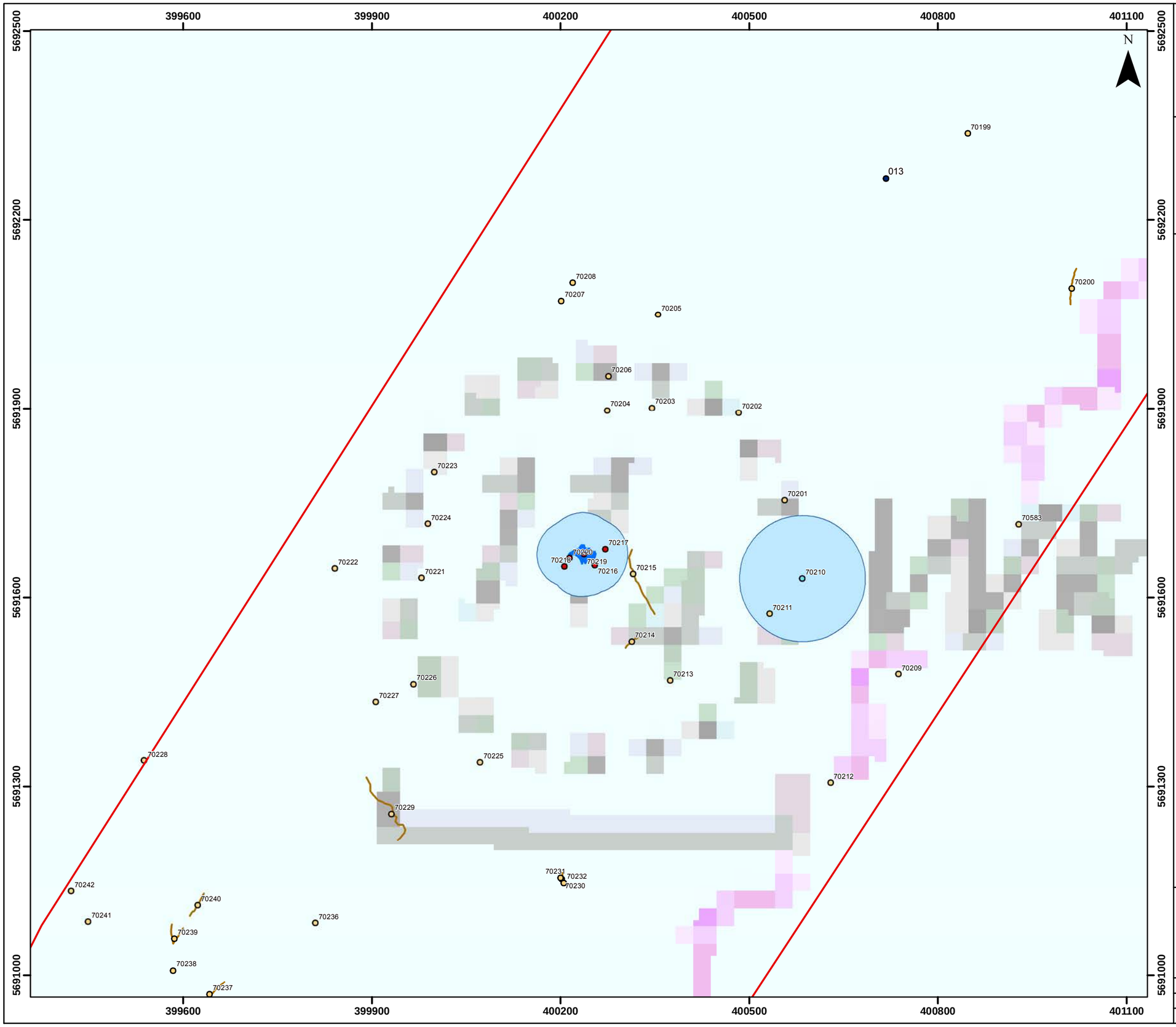
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.9



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

Figure 13.10

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

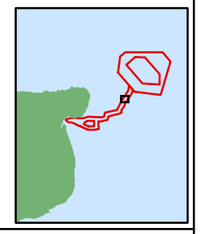
Legend

- Offshore Red Line Boundary

Geotechnical sample locations (Fugro 2016)

- CPT and Vibrocore
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended AEZs

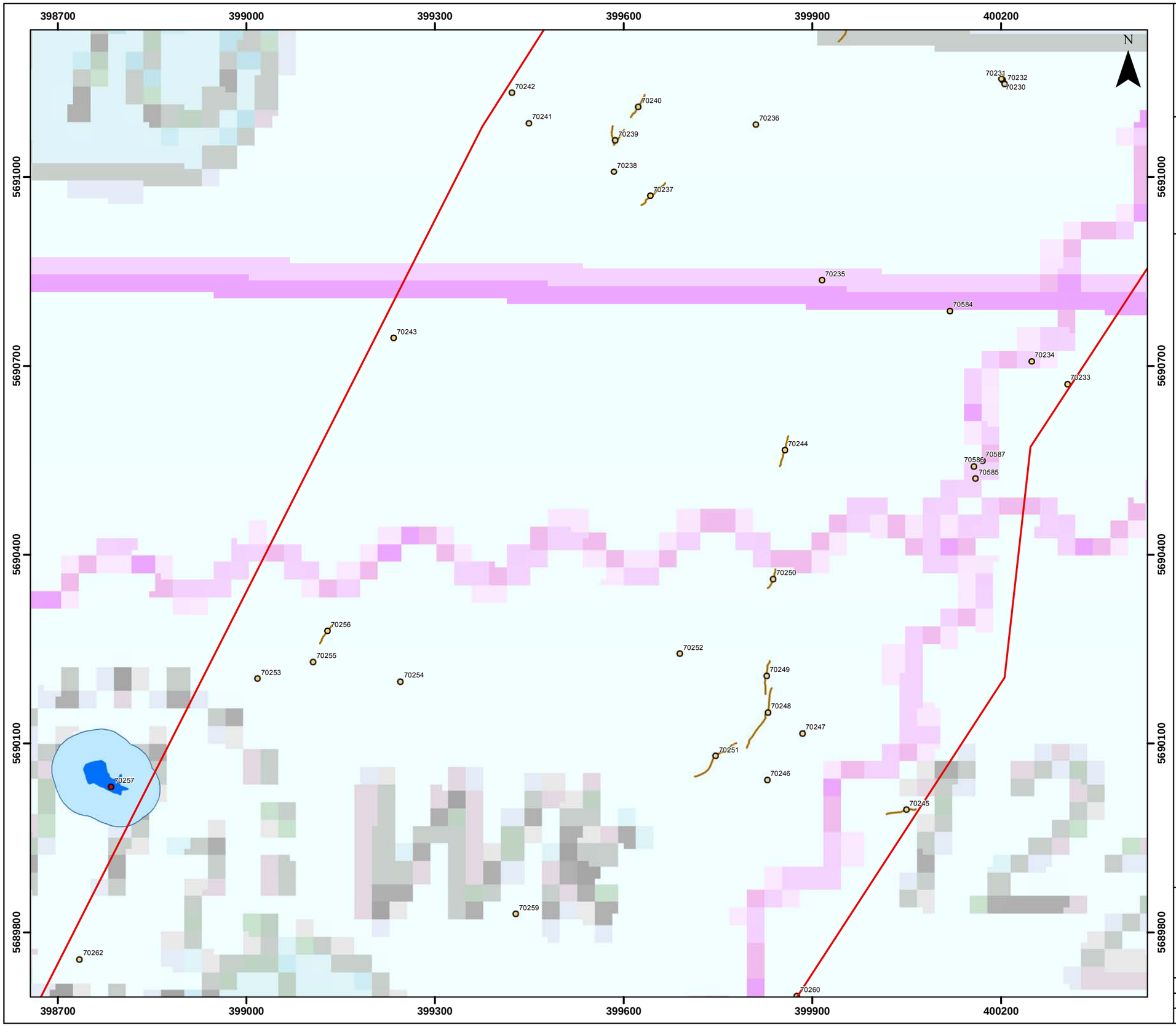
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.10



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

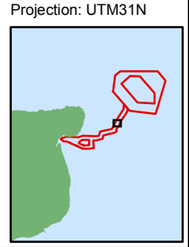
Figure 13.11

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

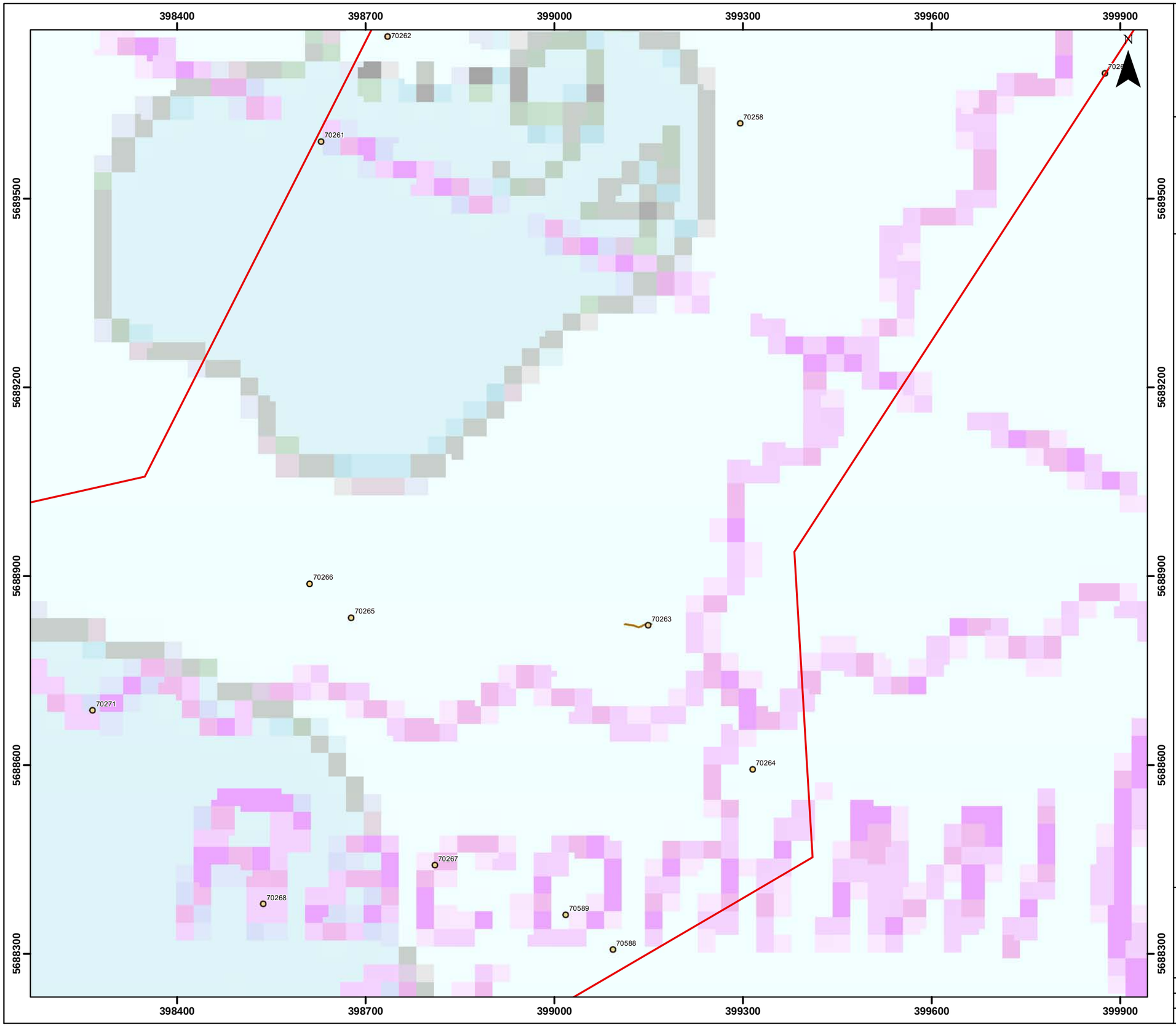
- Offshore Red Line Boundary
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- Linear features
- Site extents
- Recommended AEZs

Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26			**Figure 13.11**
Rev	3	Date	24/05/2018	
By	KL	Layout	N/A	



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

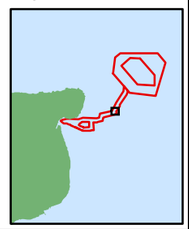
Figure 13.12

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- Linear features

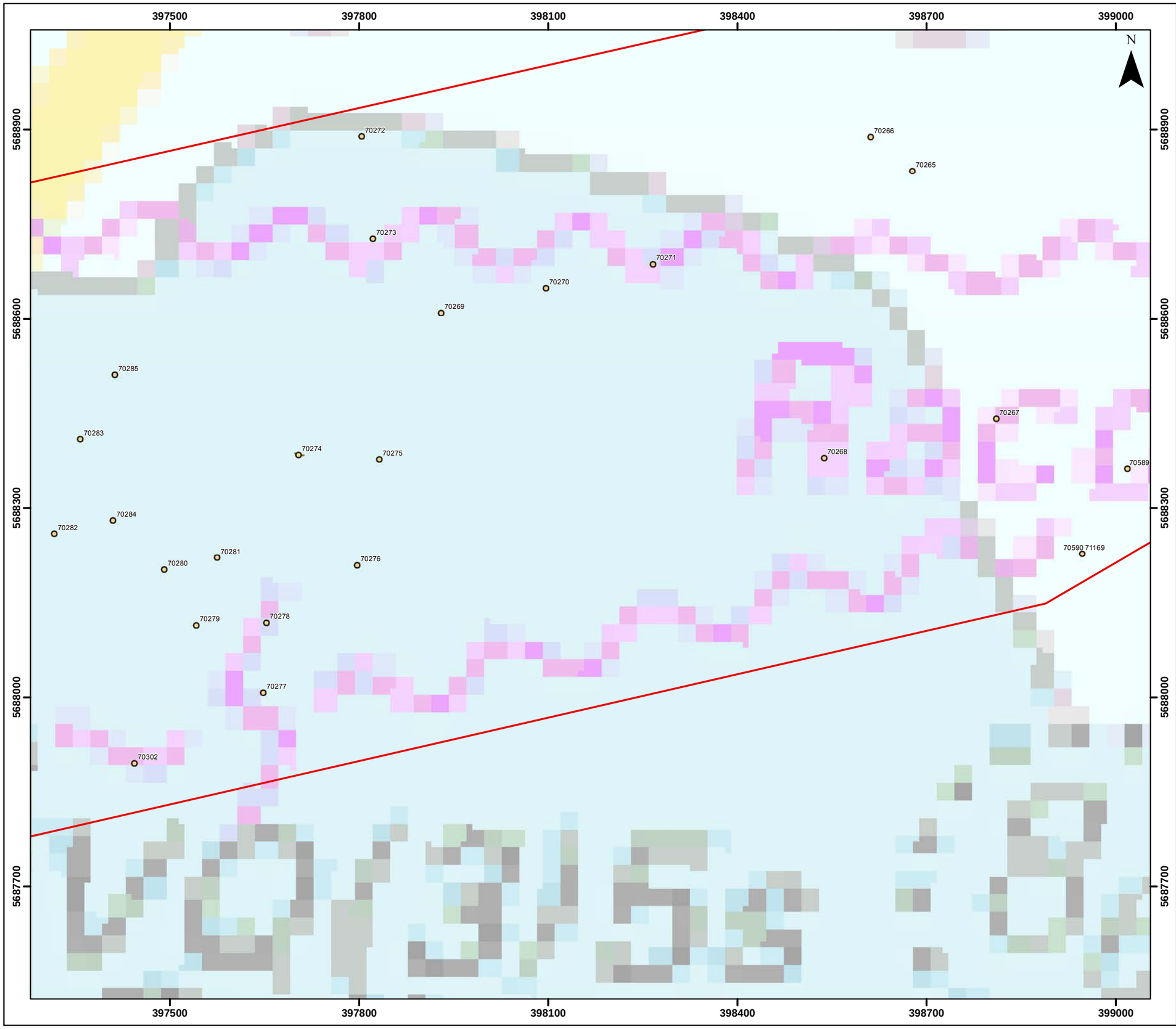
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.12



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

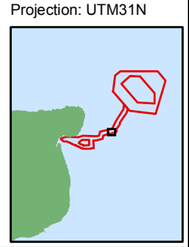
Figure 13.13

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- Linear features

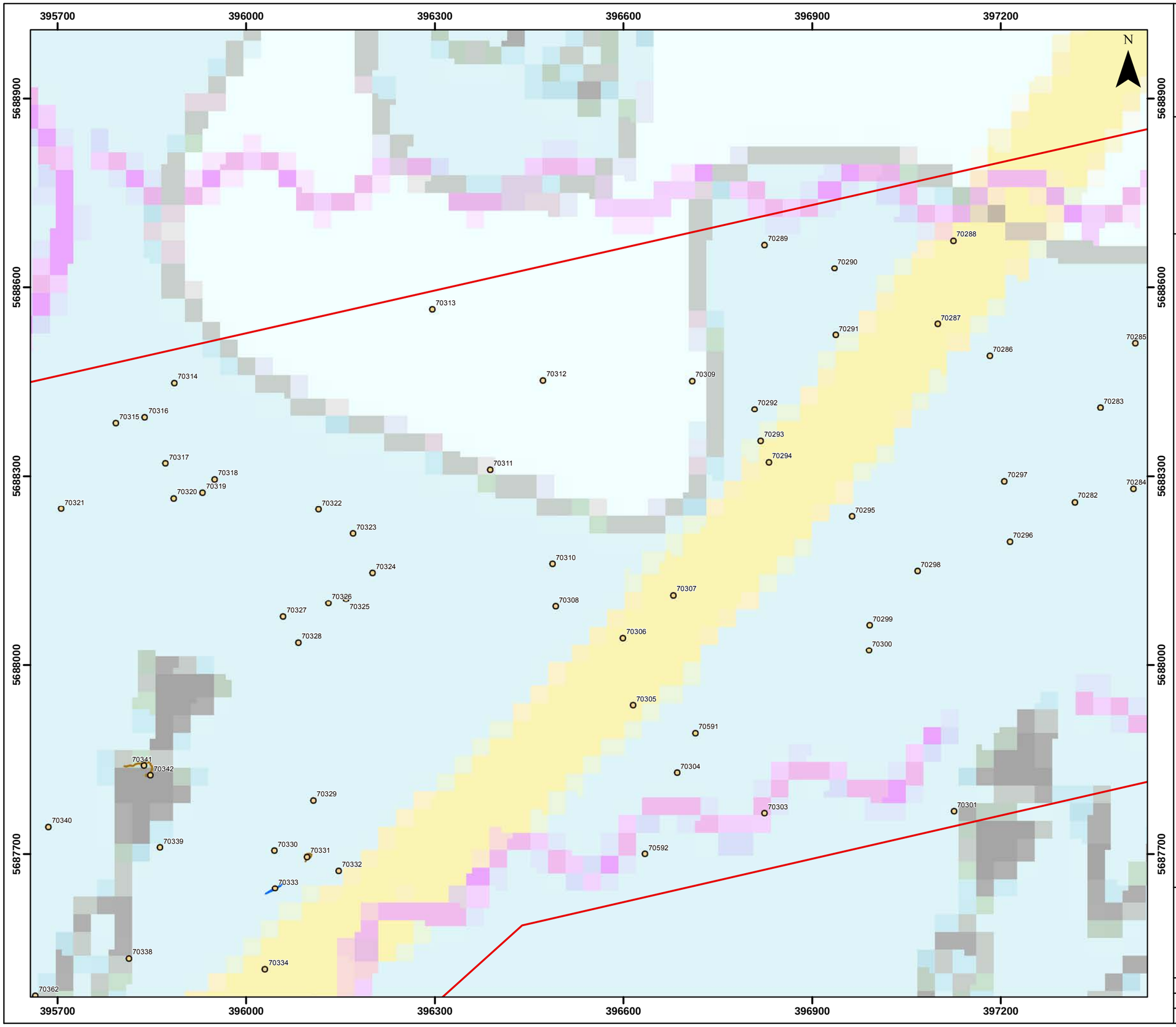
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.13



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

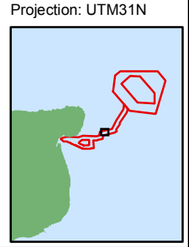
Figure 13.14

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- Linear features
- Site extents

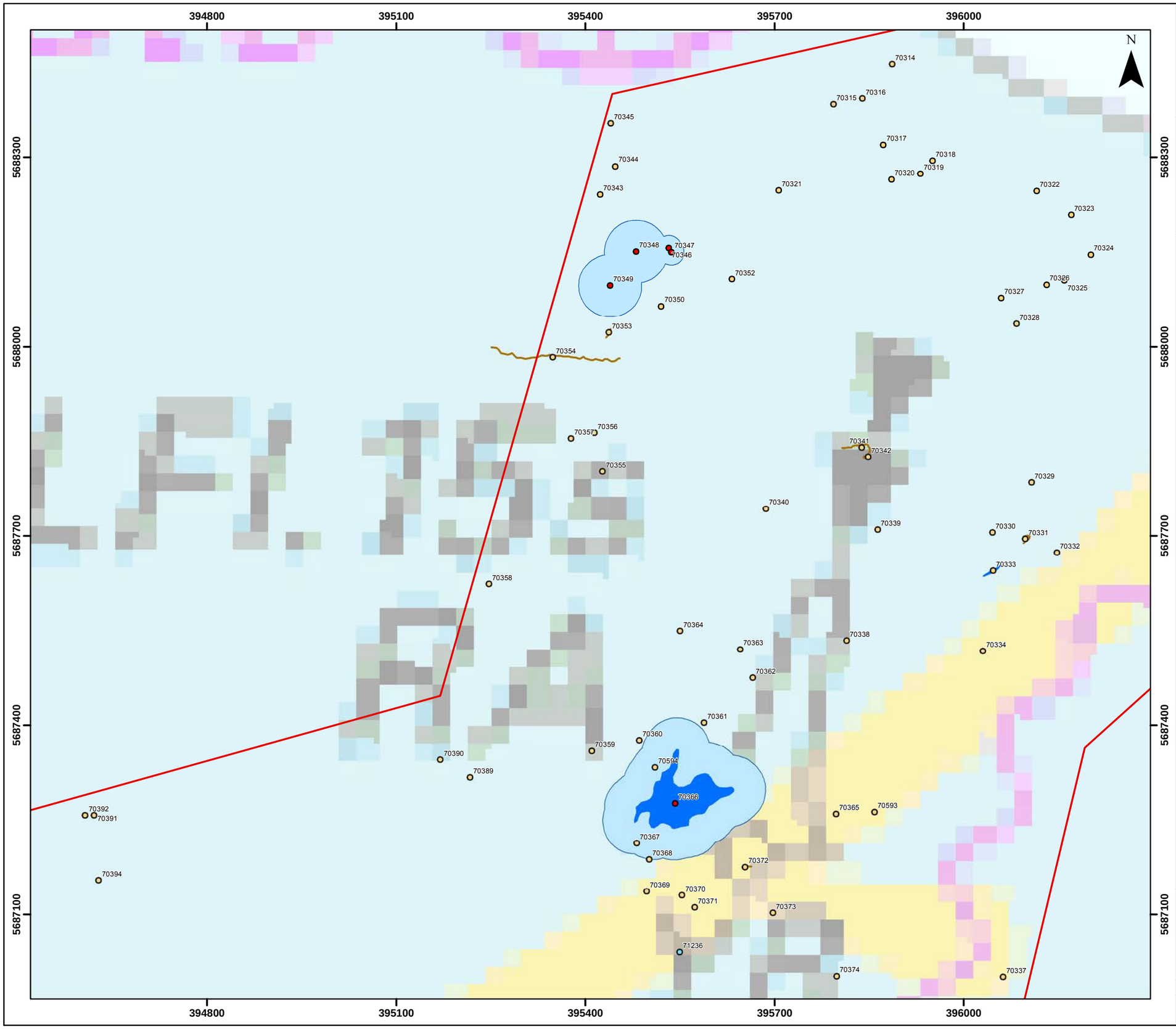
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.14



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

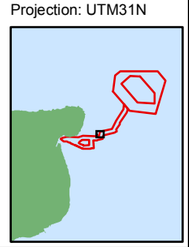
Figure 13.15

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended

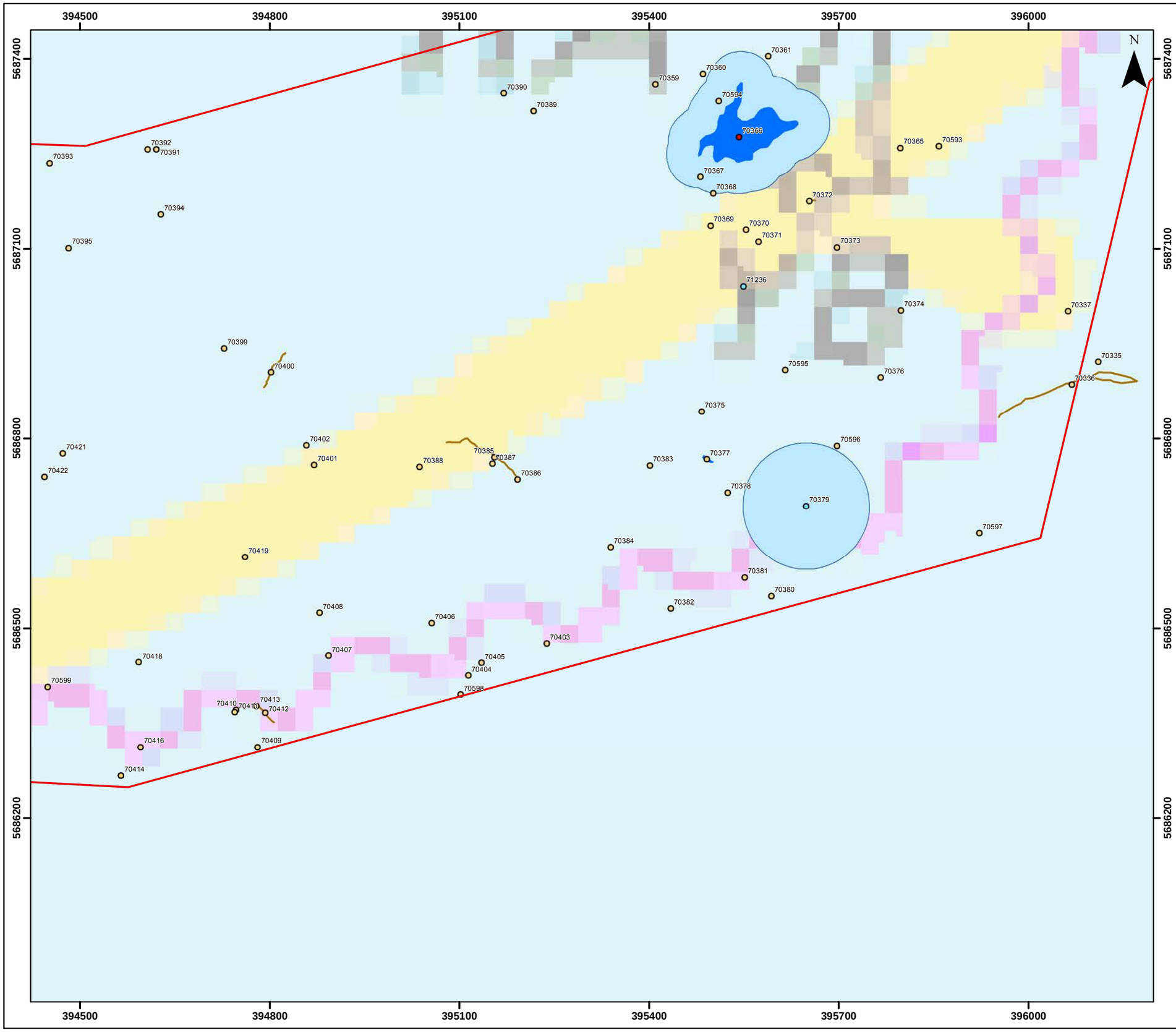
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.15



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

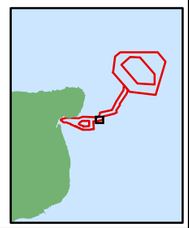
Figure 13.16

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended AEZs

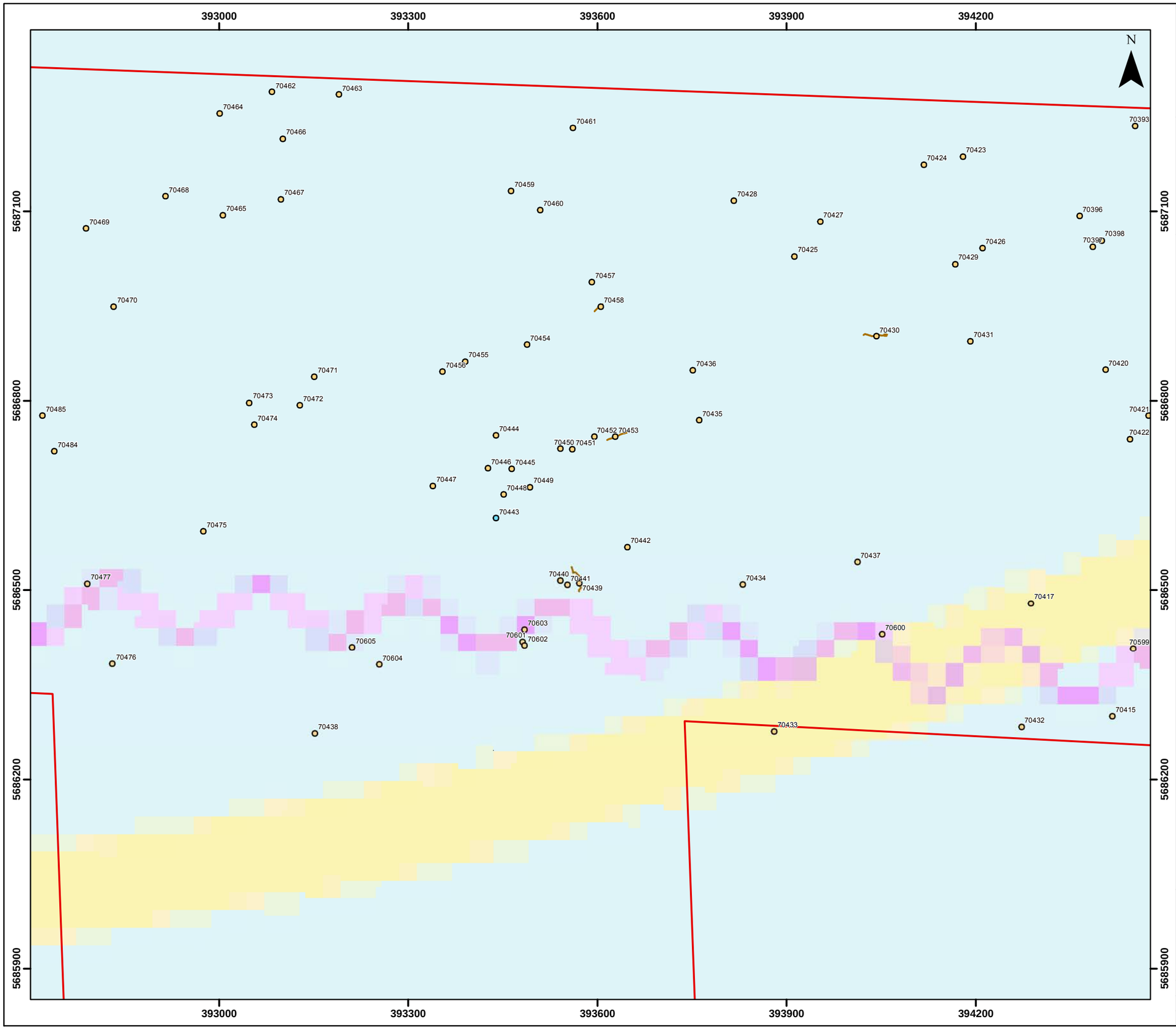
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.16



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

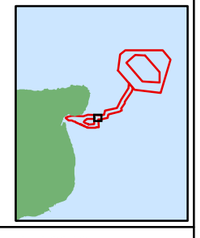
Figure 13.17

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features

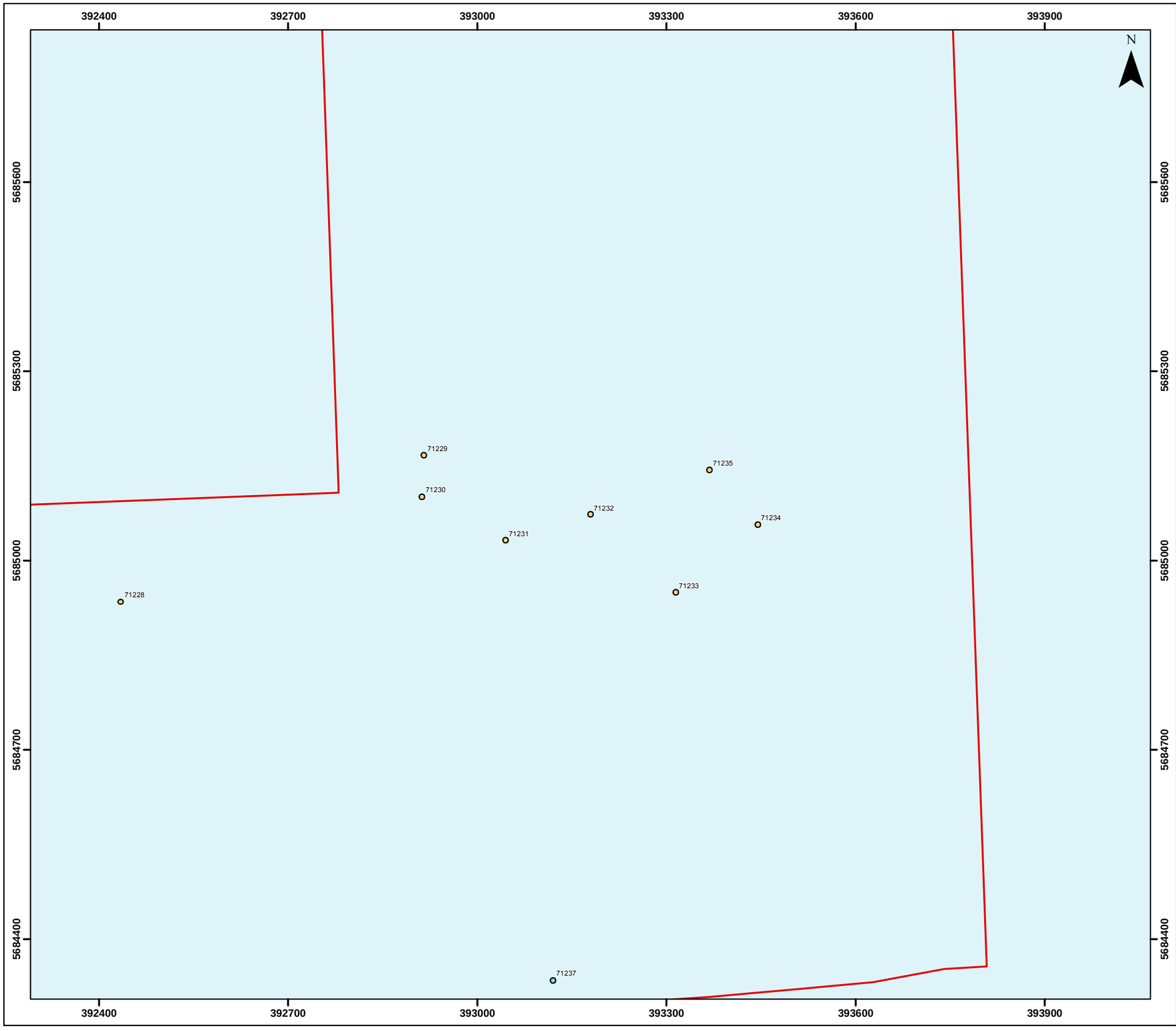
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.17



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

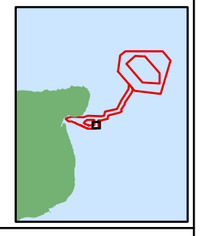
Figure 13.18

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly

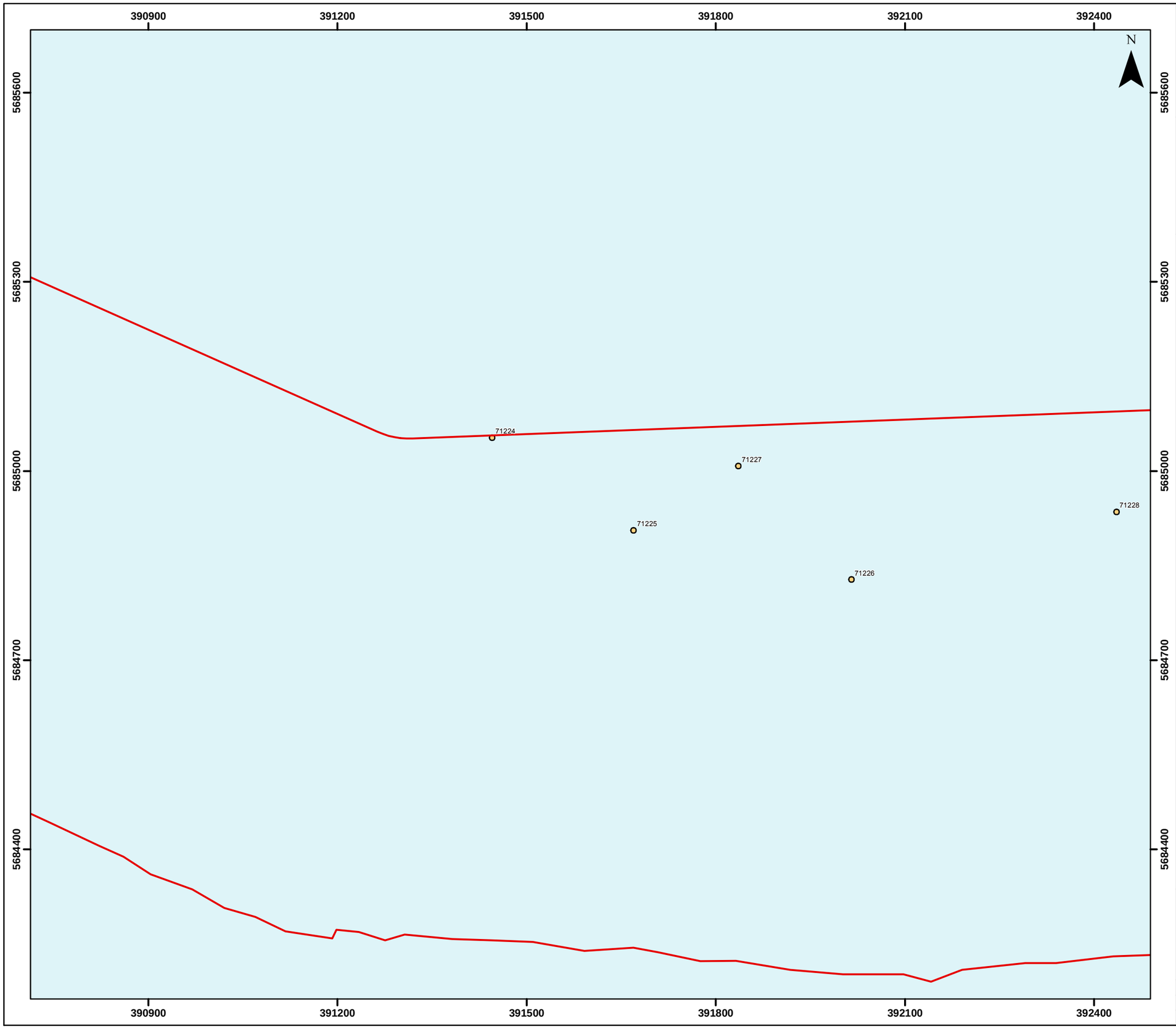
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.18



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

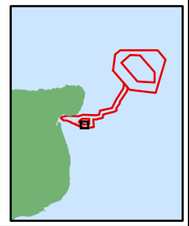
Figure 13.19

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest

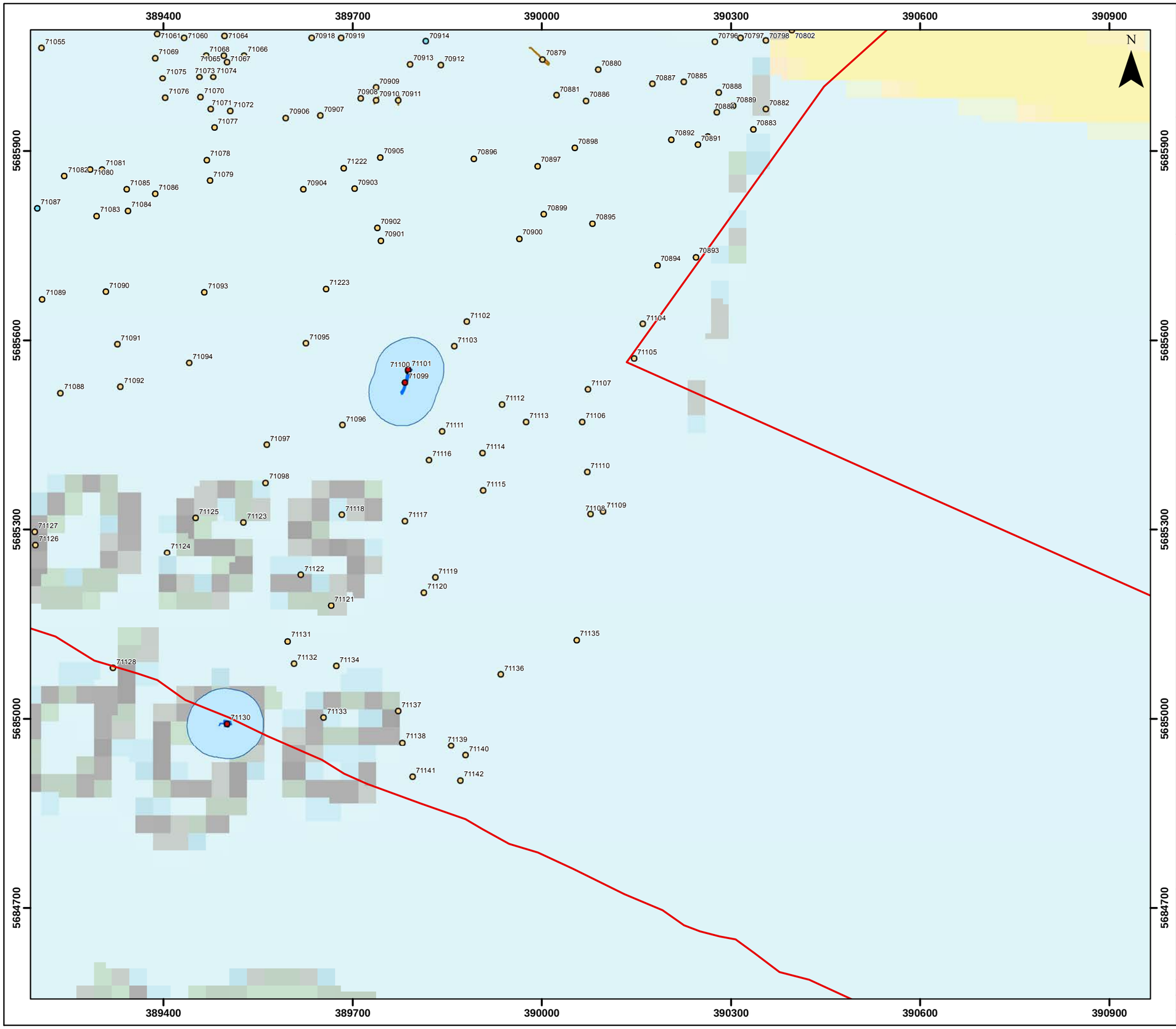
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.19



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

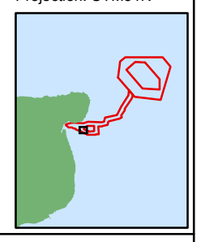
Figure 13.20

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents
- Recommended AEZs

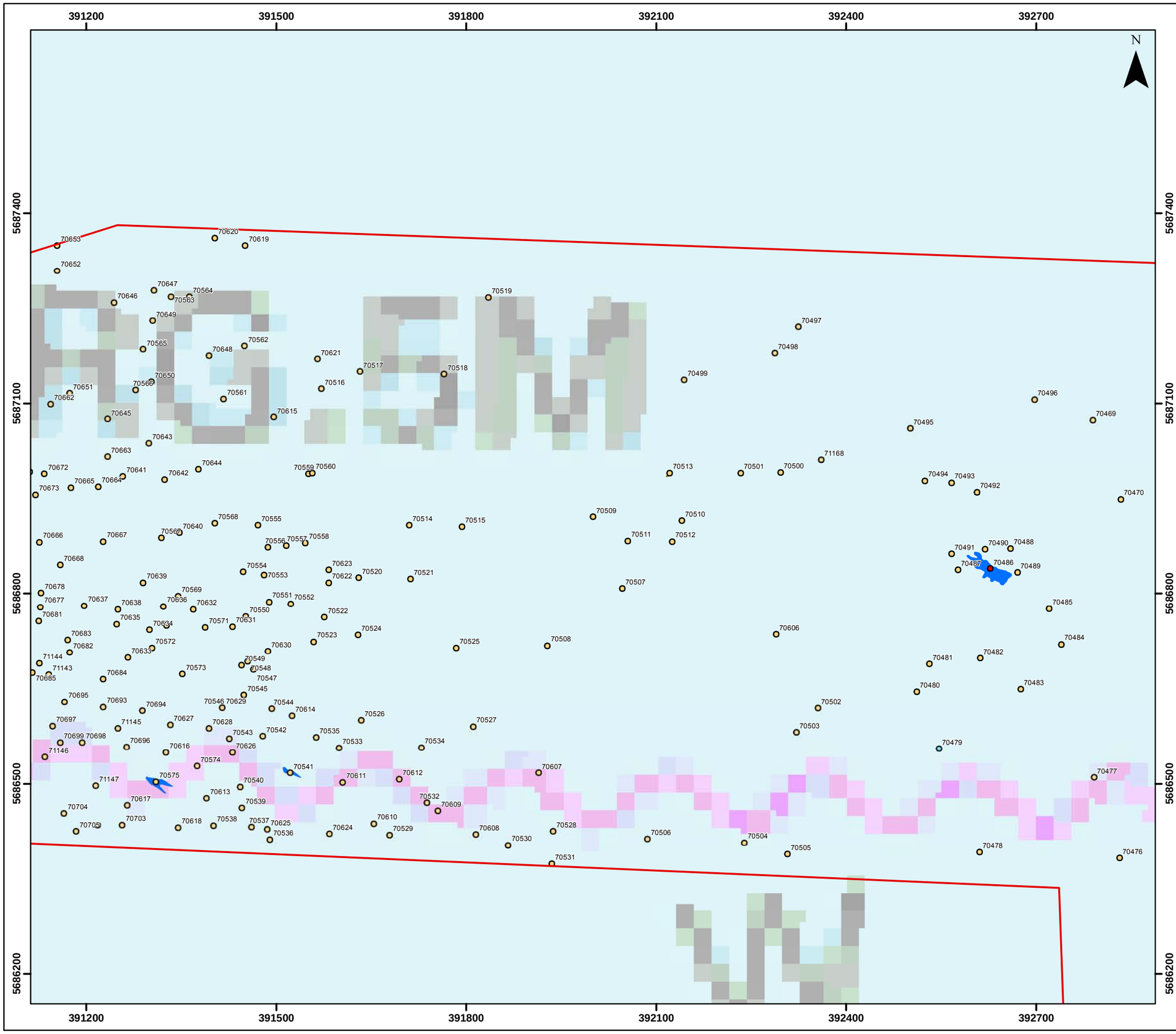
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.20



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

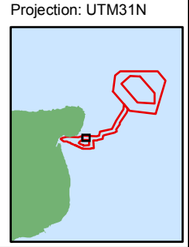
Figure 13.21

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A1 – Anthropogenic origin of archaeological interest
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents

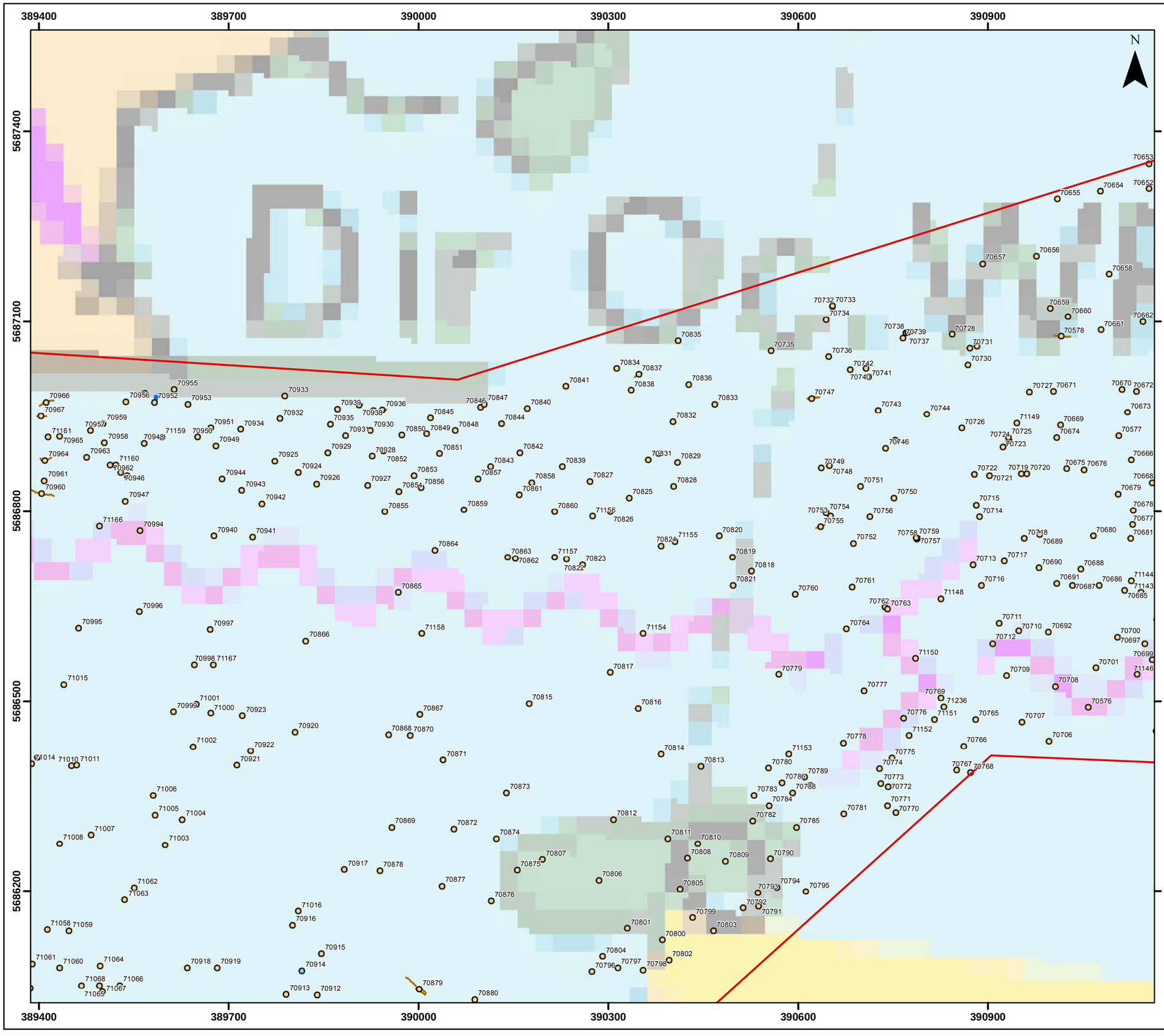
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.21



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

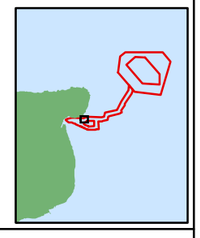
Figure 13.22

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents

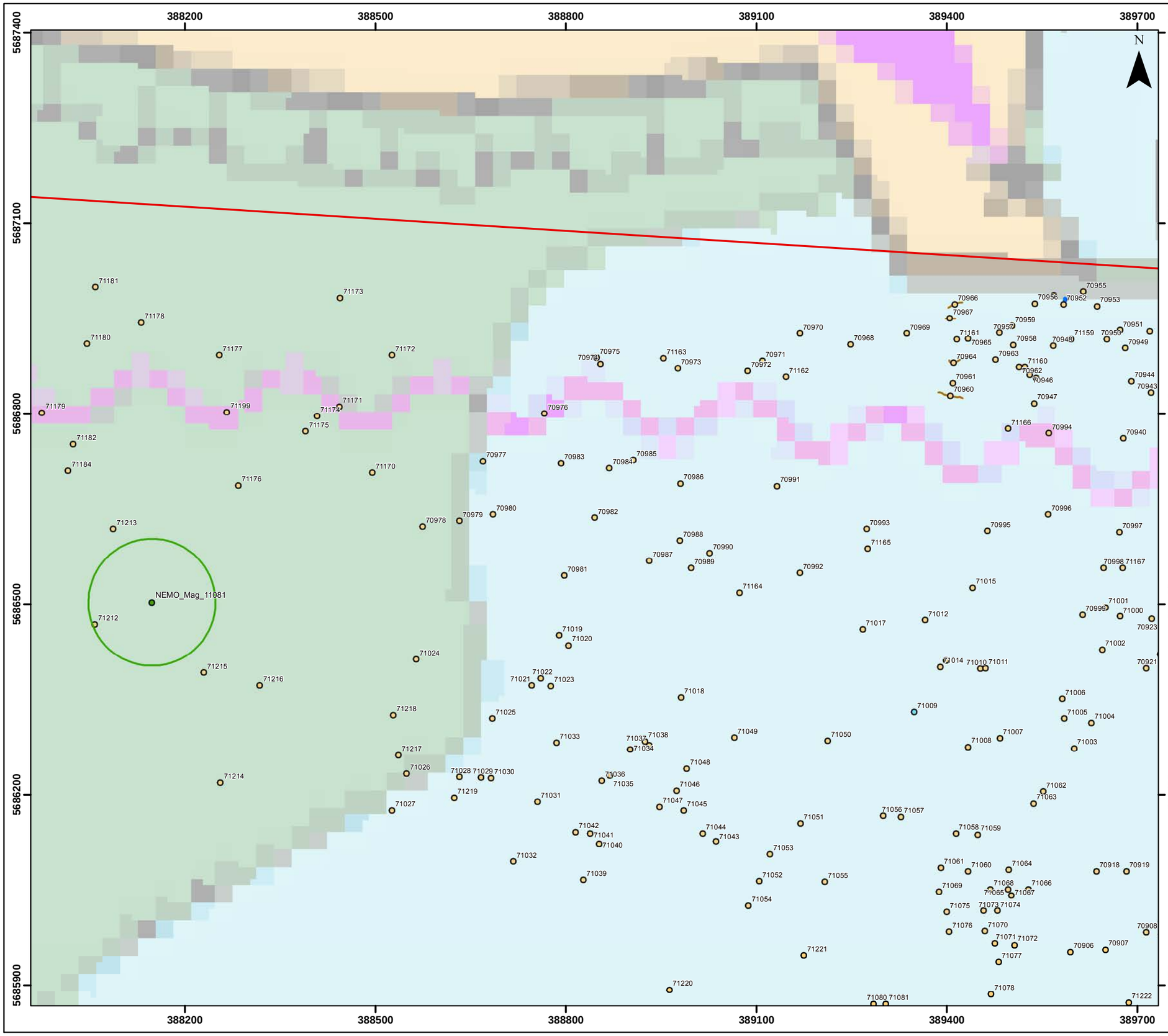
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.22



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

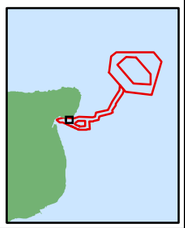
Figure 13.23

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

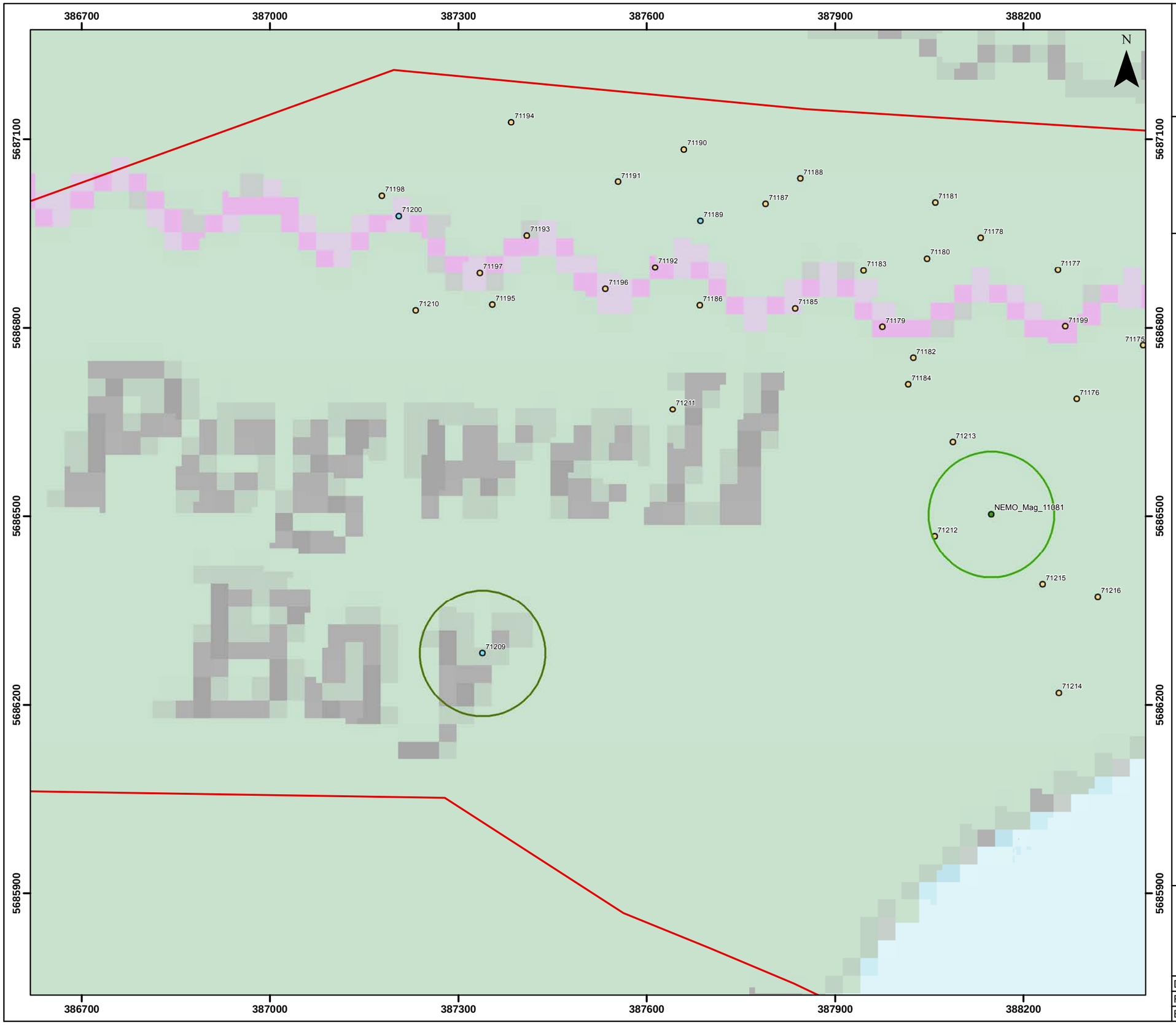
- Offshore Red Line Boundary
- Aircraft material identified during NEMO UXO survey
- 100 m buffer for NEMO_Mag_11081
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Linear features
- Site extents

Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26			**Figure 13.23**
Rev	3	Date	24/05/2018	
By	KL	Layout	N/A	



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

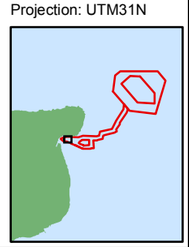
Figure 13.24

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- Aircraft material identified during NEMO UXO survey
- 100 m buffer for NEMO_Mag_11081
- 100 m buffer for 71209
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly

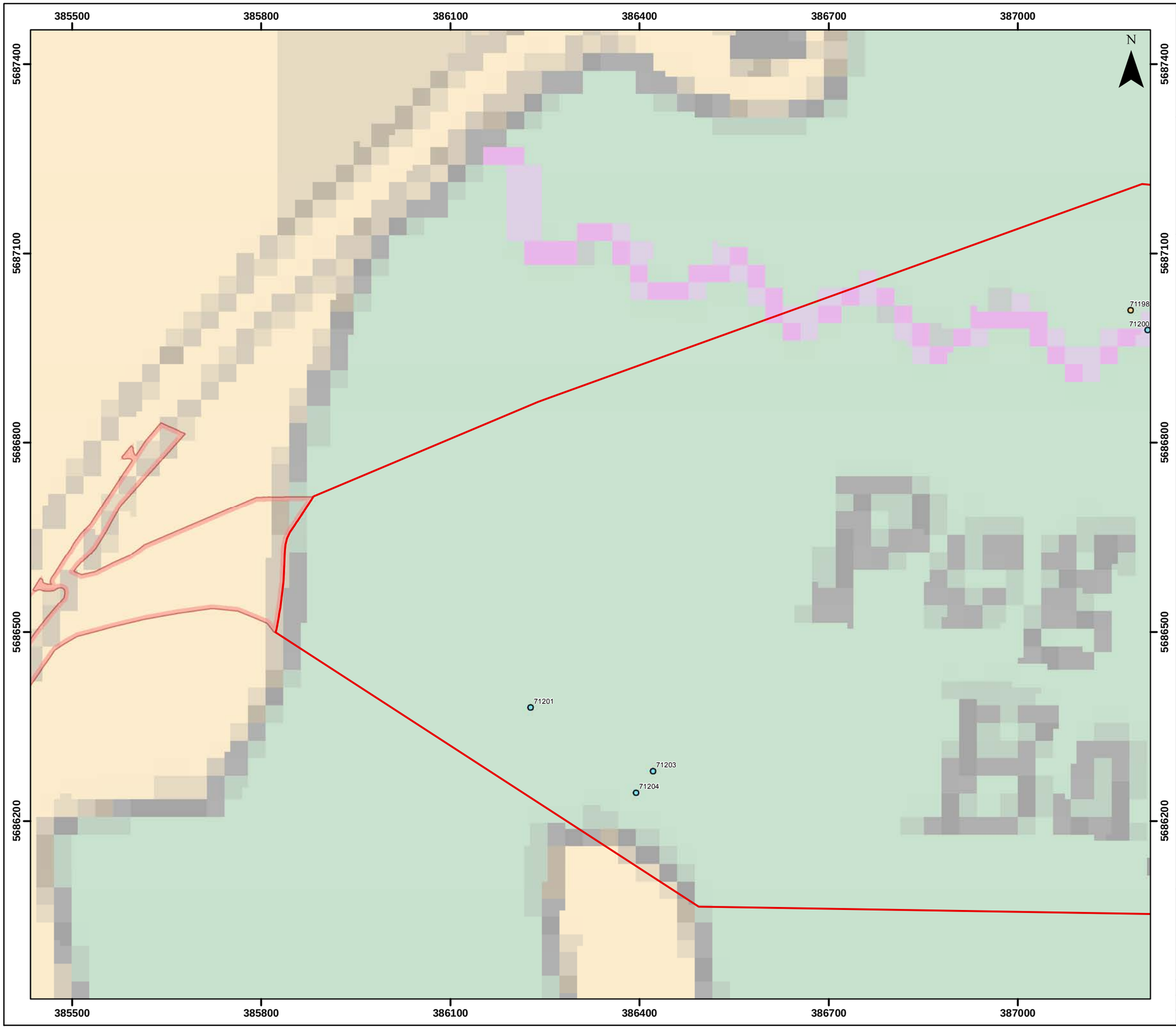
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.24



wessex archaeology VATTENFALL

THANET EXTENSION OFFSHORE WIND FARM

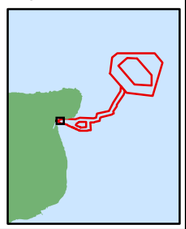
Figure 13.25

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- Onshore Red Line Boundary
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly

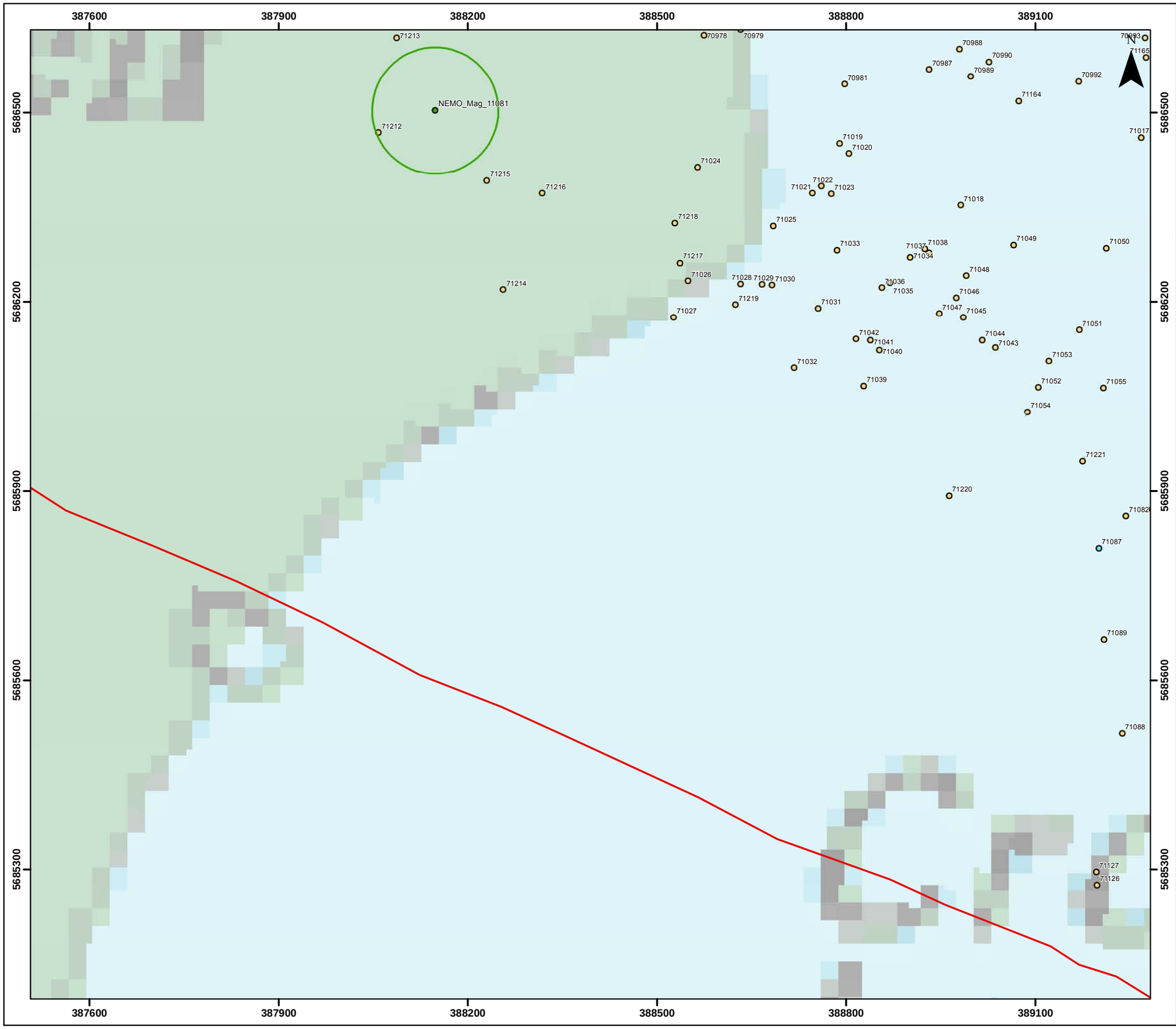
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.25



THANET EXTENSION OFFSHORE WIND FARM

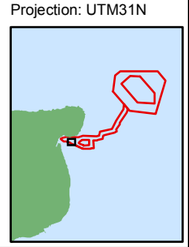
Figure 13.26

Seabed Features of Archaeological Potential in Data Examples of Seabed Anomalies in TEOWF Cable Corridor

Legend

- Offshore Red Line Boundary
- Aircraft material identified during NEMO UXO survey
- 100 m buffer for NEMO_Mag_11081
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record of possible archaeological interest with no corresponding geophysical anomaly
- Site extents

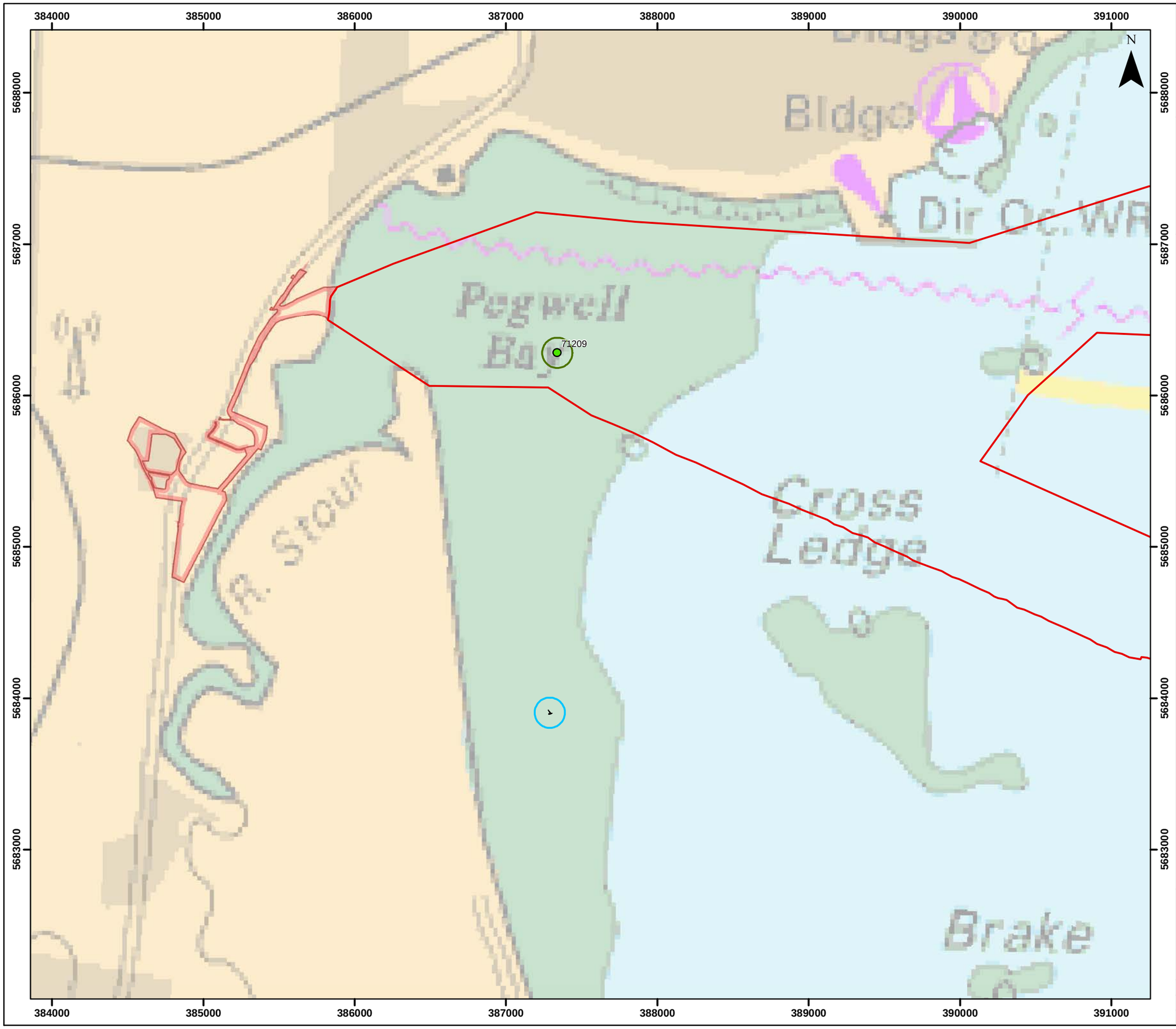
Datum: ETRS 1989
Projection: UTM31N



1:6,000 0 0.06 0.12 km 0 0.03 0.06 nm

Drg No	Fig_13.8-26		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.26



wessex archaeology VATTENFALL

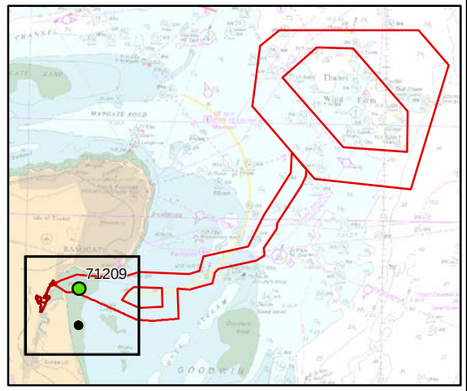
THANET EXTENSION OFFSHORE WIND FARM

Figure 13.27

Approximate possible positions of B-17 aircraft

Legend

- Offshore Development Area
- Onshore Red Line Boundary
- Approximate position of 71209, based on the NRHE record
- 100 m buffer for 71209
- Approximate position of 1035, based on 2017 walkover survey conducted by Wessex Archaeology
- 100m buffer for 1035



Datum: ETRS 1989
Projection: UTM31N

1:25,000 0 0.25 0.5 km 0 0.1 0.2 nm

Drg No	Fig_13.27		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.27

Seabed features

13.7.48 The archaeological assessment of marine geophysical survey data (Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex Document Ref: 6.4.13.2)), informed by UKHO, NRHE and KHER data identified 1,058 anomalies of potential archaeological interest in the export cable study area (Figure 13.8 to Figure 13.26). Details of the assessment can be found in Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2), and Table 13.10 provides a summary.

Table 13.10: Anomalies of archaeological potential within the Thanet Extension OECC area

Archaeological Discrimination	Quantity	Interpretation
A1	16	Anthropogenic origin of archaeological interest
A2	1,027	Uncertain origin of possible archaeological interest
A3	15	Historic record of possible archaeological interest with no corresponding geophysical anomaly
TOTAL	1,058	

13.7.49 The 16 anomalies of A1 discrimination comprise wrecks, aircraft or wreck related debris.

13.7.50 The 1,027 anomalies of A2 discrimination, of uncertain origin but of possible archaeological interest have been further discriminated into the following classifications: 118 possible items of debris; six debris fields; 100 dark reflectors; five bright reflectors; three mounds; 45 lengths of rope or chain; two seafloor disturbances; and 748 magnetic anomalies with no associated feature visible on the seabed.

13.7.51 The 15 anomalies classified as A3 relate to wrecks and obstructions. Six of the anomalies were not covered by the most recent geophysical survey data, and therefore it is not known whether they are present on the seabed or not.

13.7.52 There are two known aircraft crash sites in the export cable study area (70349 and 71209). 70349 is an A1 anomaly that was identified in the geophysical survey data approximately 5 km east of Ramsgate, however, 71209 lies in the intertidal zone within the northern corridor of the development beyond the extent of geophysical survey data, and is therefore rated A3 having been recorded by the NRHE with a 1 km diameter polygon due to the high degree of uncertainty as to its position and the lack of any aircraft debris having been identified. 70349 crashed while in military service and is therefore automatically protected under the Protection of Military Remains Act 1986. As such, the site is of very high value. In addition, the aircraft crash site, although not representing complete aircraft, is still recognisable as aircraft, and many key features of the aircraft still survives. The site also has value through its setting, in relation to its use and loss during the Second World War, and is therefore part of that broader historical landscape.

13.7.53 The site of the A3 anomaly and its related debris (71209), recorded as a B-17G 42-31243 Flying Fortress lost during the Second World War, was located and had some material recovered in the 1990s but the NRHE position was not updated. An aircraft identified as a B-17 Flying Fortress was successfully located and recorded by archaeologists in July 2017 during a walk over survey undertaken by Wessex Archaeology (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)) and recorded in the gazetteer as 1035. It is conceivable that this aircraft crash site refers to the aircraft recorded by the NRHE (NRHE ID 1602379) and/ or is possibly one of the aircraft Recorded Losses discussed in the desk-based assessment (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)). The actual position of this aircraft crash site (1035) was located within the intertidal zone on Sandwich Flats to the south of Pegwell Bay 2 km from the position of the NRHE's record (Figure 13.27). As the aircraft was discovered outside the corridor it is considered to have no impact on the development. Since it is possible that the NHRE record of 71209 could refer to one of the other aircraft Recorded Losses discussed in the DBA (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)) and may be an entirely different aircraft than 1035, its position has been retained in the figures for information/ consistency using the centre point of the polygon provided by the NRHE. On balance, it is recommended that the NRHE footprint for this anomaly be reduced to a 100 m buffer since the original 1 km buffer around the position was in place due to the uncertainty surrounding the location of the aircraft, which is now considered to have been determined, the details of the loss actually being consistent with that of site 1035. The visible extent of the aircraft wreckage for 1035 included significant portions of the airframe and was mapped during the walkover survey. Due to the debris present around the site and the potential for further buried debris, a 100 m buffer was placed around the location (Figure 13.27). There are no shipwrecks designated under the Protection of Wrecks Act 1973 or the Protection of Military Remains Act 1986.

13.7.54 In addition to these aircraft crash sites, the pre-disturbance UXO survey undertaken for the Nemo Link cable route identified possible aircraft material (NEMO_Mag_11081) (Figure 13.20). Diver investigations indicated a metallic object approximately 3 m long and 0.4 m wide, however most of the object remained buried. The exposed material comprises thin metal plates fixed by metal rivets. It was identified as the possible remains of an aircraft component, possibly the wing, due to the construction and material of the section uncovered. As there was potential for the material to relate to a military aircraft, which would therefore be protected under the Protection of Military Remains Act 1986, the archaeological report (Wessex Archaeology, 2017b) recommended the implementation of a temporary exclusion zone of 100 m around the site.

13.7.55 Of the A1 anomalies of known wreck sites and associated debris, six have been named or identified through UKHO survey (70219, 70257, 70348, 70366 70486 and 71130). For these wrecks it is possible to assess their value based on the date of build, use and loss, and their survival on the seabed. Vessels built prior to 1913 (A1 anomaly: 70219 and A3 anomaly: 70210) and those lost due to military action during the First World War (A1 anomalies: 70219, 70257, 70346 and A3 anomaly 70210) or the Second World War (A1 anomaly 70366, and A3 anomaly: 70379), would be of medium to high value, as would be the British landing craft LCP 586 (A1 anomaly: 71130) lost in 1946, but related to the international conflict. Of particular interest would be the German submarine UB 12 (A1 anomaly 70348), if it could be confirmed at this location. Vessels lost between the wars would require further assessment as to date of build or use, but could be of medium value. Wrecks post-dating 1945 (such as A3 anomalies 70479, 70914 and 71087) are less likely to be of archaeological interest, and therefore are considered to be of low value. Also of low value is A1 anomaly 70486, the cargo of a tug boat *Neg Chieftain* that capsized in 1983. None of the wrecks are protected under the Protection of Wrecks Act 1973.

13.7.56 The setting of the named wrecks has been assessed. The vessels lost during the First and Second World War have settings influenced by these major international conflicts. For example, vessels lost due to striking mines (70219, 70210, 70257, 70379 and 70366) were lost specifically due to their unfortunate position within a mine field and reflect not only the circumstances of the war but also the specific methods being used to target ships. For the more modern wrecks that have been lost for various reasons, their locations are coincidental rather than intentional, and therefore their setting is less important.

13.7.57 Shipwrecks that have not been named and possible wrecks should be considered to be of medium to high value unless proven otherwise. As these wrecks have not been identified, it is not possible to assess their setting at this time, however setting would be assessed on a case-by-case basis should more information become available.

13.7.58 For the majority of obstructions, too little is presently known about them to assess their value or setting. Should further evaluation reveal them to be wreck-related material, they will have to be assessed on a case-by-case basis, but should be considered to be of high value until proven otherwise. However, the records of some obstructions provide sufficient detail to confirm that they comprise modern debris or natural features of no archaeological interest.

13.7.59 There is also potential for as yet undiscovered shipwreck and aircraft crash sites in the OECC study area. The potential for these has been discussed in more detail in the array section, above. Any further discoveries would have to be assessed on a case by case basis, but shipwrecks should be considered to be of high value and aircraft of very high value until proven otherwise.

13.7.60 If undisturbed by development, the baseline discussed above is likely to remain relatively unchanged for the foreseeable future.

Historic Seascape Characterisation

13.7.61 Scoping identified HSC as a data source, in order to assess the key cultural processes that have shaped the historic seascape within a given area and to understand impacts where proposed development activities result in changes to its character. However, HSC was not identified within the Scoping summary of potential impacts to be scoped in to the PEIR assessment. In the PEIR consultation process, HE indicated that the assessment seek to examine how those perceptions of historic seascape could change due to the development, and therefore the potential impacts have been considered in this ES. In order to inform the ES, a review has been undertaken in order to understand the HSC of the study area and to inform the assessment of how the seascape could change.

13.7.62 The HSC assessment is based on the work undertaken by Cotswold Archaeology (Cotswold Archaeology, 2015).

13.7.63 Within the OECC, the seascape character is comprised of the following character types. On shore, the area includes areas of cultural topography facing landward, such as a town, cliffs and dunes, an area of sandy foreshore and an area of shingle foreshore. There are sea defences against flood and erosion. The seabed comprises coarse sediment plains, fine sediment plains, mixed sediment plains and exposed bedrock. Navigational features include anchorages, buoys, and navigation routes. Navigational hazards include shoals and flats, wrecks, maritime debris, hazardous water, and water turbulence. Ports and docks features include a civilian dockyard, harbours, a landing point, and a port. Fishing activity includes fixed netting, and pelagic trawling. Features associated with industry include submarine power cables, submarine telecommunications cables, and the area is part of a commercial shipping route. Associated recreational activities include leisure beaches, parks and gardens, wildlife watching, and leisure sailing.

13.7.64 The HSC of the study area is considered to be of medium archaeological value, due to the area's important and prolonged maritime history and its continued use today. Although the area is already characterised by the broad category of industry, more specifically, renewable energy and submarine communication cables, the nature of HSC is such that it reflects not only the past use of the sea but also the present, and therefore it has been included in the impact assessment.

13.7.65 If undisturbed by development, the baseline discussed above is likely to remain relatively unchanged for the foreseeable future.

13.8 Overview of project development

Turbines, Foundations and Layouts

13.8.1 The wind turbine types, foundations and layouts have not been confirmed at this stage, however the maximum parameters of the development have been identified. The maximum capacity will be 340 MW. The final wind turbine layout will be determined at the wind turbine procurement stage. The maximum number of turbines will depend on the turbine size chosen, for example 34 turbines for 8 - 10 MW, 28 turbines for 12 MW. Subject to final design, it is possible that an alternative, larger capacity WTG (i.e. >12 MW) type may be selected. In this scenario the number of turbines would be reduced, but the overall maximum capacity would remain at 340 MW and the parameters such as blade tip height, rotor diameter and hub height would remain within the maximum design envelope.

13.8.2 The following foundation types are being considered: jackets and variants of this type (jacket with three or four piles, jacket with three or four suction caissons); and monopiles.

13.8.3 Details of the dimensions of each foundation type and scour protection, any seabed preparation and piling requirements are presented in Volume 2, Chapter 1: Project Description - Offshore (Document Ref: 6.2.1).

Ancillary Structures

13.8.4 Although still in consideration, the maximum could be one Offshore Substation (OSS). It will be located within the project array area, however the precise location has not been confirmed, and will depend upon the turbine layout design and other factors. There are a number of possible foundation types in consideration.

13.8.5 Other offshore infrastructure may include:

- Up to one meteorological mast (met mast), which could be installed within the Thanet Extension site. The foundation types under consideration as the same as for WTG foundations, although the met mast foundation would likely be smaller; and
- A Floating LIDAR Device (FLDs) and one wave buoy may be needed across the Thanet Extension site.

Inter-array cables

13.8.6 The inter-array cables will connect all of the wind turbines and the offshore substation. The final layout of the inter-array network will be determined by the wind turbine layout. The general design will consist of a number of adjacent wind turbines cabled together in a ‘string’, with the last wind turbine then connected to the offshore substation. Cables will be laid along the shortest practical route, and their length will be based on the wind turbine spacing.

13.8.7 Each section of inter-array cable will be laid separately in a single trench, however when approaching the substation or turbine foundations, two or more cables may be installed close together on the seabed. Trench widths and shape will be the same as the export cable, discussed in more detail below. Potential cable laying methodologies are: surface lay; ploughing; pre-trenching or cutting; and jetting. In some cases cable protection will be required, and the methods could include: rock placement; concrete mattresses; frond mattresses; or Uraduct.

Export Cables

13.8.8 There will be a maximum of four export cables. The export cables are expected to be 3-core High-Voltage Alternating Current (HVAC) cables. Pre-sweeping (dredging) works will be required, including ensuring that the route is free from obstructions. A survey vessel will be used to clear debris during ‘pre-sweeping (dredging)’. Areas of sand waves may have to be levelled by dredging. Crossings will also be required for cables.

13.8.9 The preferred construction technique and depth of burial will be confirmed after geotechnical ground investigation, a construction risk assessment, and a lifetime O&M assessment. The possible installation techniques include: ploughing; jetting; dredging; and trenching. The export cables will be buried at depths between 0 - 3 m. Depending on the angle of the trench slope, a maximum trench width could be 12 m, with the width of disturbance for the ploughing, and a maximum width of 20 m for the pre-sweeping (dredging) resulting in a maximum area of disturbance of 20 m, if the subsequent spoil is re-deposited in the immediate area, however it is expected that the trench will be backfilled with its own material.

13.8.10 In some cases, cable protection may be required, including: rock placement; concrete mattresses; frond mattresses; and uraduct or similar.

13.8.11 Where cable crossings are required, additional protective elements may be employed, such as concrete mattresses or rock filter bags.

Cable Landfall

13.8.12 The landfall is situated within Pegwell Bay Country Park (hereafter referred to as ‘the Country Park’. The landfall describes the location where the offshore cables are brought ashore and jointed to the onshore cables within up to four Transition Joint Bays (TJBs). There are presently three landfall options (Volume 3, Chapter 1: Project Description (Onshore) (Document Ref: 6.3.1).

13.8.13 There could be between two to four cables through the mud flats and saltmarsh, with 5 m separation of cables. At the landfall, the offshore cables will be installed through/ over/ under existing sea wall, depending on the construction methodology selected, to be jointed to the onshore cables at the TJBs at the landfall site. To enable this installation, onshore TJBs within the Country Park are proposed to be employed. Over the intertidal sand and mud flats, the cable could be laid from a flat barge beached at low tide. Over the saltmarsh, it is expected that an open cut trench solution will be used. A small section of sea wall may be opened up temporarily, or if ground conditions are deemed suitable Horizontal Directional Drilling may be employed. Within the Country Park, cable installation works will either be undertaken above ground, or if ground conditions are deemed suitable the cable and associated infrastructure will be buried.

13.8.14 The offshore works are assessed here, however onshore works, including the TJBs onshore, are assessed within the onshore archaeology assessment (Volume 3, Chapter 7: Onshore Historic Environment (Document Ref: 6.3.7)).

Construction strategy

13.8.15 The time frame for construction will depend on the final project design. It is expected that installation for all foundations would take a maximum duration of six months. The total construction period would last for a maximum of 28 months. The number and specifications of the vessels employed during construction will be determined by the marine contractor and the construction strategy.

Operation and Maintenance

13.8.16 Once commissioned, the wind farm is planned to operate for up to 30 years. Although this may be extended as the project nears decommissioning as maintenance and technology improve. During this period, all offshore infrastructure, including wind turbines, foundations, cables and offshore substations would be monitored and maintained. There are a number of potential O&M strategies, including: O&M from shore using varying vessels and/ or helicopters; an offshore base, such as an accommodation vessel or accommodation platform; or a combination.

13.8.17 Typical O&M activities, as described in the Project Design - Section 11.2 (Vattenfall, 2017 (Document Ref: TE-TPM-DD-0011)), would include: general wind turbine service; oil sampling/ change; UPS (uninterruptible power supply) battery change; service and inspections of wind turbine safety equipment, nacelle crane, service lift, HV system and blades; major overhauls, wind turbine repairs, and restarts.

13.8.18 The cables may also require repairs or re-burial. For cable repairs, in most cases, the cable would be de-buried using jetting (or removal of protection), the damaged part of the cable taken out, a new joint inserted, and then re-burial (or replacement of protection). For export cables, only a localised area of cable will be replaced, whereas for inter-array cables that are shorter, the entire cable could be replaced. There are a number of techniques to detect exposed cables, including Distributed Temperature Setting (DTS), and exposed cables will be reburied.

Decommissioning

13.8.19 The scope of decommissioning works will be determined based on the relevant legislation and guidance at the time of decommissioning and will likely involve the removal of accessible installed components, including: all of the wind turbine components; the foundations above seabed level; and the sections of inter-array cables close to offshore structures; as well as sections of the export cables. The process for removal will generally be the reverse of the installation process.

13.9 Key parameters for assessment

13.9.1 The following section describes the engineering parameters of the project design envelope that constitute the maximum adverse scenario when assessing potential negative impacts on offshore archaeological and cultural heritage receptors. By assessing the maximum adverse scenario for each individual impact, this assessment presents the maximum possible effect upon the marine archaeological environment in and around the proposed development area. As such, impacts of greater adverse significance would not arise should any other development scenario be taken forward in the final scheme design.

13.9.2 Although the proposed development is confined to the Site Investigation Boundary, the exact layout of the proposed turbines, other structures and cable route has not been confirmed. As such, there is no clear maximum adverse scenario for effects upon the offshore archaeological environment. With regards to offshore archaeology, the impact on specific receptors (i.e. a specific very high value wreck site) would be the maximum adverse effect of the development. Variations to the final layout may in theory determine the degree to which different archaeological receptors are affected. However, due to the scale of the project, the wide distribution of known archaeological receptors and the uncertain distribution of potential archaeological receptors, the worst-case scenario approach ensures that any difference in layout is fully captured as part of the assessment in the ES.

13.9.3 For the selection of worst-case scenarios for major adverse effects on offshore archaeological and cultural heritage receptors, a number of potential scenarios have been assessed. For seabed receptors (i.e. wrecks/ aircraft) in shallow seabed sediments, the maximum adverse scenario involves the maximum number of impact locations on the seabed and the design with the greatest maximum footprint including scour protection. For palaeogeographic receptors, the maximum adverse scenario involves the maximum potential disturbance of below seabed sediments across the largest area and in the greatest number of locations.

13.9.4 Where potential impacts are considered to arise as a result of changes in hydrodynamic and sedimentary regimes, this assessment relies on the outputs of the assessments in Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2).

13.9.5 Table 13.12 describes the project design envelope scenarios identified as presenting the maximum adverse scenario for each potential impact in relation to offshore archaeology and cultural heritage. All scenarios are considered to be realistic and fully justified. Where the term ‘seabed receptors’ is used, it includes known shipwrecks, aircraft crash sites, geophysical anomalies and palaeogeography.

13.9.6 For the assessment, the following scenarios were assessed: 8 MW, 10 MW and 12+ MW.

Table 13.11: Maximum design scenario assessed

Potential effect	Maximum adverse scenario assessed	Justification
Construction		
Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments from seabed preparation, construction activities.	The maximum impact within the study area as part of seabed preparation activities has not yet been determined, as the number and type of turbines has not yet been confirmed. In general, the maximum impact will be from: • Maximum seabed preparation area for turbines; • Maximum number of turbine locations (34 x 8/ 10 MW turbines): 34 locations; • Maximum area of seabed preparation area per turbine: (Piled Quadropod/ Jacket or Suction Caisson Quadropod/ Jacket: 12 MW turbine 3,200 m^2 x 28 turbines = 89,600 m^2; • Bed preparation depth over full foundation area; • Maximum diameter of seabed preparation area for OSS; • Bed preparation depth over full OSS foundation area; • Maximum seabed preparation per ancillary structure; • Maximum seabed preparation dredge volume for turbine foundations; • Total prepared volume per release; • Dredged material from bed levelling to impact the seabed; • Seabed preparation material deposition; and • Pre-sweeping for OECC (dredging), if required – indicative length of cable 6 km x up to 4 cables x maximum width of pre-sweeping (dredging) 20 m. Total length: 24 km, Total area: 0.48 km^2.	Seabed preparation footprint: maximum preparation footprint, therefore maximum potential disturbance of seabed across the largest area and in the greatest number of locations (greatest potential for impacts to occur) Disposal of bed levelling material if required.
	The maximum construction footprint of the turbines within the study area will be: • Maximum number of locations (34 x 8/ 10 MW turbines): 34; and • Configuration with maximum project base footprint (including scour protection): 28 x 12 MW turbines, one OSS and one met mast with suction caisson quadropod/ jacket foundation, with scour protection. Total area: 235,620 m^2.	Maximum project base footprint therefore maximum potential disturbance of seabed across the largest area and in the greatest number of locations (greatest potential for impacts to occur).

Potential effect	Maximum adverse scenario assessed	Justification
	The maximum construction footprint of the associated infrastructure (including seabed preparation and foundation) within the study area will be: • One met mast (jacket, gravity base or monopile). With maximum footprint on seabed. Foundation to be determined; • One LIDAR Device (floating or monopile); • One wave buoy (floating with anchors); and • Two permanent vessel moorings (concrete gravity base or standard ground tackle).	Maximum seabed area disturbed, therefore maximum potential disturbance to seabed features
	The maximum construction footprint of the cables (including inter-array and export cables) within the study area will be- Inter-array cables: • Maximum potential length: 340 MW development, 64 km. Indicative trench width 1 m. = 64 km^2; • Maximum area of disturbance from either ploughing or jetting: 340 MW development, 0.6 and 0.3 km^2 respectively; • Maximum burial depth 3 m, over the maximum length of cable; • Width of rock berm protection for cable burial (5 m x 25% of cable length (16 km)): 80,000 m^2; and • Maximum area of rock berm protection for crossings (340 MW development = 12 crossings x 1,000 m^2 per crossing): 12,000 m^2. Export cables: • Maximum length of HVAC export cable within project boundary: 120 km; • Indicative total length per cable: 30 km x maximum number of export cables: 4 x Indicative trench width: 10 m. Total area = 1.2 km^2; • Indicative spacing between cables: 50 m within pair, 120 m between pairs; • Indicative width of disturbance from ploughing: 12 m; • Width of pre-sweeping (dredging) corridor: 20 m; • Maximum burial depth: 3 m. Over the maximum length of cable; and	Largest seabed area disturbed and/ or greatest depth of burial along the greatest distance at the maximum number of locations (greatest potential for direct impacts to occur). The depth of cable burial is of particular concern in areas of high potential, such as the area close to Goodwin Sands and at A2 magnetic anomalies without surface expression.

Potential effect	Maximum adverse scenario assessed	Justification
	• Width of rock berm protection for cable burial (7 m x 25% of cable length (7.5 km) x 4 cables): 210,000 m^2; and • Maximum number of cable crossings per cable: maximum number of cables 4 x number of cable crossings per cable: 20 x maximum length of crossing 100 m x width of crossing 10 m. Total area of post lay rock berm protection per cable crossing: 1000 m^2 = 80,000 m^2.	
	Construction at the export cable landfall: • Footprint of flat barge beached at low tide, plus potential additional disturbance of immediate area	Maximum total physical footprint from vessels associated with construction activities
	The maximum construction footprint of the export cable landfall within the study area: • Maximum width of shoreline required: 155 m; • Option 1: Maximum extent of HDD Pits: 4 pits: 20 x 20 m: 1,600 m^2; • Option 1: Maximum extent of HDD drilling: at least 100 m seaward of the existing seawall; • Options 2 & 3: Maximum number of trenches: 4 cables through mud flats and saltmarsh, 5 m separation of cables; • Options 2 & 3: Maximum width of intertidal trenching: 10 m; • Options 2 & 3: Maximum depth of intertidal trenching: 3 m; • Options 2 & 3: Maximum width of cofferdam: 165 m; • Options 2 & 3: Maximum extent of cofferdam: 25 m seaward; • Options 2 & 3: Maximum depth of cofferdam piles: 25 m; Maximum space required in saltmarsh: 3,872 m^2; • Maximum volume of materials for cable transition area. Maximum concrete - (4 x 12 x 2.5 x 4 x 0.2 = 96 m^3), backfill - (800 x 1.5 = 1200 m^3), maximum chalk capping - (800 x 0.2 + 2025 x 2) = 4210 m^3), possible sand to fill troughs and trenches (4 x 12 x 2.5 x 4 x 0.8 = 384 m^3), rock wall - (5 x 100 x 2 = 1000 m^3): • Maximum area of saltmarsh material removed or relocated.	Maximum potential area and depth of disturbance of intertidal deposits along the greatest distance at the maximum number of locations (greatest potential for direct impacts to occur).

Potential effect	Maximum adverse scenario assessed	Justification
Permanent physical loss/ disturbance of known and potential palaeogeographic receptors from construction activities where activities penetrate the seabed.	The maximum footprint from the legs of jack-up crane vessels and/ or anchors of other vessels during construction within the study area will be: • Jack-up footprint for turbine construction (individual leg diameter 10 m, individual leg footprint area 78.54 m^2, maximum number of legs 6, combined leg area 471.24 m^2, maximum jacking operations per turbine 2 (2 x 471.24 x 34 (8 or 10 MW) WTGs, one OSS, and one met mast) = 33,929 m^2; • Maximum depth of jack-up leg penetration: 15 m; Maximum volume (assuming area of maximum impact identified above): 508,939 m^3; • Maximum anchor penetration depth: 3 m; • Anchor footprint of 69,810m^2 for installation of foundations (34 turbines, one OSS and one met mast), OSS topside, export cables and inter-array cables (150 m^2 per foundation x 36 (5,400 m^2 total) + 150 m^2 for OSS topside + 34,560 m^2 for export cable installation + 29,700 m^2 for inter-array cable installation)	Maximum total physical footprint from vessels associated with construction activities Maximum impact on shallow seabed receptors due to depth of seabed penetration from vessels associated with construction activities
	The scheme design with the maximum depth disturbance within the study area will be: • Maximum embedment depth of monopile: 75 m; • Greatest number of locations: 36 (8 or 10 MW turbines, one OSS and one met mast); • Largest turbine area: 28 x 12 MW turbines (10 m diameter): 2,199 m^2; • Maximum area of OSS: Monopile (10 m diameter): 78.5 m^2; and • Maximum size of met mast foundations (using monopile base for 12 MW turbine: 10 m diameter): 78.5 m^2	Scheme design with the maximum depth therefore maximum potential disturbance of below seabed sediments across the largest area and in the greatest number of locations (greatest potential for impacts to occur).
	The associated offshore infrastructure (including seabed preparation and foundations) with the maximum depth disturbance within the study area will be: • One offshore substation foundation: Monopile: 75 m; • One met mast. Maximum depth of penetration. Monopile: 75 m; • Mooring buoys. Maximum depth of anchor penetration: 3 m; and • LIDAR buoys. Maximum depth of anchor penetration: 3 m.	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes.
	The maximum depth of disturbance from the legs of jack-up crane vessels and/ or anchors of other vessels during construction within the study area will be: • Maximum penetration of jack-up legs: 15 m; and	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes.

Potential effect	Maximum adverse scenario assessed	Justification
	• Maximum depth of anchors for installation of turbines and substation: 3 m.	
	The maximum depth disturbance of the cables within the study area will be: • Inter-array cables: maximum burial depth 3 m, over the maximum length of cable (64 km); and • Export cables: maximum burial depth: 3 m. Over the maximum length of cable (120 km).	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes (although this is unlikely given that the maximum burial depth is relatively shallow).
	The maximum depth disturbance of the export cable landfall within the study area: • Options 1, 2 & 3: Maximum depth of intertidal trenching: 3 m; • Options 2 & 3: Maximum depth of cofferdam piles: 25 m;	Maximum depth of disturbance so may impact on submerged prehistoric material and below seabed palaeolandscapes
Indirect effects upon known and potential marine archaeological receptors as a result of changes to sedimentation and erosion patterns.	Potential introduction of scour as a result of the construction of the array. In order to ensure the full consideration of the metrics in the project description, the potential for scour effects have been assessed as per Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2), and the design that will cause the greatest increase in scour.	Maximum potential for indirect effects.
Indirect effects on the setting of marine archaeological receptors offshore and at the landfall	Maximum physical impact to sites and therefore setting; and Maximum number of vessels on site at any one time: 48.	Maximum disturbance to sites and therefore to their integral setting. Maximum number of vessel movements and therefore visual impact to setting.
Operation		
Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments from the legs of jack-up vessels and/ or anchors of other vessels associated with maintenance activities.	The maximum footprint during the O&M phase within the study area will be: • Maximum jack-up footprint: maximum number of legs: x the number of required activities (for example turbine replacement, OSS maintenance); and • Maximum area covered by anchors, if required, if similar to installation vessels (number of anchors x maximum number of required activities). The maximum depth during the O&M phase within the study area will be: • Maximum depth of jack-up: 15 m, over the maximum number of required activities • Maximum depth of anchors: 3 m, over the maximum number of required activities; and • Maximum length of export cable and inter-array cable replacement, repair/ reburial.	Maximum total physical footprint from vessels associated with O&M activities. Maximum impact to shallowly buried receptors from greatest depth of penetration.

Potential effect	Maximum adverse scenario assessed	Justification
Permanent physical loss/ disturbance of known and potential palaeogeographic receptors from construction activities that penetrate the seabed.	The maximum depth during the O&M phase within the study area will be: • Maximum penetration of jack-up legs: 15 m, over the maximum number of required activities; and • Maximum depth of anchors: 3 m, over the maximum number of required activities.	Maximum depth of effect from vessels associated with O&M activities, potentially impacting buried receptors.
Indirect effects upon known and potential marine archaeological receptor as a result of changes to the hydrodynamic and sedimentary regimes from the presence of foundation structures.	Potential introduction of scour as a result of the presence of the array. In order to ensure the full consideration of the metrics in the project description, the potential for scour effects have been assessed as per Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2), and the design that will cause the greatest increase in scour.	Maximum potential for indirect effects.
Indirect effects on the setting of marine archaeological receptors offshore and at the landfall	Maximum number of vessel movements and therefore visual impact to setting: 307 O&M vessels per year, round trips. Maximum disturbance to sites and therefore to their integral setting.	Maximum number of vessel movements and therefore visual impact to setting. Maximum disturbance to sites and therefore to their integral setting.
Decommissioning		
Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments from the legs of jack-up vessels and/ or anchors of other vessels associated with decommissioning activities.	The maximum footprint during the decommissioning phase within the study area will be: • Maximum jack-up footprint over the maximum number of turbines (34), met mast and OSS (assuming similar required as per construction, and assuming area of impact has not previously been impacted): 33,929 m^2; • Maximum depth of jack-up penetration: 15 m. Maximum volume (assuming area of maximum impact identified above): 508,939 m^3; • Maximum anchor footprint over maximum number of anchor movements (assuming similar required as per construction, and assuming area of impact has not previously been impacted), for turbines, topside, met mast and OSS: 5,550 m^2; • Maximum depth of anchor penetration: 3 m. Maximum volume impacted (assuming maximum area identified above): 16,650 m^3; and • Maximum of anchor footprints for removal of cable (if required).	Maximum project base footprint therefore maximum potential disturbance of seabed across the largest area and in the greatest number of locations (greatest potential for impacts to occur). Maximum disturbance to shallowly buried receptors from seabed penetration.
Permanent physical loss/ disturbance of known and potential palaeogeographic receptors from construction activities where foundations penetrate the seabed.	The maximum depth during the decommissioning phase within the study area will be: • Maximum penetration of jack-up legs: 15 m, over the maximum number of required activities.	Maximum seabed area disturbed, therefore maximum potential disturbance to seabed features
Indirect effects upon known and potential marine archaeological receptors as a result of changes to the	Potential introduction of scour as a result of the removal of the array.	Maximum potential for indirect effects.

Potential effect	Maximum adverse scenario assessed	Justification
hydrodynamic and sedimentary regimes from the presence of foundation structures.	In order to ensure the full consideration of the metrics in the project description, the potential for scour effects have been assessed as per Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2), and the design that will cause the greatest increase in scour.	
Indirect effects on the setting of marine archaeological receptors offshore and at the landfall	Maximum number of vessel movements. The decommissioning sequence will likely be the reverse of the construction sequence, and involve similar types and numbers of vessels and equipment, as discussed above. Maximum disturbance to sites and therefore to their integral setting.	Maximum number of vessel movements and therefore visual impact to setting. Maximum disturbance to sites and therefore to their integral setting.
Cumulative effects		
Permanent physical loss/ disturbance of potential marine archaeological receptors in the wider marine archaeological environment from cumulative impacts.	Cumulative direct impacts to potential marine archaeological receptors within the wider marine archaeological environment, as a result of the proposed Thanet Extension development in combination with other proposed/ in-planning developments and activities.	Potential for cumulative impacts from developments within the wider area.

13.10 Embedded mitigation

13.10.1 Mitigation measures that were identified and adopted as part of the evolution of the project design (embedded into the project design) and that are relevant to offshore archaeology and cultural heritage are listed in Table 13.12. These general mitigation measures apply to all parts of the development works, including pre-construction, construction, O&M and decommissioning.

13.10.2 As embedded mitigation a draft WSI will be produced that will detail all aspects of any further archaeological work and outline how mitigation can be effectively completed and reported upon in good time before any construction is planned, and prior to any consent being formally considered, to ensure archaeological input into the project design. Therefore, while the need for a draft WSI is considered to be the embedded mitigation, and will be based on the mitigation measures set out in this chapter (Section 13.16), the finer details that will be contained in the final WSI will be agreed with the archaeological curators. The WSI will be developed in line with standard guidance and TCE document *Model Clauses for Archaeological Written Schemes of Investigation* (TCE, 2010), which sets out agreed archaeological methodologies.

13.10.3 The draft WSI will set out procedures for implementing AEZs, provide information about areas of archaeological potential, identify further geotechnical work on existing cores, and will set out procedures for further works, including archaeological input into any further geophysical, geotechnical, ROV, UXO, and/ or diver surveys, as well as any watching briefs, preservation by record, offsetting damage and how to handle the discovery of previously unidentified material, as discussed in more detail in (Section 13.16). It is important that archaeological expertise is incorporated in any remaining surveys undertaken for non-archaeological purposes, to ensure that the survey data acquired is to a specification to maximise the potential to inform archaeological assessment of the data. The WSI will also take into account recommendations from *People and the Sea: A Maritime Archaeological Research Agenda for England* (Ransley and Sturt, 2013).

13.10.4 Once the final development scheme has been confirmed, the WSI can be finalised, setting out when, how, and why mitigation measures are to be implemented, and methodologies for any further work can be assessed and incorporated, or appended as separate method statements, if required. Scheme-specific mitigation will be established where appropriate. The WSI will include a strategy for monitoring the effects over all phases of the development.

13.10.5 A draft WSI has been produced (Wessex Archaeology, 2018b), for discussion and agreement with the archaeological curator(s). Although the need for the draft WSI is considered as embedded mitigation, it does not remove the requirement for the impact assessment undertaken in sections 13.11 to 13.18

Table 13.12: Embedded mitigation relating to offshore archaeology and cultural heritage

Parameter	Mitigation measures embedded into the project design
General	
WSI	A WSI will be produced, and agreed by the archaeological curator(s), outlining mitigation measures.
AEZs	AEZs are recommended around known features of anthropogenic origin of archaeological interest (A1 anomalies) and historic records of archaeological material (A3 anomalies), no works that disturb the seabed will be undertaken within the extent of an AEZ. More details about the recommended AEZs can be found in Table 13.15 and Table 13.16.

13.11 Environmental assessment: construction phase

13.11.1 Impacts resulting in potential adverse effects upon archaeological receptors as part of construction works are those involving contact with the seabed or the removal of seabed sediments. Offshore archaeological receptors with height, such as shipwrecks, may also be impacted by activities that occur within the water column. Impacts from construction activities include:

- Seabed preparation prior to foundation installation;
- Installation of turbine foundations;
- Placing of scour protection around turbine foundations;
- Installation of offshore substation;
- Installation of met mast, mooring buoys, and LIDAR buoys;
- Seabed preparation prior to cable laying;
- Installation of inter-array and export cables;
- Installation of cable protection;
- Vessel moorings; and
- Seabed contact by the legs of jack-up vessels, and/ or anchors of other vessels.

Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments from seabed preparation and construction activities

13.11.2 Activities considered here refer to direct impacts associated with seabed preparation, construction and decommissioning activities undertaken in the proposed development areas. Direct impacts associated with construction works are considered to arise as a result of seabed preparation, turbine installation and associated scour protection, installation of the OSS, cable installation/ protection and seabed contact by construction vessels through jack-ups or anchors.

13.11.3 Any adverse effects upon offshore archaeological receptors would be permanent and irreversible.

13.11.4 With regards to activities associated with the construction works, any of the sources of direct impact listed above have the potential to destroy entire receptors as well as damaging a receptor or its relationship with the wider environment. Once a receptor is damaged or destroyed, or its context is altered, it is not possible to reinstate lost data. Therefore, the impact from the temporary footprint of a jack-up barge is of the same magnitude as a turbine foundation with a longer-term presence.

13.11.5 As such, the magnitude of direct impacts on known and potential seabed receptors as part of construction activities, if they were to occur, would be High and negative.

13.11.6 All seabed receptors have the potential to be damaged or destroyed if they are directly impacted during seabed preparation or construction activities. Furthermore, all damage to archaeological sites or material is permanent and recovery is limited to stabilisation or re-burial, limiting further impact. There is no potential for the recoverability of any seabed receptors if they are affected following a direct impact. As such, all wrecks, aircraft, and associated material and debris should be regarded as having High sensitivity. Potential impacts due to the depth of cable burial is of particular concern in areas of high potential, such as the area close to Goodwin Sands and at A2 magnetic anomalies without surface expression.

13.11.7 Due to the fragile and non-renewable nature of seabed receptors on and/ or under the seabed, any impacts have the potential to be permanent and negative. As a result, if appropriate mitigation is not applied, both the sensitivity and the magnitude of impact on such resources would result in an assessment of **Major** adverse significance. However, following the application of appropriate mitigation, as outlined in the mitigation section (13.16), and detailed in the draft WSI (Wessex Archaeology, 2018b), the results would be **Minor** to **Negligible** adverse significance. In some cases, the application of appropriate mitigation, such as archaeological investigation of seabed anomalies prior to impact could lead to effects of **Minor** to **Moderate** beneficial significance, through ensuring that any information gained is disseminated, for example through reports to the KHER, NRHE and/ or through publication if the importance of the discovery warrants it.

Permanent physical loss/ disturbance of known and potential palaeogeographic receptors from construction activities where activities penetrate the seabed

13.11.8 Activities considered here refer to direct impacts associated with construction works (e.g. turbine installation, offshore substation installation, and cable installation), where activities penetrate the seabed.

13.11.9 Archaeological sites and material beneath the shallow seabed sediments comprise potential palaeogeographic receptors. These can range in size from individual artefacts or artefact scatters through to palaeolandscapes. As such, any of the sources of direct impact listed above, that penetrate the shallow seabed sediments, have the potential to destroy entire receptors as well as damaging a receptor or its relationship with the wider environment. Once a receptor is damaged or destroyed, or its context is altered, it is not possible to reinstate lost data. Hence, the impact from the temporary footprint of a jack-up barge is the same magnitude as a turbine foundation with a longer-term presence. The magnitude of direct impacts on known and potential palaeogeographic receptors during construction activities would therefore be High.

13.11.10 All palaeogeographic receptors have the potential to be damaged or destroyed if they are directly impacted during the construction of the proposed development. Furthermore, all damage to archaeological sites or material is permanent and recovery is limited to stabilisation or reburial, limiting further impact. There is no potential for the recoverability of any buried receptors if they are affected following a direct impact. As such, all palaeogeographic receptors should be regarded as being of High sensitivity.

13.11.11 The palaeogeographic receptors are fragile and non-renewable, and therefore any impacts have the potential to be permanent and negative. As a result, and if appropriate mitigation measures are not applied, both the sensitivity and the magnitude of the impact on such resources will automatically be considered high, resulting in **Major** adverse significance. However, following the application of appropriate mitigation, as outlined in the mitigation section (13.16), and detailed in the draft WSI (Wessex Archaeology, 2018b), the results would be **Minor** to **Negligible** adverse significance and/ or **Minor** to **Moderate** beneficial significance, through the dissemination of survey results, which would make the data available to the heritage sector, academics and the general public.

Indirect effects upon known and potential marine archaeological receptors as a result of changes to sedimentation and erosion patterns during construction

13.11.12 The indirect effects upon the known and potential offshore archaeological receptors considered here are those which occur as a result of changes to hydrodynamic and sediment transport regimes, where these changes have occurred as a consequence of activities and structures associated with the construction activities. Indirect impacts may affect marine archaeological baseline conditions where they result in the increased exposure or burial of offshore archaeological receptors. The increased exposure of offshore archaeological receptors has the potential to cause erosion and deterioration to the receptors. Conversely, should offshore archaeological receptors be subject to increased sedimentation and burial, they may in turn benefit from conditions which afford higher levels of preservation.

13.11.13 The potential for indirect effects has been assessed with reference to Volume 2 Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2).

13.11.14 Scour refers to the development of pits, troughs, or other depressions in the seabed sediments around the base of wind turbine foundations, and is the result of net sediment removal over time. Evidence from TOWF suggests that the majority of scour was present by the beginning of the monitoring phase, and it can take anywhere a period of minutes to occur to several months. Due to this time differential, in Volume 2 Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2), scour is considered only within the O&M phase.

13.11.15 The seabed sediment across much of the array area comprises coarse sand and gravel, with varying quantities of fines. During dredging works, coarse sediment will not create persistent plumes, as it will settle quickly to the seabed, however, finer grained sediments can produce more persistent plumes that settle out of suspension over a wider area. In addition, drilling for foundations would also result in the release of coarse grained sediments in the immediate area, with finer grained material travelling further. Therefore, any known or potential archaeological receptors adjacent to dredging or drilling operations could be temporarily covered with additional protective material.

13.11.16 Offshore archaeological receptors are considered to have high sensitivity towards changes to bed levels where they are subject to increased erosion or scour. However, offshore archaeological receptors are considered to have low sensitivity towards changes to bed levels where they are subject to increased burial. Burial or partially buried marine archaeological receptors are often afforded greater levels of preservation than their exposed counterparts.

13.11.17 The Goodwins sand banks are located within the Goodwin Sands recommended Marine Conservation Zone (rMCZ), located approximately 2 km to the south of the Thanet Extension OECC, approximately 10 km off the Kent coast. Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2) outlines that while the sand banks are considered to be of high sensitivity/ importance, the magnitude of impact to the sand banks is predicted to be Negligible, as no sediment will be removed from the system and therefore the rate at which the sediment is supplied to the adjacent banks will remain unaltered. The overall effect significance has been determined as **Negligible**. Therefore, the effects on marine archaeological receptors within the Goodwin Sands will also be of **Negligible** significance, which is not significant in EIA terms.

Indirect effects on the setting of marine archaeological receptors offshore and at the landfall

13.11.18 There is potential for indirect effects on the setting of marine archaeological receptors in the immediate proximity of each asset. However, due to the generally limited visibility in the marine environment, these impacts would be very localised. Therefore, indirect effects on the immediate setting of each asset underwater is covered more thoroughly in the direct impact section.

13.11.19 The Marine Geology, Oceanography and Physical Processes assessment (Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2)) noted that coastal features at the landfall are considered to be of High sensitivity/ importance. However, the magnitude of potential impact is predicted to be Low, and therefore any effects on the coast, and therefore coastal archaeological features, is expected to be of **Minor** adverse significance during the construction phase, which is not significant in EIA terms.

13.11.20 There is potential for indirect effects on the wider setting of marine archaeological receptors, for example those with an aspect of setting reflecting wider historical events, such as the two World Wars and other international conflicts. Indirect effects to the wider setting are more ephemeral, but as the setting is considered to be of Medium to High importance, and the extent of impact could cover a wide area, the duration would last for the lifetime of the wind farm, or if the assets are physically affected, could be irreversible, and therefore could be severe. The magnitude of impact is expected to be Medium to High negative, and therefore the significance would be expected to be **Moderate** to **Major** adverse in the absence of mitigation. However, following the application of appropriate mitigation, as outlined in the mitigation section (13.16), the results would be **Minor** adverse to **Negligible** adverse significance.

13.11.21 There is potential for activities to cause indirect effects on the setting of marine archaeological receptors offshore and at the landfall during the construction phase. Activities would include construction vessel movements related to the laying of the export cables and activities at the landfall, which could disrupt the way in which the heritage assets are experienced, for example, not being able to see a historic lighthouse from a boat offshore. However, the construction activities and vessel traffic will occur in a wider context of vessel traffic, as this is one of the busiest shipping channels between the south-east coast and mainland Europe, and there is already an influence on seascape and setting from the nearby TOWF O&M vessels. The sensitivity of the onshore heritage assets within the study area is considered to be Low to Medium. The indirect effects would be over a small extent of area, temporary, infrequent and not severe. The magnitude of the indirect effects on setting of onshore receptors is therefore considered to be Low. The effects are therefore considered to result in **Minor** adverse effects.

13.11.22 The potential effects of the wind turbines on the setting of onshore heritage assets are considered within Volume 2, Chapter 3: Seascape, Landscape and Visual (Document Ref: 6.2.12).

Changes to the perceptions of historic seascapes from construction activities

13.11.23 The nature of HSC is such that it reflects not only the past uses of the sea, but also the present, and therefore any changes through construction activities would be reflected in updated HSC. Impacts to HSC can be assessed by examining the construction activities within the multi-level character of the sea: the shore, the sea surface, the water column, the sea floor and the subsea floor, then assessing changes in how perceptions of HSC could change given the nature of the proposed development.

13.11.24 Potential impacts to the sea floor and subsea floor are covered above in the consideration of direct impacts, and the presence of additional structures on the sea floor would require an update to HSC to reflect this. During construction there will also be changes to activities in the water column and on the sea surface. Activities and structures currently present in the area are related to fishing, navigation, submarine power and telecommunications cables, TOWF windfarm, a commercial shipping route and military uses. There will be changes to some of these activities during construction, as they will be replaced with construction traffic and, as the windfarm develops, the wind turbines and associated infrastructure.

13.11.25 Although the area is already partially characterised by offshore renewables, impacts to HSC will occur with the introduction of new elements which will cause an alteration in that character, and the project will add an additional example of offshore renewable energy industry, cables, and construction and O&M vessels. In addition to the changes in activities and structures, there will also be changes to the perceptions of historic seascapes from these activities, for example in the array area, areas of previously open sea used for navigation will now have structures present. To some extent the changes to perception of the visible elements of the shore and the sea surface have been captured through the assessment in Volume 2, Chapter 12: Seascape, Landscape and Visual. With regards to changes to perception of the subsea floor, seabed, and water column, these are more ephemeral, and are best captured through the multi-layered HSC assessment.

13.11.26 The array area and the OECC are considered to have a low to medium sensitivity. Changes to the HSC will endure for the duration of the wind farm, and in some cases such as any infrastructure on the seabed or impact below the seabed, may be permanent. Therefore they are of low to medium magnitude. Impacts to HSC will occur with the introduction of new elements which will cause an alteration in that character, and the perception of that character, and the project will add an additional example of offshore renewable energy industry and cables to the existing HSC. The resulting effects to the array area will be of **Minor** to **Moderate** adverse significance.

13.11.27 HSC is designed to reflect current activities, and will therefore be impacted by any changes to activities in the area. HSC should be updated to reflect the changes, and this is included as mitigation (section 13.16). With this mitigation, the significance of effects would be reduced to **Minor** to **Negligible** adverse.

13.12 Environmental assessment: Operational and Maintenance phase

13.12.1 Activities undertaken as part of O&M works, and existing structures during the O&M phase, have the potential to directly and indirectly impact marine archaeological receptors on or under the seabed, resulting in their loss or the disruption of relationships between receptors and their wider surroundings.

13.12.2 Direct impacts resulting in these potential effects as part of O&M works are those involving seabed contact, and include:

- Anchors of vessels deployed during periodic overhauls and scheduled or unscheduled O&M; and
- Seabed contact by the legs of jack-up vessels.

13.12.3 Indirect impacts include changes to hydrodynamic and sedimentary regimes from the presence of foundation structures.

Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments from the legs of jack-up vessels and/ or anchors of other vessels associated with O&M activities

13.12.4 The magnitude of impacts, receptor sensitivity and significance is the same as that outlined above for the construction phase.

13.12.5 Because of the fragile and non-renewable nature of the offshore archaeological receptors on the seabed any impacts have the potential to be permanent and adverse. As a result of this, and if appropriate mitigation measures were not in place, both the sensitivity and magnitude of the impact on such resources would automatically be considered High, resulting in **Major** adverse effects. However, following the application of appropriate mitigation, as outlined in section 13.16, and detailed in the draft WSI (Wessex Archaeology, 2018b), the results would be **Minor** to **Negligible** adverse significance. In some cases, the application of appropriate mitigation, such as the implementation of ORPAD for unexpected discoveries, could lead to effects of **Minor** to **Moderate** beneficial significance, through further investigation, research and the dissemination of results through the NRHE/ KHER and to the wider public.

Permanent physical loss/ disturbance of known and potential palaeogeographic receptors from construction activities that penetrate the seabed

13.12.6 The magnitude of impacts, receptor sensitivity and significance for potential palaeogeographic receptors is the same as that outlined above for the construction phase.

13.12.7 Because of the fragile and non-renewable nature of the offshore archaeological receptors under the seabed any impacts have the potential to be permanent and adverse. As a result of this, and if appropriate mitigation measures were not in place, both the sensitivity and magnitude of the impact on such resources would automatically be considered high, resulting in **Major** adverse effects. However, following the application of appropriate mitigation, as outlined in the mitigation section (13.16), and detailed in the draft WSI (Wessex Archaeology, 2018b), the results would be **Minor** to **Negligible** adverse significance.

Indirect effects upon known and potential marine archaeological receptors as a result of changes to the hydrodynamic and sedimentary regimes from the presence of foundation structures

13.12.8 The indirect effects upon the known and potential offshore archaeological receptors considered here are those which occur as a result of changes to hydrodynamic and sediment transport, where these changes have occurred as a result of the presence of foundation structures associated with the proposed development. Indirect impacts may affect baseline conditions where they result in the increased exposure of burial of offshore archaeological receptors. The increased exposure of marine archaeological receptors has the potential to promote conditions in which archaeological material may be vulnerable to erosion and deterioration. Conversely, should offshore archaeological receptors be subject to increased sedimentation and burial, they may benefit from conditions which afford higher levels of preservation.

13.12.9 The assessment of Marine Geology, Oceanography and Physical Processes (Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2)) indicated that the key potential for scour can be summarised as follows: the greatest area of local scour effect (per foundation) and the greatest potential for volume of scoured material, is associated with the largest (10 m) monopiles; for Thanet Extension as a whole, the greatest extent of local scour is associated with the array of 34 x 10 m monopile foundations; and the greatest extent of global scour would be with an array of 28 quadropod foundations. However, in areas where erosion resistant (pre-Holocene) material is present at or close to the seabed, there will be limited scour. The assessment is considered to be conservative, as evidence from the TOWF 3 MW turbines (up to 5.1 m in diameter) suggests scour pits of 3.7 - 4.4 m in diameter. Overall, the greatest influence on local scour depth would arise from the installation of scour protection where it is deemed necessary. The installation of correctly designed and installed scour protection will essentially prevent the development of local primary scour.

13.12.10 Offshore archaeological receptors are considered to have High sensitivity towards scour effects where they are subject to increased exposure, leading to degradation and damage.

13.12.11 Where scour protection is correctly applied, scour will be limited, and therefore any impacts to marine archaeological receptors will also be limited, and therefore will be of Low magnitude and any effects would be of **Negligible** significance.

13.12.12 Should sedimentation lead to burial of offshore archaeological receptors, this will lead to increased preservation, and therefore the sensitivity will be low.

13.12.13 The magnitude of offshore archaeological receptors protected by increased sedimentation would be Minor to Moderate beneficial and any effects would be of **Minor** to **Moderate** beneficial significance.

13.12.14 With regards to the Goodwin sand banks, Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2) indicates that the magnitude of any impact will be very low, and therefore the overall effect on sand banks will be of **Negligible** significance during the O&M phase.

Indirect effects on the setting of marine archaeological receptors offshore and at the landfall

13.12.15 During O&M, the potential impacts of activities associated with the OWF include the movement of O&M vessels in the area. The setting of offshore and onshore assets is considered to already be influenced by TOWF and passing shipping vessels, which reduce the sensitivity and magnitude of change.

13.12.16 In addition, Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2) indicates that changes to coastal features will be of Low to Very Low magnitude, and therefore no greater than **Minor** adverse significance.

13.12.17 The significance of indirect effects on offshore receptors will also be **Low** to **Negligible**.

13.12.18 The potential effects of the wind turbines on the setting of onshore heritage assets are considered within Volume 2, Chapter 12: Seascape, Landscape and Visual (Document Ref: 6.2.12).

Changes to the perceptions of historic seascapes from O&M activities

13.12.19 Assuming HSC has been updated to reflect changes due to construction and the eventual placement of the wind farm, during the construction phase, there will be no further changes during the O&M phase, and effects would be **Negligible**.

13.13 Environmental assessment: decommissioning phase

13.13.1 Activities undertaken as part of decommissioning works have the potential to directly and indirectly impact marine archaeological receptors on or under the seabed, resulting in their loss or the disruption of relationships between receptors and their wider surroundings.

13.13.2 Direct impacts resulting in these potential effects as part of decommissioning works are those involving seabed contact, and include:

- Where required, the removal of turbine and offshore substation foundations, scour protection, cable protection and cables;
- Anchors of vessels deployed for decommissioning; and
- Seabed contact by the legs of jack-up vessels.

13.13.3 Indirect impacts include changes to hydrodynamic and sedimentary regimes due to the removal of foundation structures.

Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments from decommissioning activities

13.13.4 Activities associated with the decommissioning phase are anticipated to be broadly similar to the construction phase. As such, the magnitude of any potential impacts on known and potential receptors on the seabed and in shallow sediments associated with this phase are unlikely to exceed the maximum adverse scenario assessed for construction. However, it is possible that receptors that have not yet been impacted could be at this stage, and therefore appropriate mitigation measures should be implemented, in line with the mitigation as outlined in the section 13.16, and detailed in the draft WSI (Wessex Archaeology, 2018b).

Permanent physical loss/ disturbance of known and potential palaeogeographic receptors from decommissioning activities where activities penetrate the seabed

13.13.5 Activities associated with the decommissioning phase are anticipated to be broadly similar to the construction phase. As such, the magnitude of any potential impacts on potential buried receptors associated with this phase are unlikely to exceed the maximum adverse scenario assessed for construction.

Indirect effects upon known and potential marine archaeological receptors as a result of changes to sedimentation and erosion patterns

13.13.6 In Volume 4, Annex 2-1: Marine Geology, Oceanography and Physical Processes Technical Report (Document Ref: 6.4.2.1) indicates that the removal of foundations has the potential to affect hydrodynamic regime, sediments and sedimentary structures, and suspended sediment concentrations and transport. However, any impacts arising from decommissioning are likely to be of lower magnitude than those described for construction

Indirect effects on the setting of marine archaeological receptors offshore and at the landfall

13.13.7 Activities associated with the decommissioning phase are anticipated to be broadly similar to the construction phase. As such, the magnitude of any potential impacts on potential buried receptors associated with this phase are unlikely to exceed the maximum adverse scenario assessed for construction.

Changes to the perceptions of historic seascapes from decommissioning activities

13.13.8 HSC is such that it reflects past and present uses of the sea, and therefore any changes through decommissioning activities would need to be reflected in updated HSC. Depending on the decommissioning activities, there will be changes to the character of the multi-level character of the sea: the sea surface, the water column, the sea floor and the subsea floor, and the HSC should be updated accordingly. Effects will be M**inor** to M**oderate** adverse, however following mitigation comprising updating the HSC, effects will be M**inor** to **Negligible** adverse.

13.14 Environmental assessment: cumulative effects

13.14.1 Cumulative effects refer to effects upon receptors arising from Thanet Extension when considered alongside other proposed developments and activities and any other *reasonably foreseeable project(s)* proposals. In this context the term *projects* is considered to refer to any project with comparable effects and is not limited to offshore wind projects.

13.14.2 The approach to cumulative assessment for Thanet Extension takes into account the Cumulative Impact Assessment Guidelines issued by RenewableUK in June 2013, together with comments made in response to other renewable energy developments within the Southern North Sea, and the PINS 'Advice Note 9: Rochdale Approach'. The renewable energy developments that have informed this approach have been agreed within the Scoping Opinion, the suggested tiers, and the Volume 1, Annex 3-3: Cumulative Impact Assessment (Document Ref: 6.1.3.1) conducted for Thanet Extension. The methodology is outlined in paragraphs 13.4.32 to 13.4.36.

13.14.3 In assessing the potential cumulative impact(s) for Thanet Extension, it is important to bear in mind that for some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, relevant projects/ plans that are already under construction are likely to contribute to cumulative impact with Thanet Extension (providing effect or spatial pathways exist), whereas projects/ plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

13.14.4 For this reason, all relevant projects/ plans considered cumulatively alongside Thanet Extension have been allocated into 'Tiers', reflecting their current stage within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each scenario (Tier) in the decision making process when considering the potential cumulative impact associated with Thanet Extension (e.g. it may be considered that greater weight can be placed on the Tier 1 assessment relative to Tier 2).

13.14.5 The projects and plans selected as relevant to the assessment of impacts to offshore archaeology and cultural heritage are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved, see Volume 1, Annex 3-3: Cumulative Impact Assessment (Document Ref: 6.1.3.1).

13.14.6 The proposed tier structure that is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in the Thanet Extension ES is as follows:

Tier 1

13.14.7 Thanet Extension considered alongside other projects/ plans currently under construction and/ or those consented but not yet implemented, and/ or those submitted but not yet determined where data confidence for the projects falling within this category is high.

13.14.8 Built and operational projects will be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/ or any residual impact may not have yet fed through to and been captured in estimates of 'baseline' conditions or there is an ongoing effect.

Tier 2

13.14.9 All projects included in Tier 1 plus other projects/ plans consented but not yet implemented and/ or submitted applications not yet determined where data confidence for the projects falling into this category is medium.

Tier 3

13.14.10 The above plus projects on relevant plans and programmes (the PINS Programme of Projects and MMO 'Marine Case Management System' being the source most relevant for this assessment). Specifically, all projects where the developer has advised PINS in writing that they intend to submit an application in the future were considered. This includes, projects for which scoping reports have been submitted and data availability is limited and/ or data confidence is low.

13.14.11 The specific projects scoped into this cumulative impact assessment, and the tiers into which they have been allocated are presented in Table 13.13 below (Figure 13.28). The operational projects included within the table are included due to their completion/ commission subsequent to the data collection process for Thanet Extension and as such not included within the baseline characterisation.

Table 13.13: Projects for cumulative assessment

Development type	Project	Status	Data confidence assessment/ phase	Tier
Marine Aggregate and Disposal	Cutline – 446	Consenting/ Pre-Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 2
	Cutline – 447	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Goodwin Sands	Consenting/ Pre-Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 2
	Longsand – 508	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Longsand – 509/ 1	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Longsand – 509/ 2	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Longsand – 509/ 3	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Longsand – 510/ 1	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Longsand – 510/ 2	Open	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	North Falls East – 501	Consenting/ Pre-Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 2
	North Falls East – 501/ 2	Consenting/ Pre-Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 2
	Thames D – 524	Consenting/ Pre-Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 2
Offshore Wind Farm	East Anglia One	Due to commence construction next year	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 2
	East Anglia Two	Pre-planning Application	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 2
	Galloper	Under Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Greater Gabbard	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Gunfleet Sands Demo	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1

Development type	Project	Status	Data confidence assessment/ phase	Tier
	Gunfleet Sands I	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Gunfleet Sands II	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Kentish Flats	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Kentish Flats Extension	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	London Array 1	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Thanet	Operational	High - Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
Commercial Fisheries	Fishing Rights	Operational	High -Third party project details published in the public domain and confirmed as being 'accurate' by Cefas.	Tier 1
Cables and Pipelines	Galloper Offshore Wind Farm Export Cable	Under Construction	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Greater Gabbard Offshore Wind Farm Export Cable	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Gunfleet Sands Demo Offshore Wind Farm Export Cable	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Gunfleet Sands Offshore Wind Farm Export Cable	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Kentish Flats Offshore Wind Farm Export Cable	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	London Array Offshore Wind Farm Export Cable	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	Nemo Link Interconnector	Under Construction	High - Project details published in the public domain and confirmed as being 'accurate' by developer.	Tier 1
	Thanet Offshore Wind Farm Export Cable	Active	High - Third party project details published in the public domain and confirmed as being 'accurate' by TCE.	Tier 1
	UK-FR4	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
	SEA ME WE3-S10.2	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
	Tangerine (KISS-ORCA)	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1

Development type	Project	Status	Data confidence assessment/ phase	Tier
	ULYSSES (KIS-ORCA)	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
	Atlantic Crossing-1 (AC-1)	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
	Pan European Crossing (UK-Belgium)	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
	SeaMeWe-3	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
	TAT-14	Active	Medium – Third party project details published in the public domain but not confirmed as 'accurate' by the developer.	Tier 1
Shipping and Navigation	Chatham Docks	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Colchester	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Dover Harbour	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Felixstowe	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Folkestone Harbour	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Gravesend	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Harwich	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Ipswich	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Isle of Grain	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Ramsgate	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Rye Harbour	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Sheerness	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Thamesport	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Tilbury	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
	Whitstable	Operational	High – Third party project details published in the public domain and confirmed as being 'accurate' by the developer.	Tier 1
Coastal	Extension of an existing pontoon	Approved	Medium - Third party project details published in the public domain but not confirmed as being 'accurate'.	Tier 2
	Identification of a new disposal site	Approved	Medium - Third party project details published in the public domain but not confirmed as being 'accurate'.	Tier 2

13.14.12 The cumulative Rochdale Envelope is described in the following table.

Table 13.14: Cumulative Rochdale Envelope

Impact	Scenario	Justification
Cumulative permanent physical loss/ disturbance of offshore archaeological and cultural heritage receptors in the wider environment	Significant cumulative impacts to known and potential marine archaeological receptors, from a variety of developments including OWFs, aggregate extraction activities, pipelines and cable routes, as a result of multiple unavoidable impacts to a receptor across a region. Such impacts may result in direct effects on potential receptors on or under the seabed or disturb relationships between receptors and their wider surroundings as the result of seabed contact, the removal of seabed sediments or other such activity in the water column	Numerous developments within a 100 km radius potentially directly impacting known and potential offshore archaeology and cultural heritage receptors.
Cumulative indirect effects upon offshore archaeological and cultural heritage receptors as a result of changes to hydrodynamic, sedimentary and erosion regimes	There is the potential for indirect effects to occur upon known and potential receptors as a result of changes to hydrodynamic and sediment transport regimes, caused by OWF developments, aggregate extraction activities, pipelines and cable routes. Such effects are predicted to arise as a result of changes to bed levels at the seabed caused by changes to sedimentation and erosion regimes, and leading to increased exposure or coverage of receptors. Increased exposure could cause receptors to be vulnerable to deterioration, whereas increased coverage would promote preservation.	Numerous developments within a 100 km radius potentially causing changes to sedimentary and erosion regimes, and therefore indirectly impacting known and potential offshore archaeology and cultural heritage receptors.

13.14.13 Cumulative effects result from the combined impact of a number of different projects on the same receptor. Cumulative effects on the offshore archaeological and cultural heritage receptors can result in incremental changes over time and over a wide area (Oxford Archaeology, 2008; HE, 2015).

13.14.14 The overall scope for potential cumulative effects of the proposed development was assessed in relation to all projects and plans within 100 km of Thanet Extension, based on discussions with HE. However, developments within the 100 km buffer have been scoped out where insufficient or incompatible data regarding the offshore archaeological and cultural heritage receptors was available.

13.14.15 The cumulative assessment has been compiled with Tier 1 and Tier 2 projects, as no Tier 3 projects exist within the 100 km buffer. The majority of the projects in Table 13.13 above are already operational. Those scoped into the assessment are considered to result in potential incremental changes to the offshore archaeology and cultural heritage resource across a wider area. The small number of Tier 2 projects are unlikely to have considerably different cumulative effects on the offshore archaeology and cultural heritage receptors, and therefore, this section considers Tier 1 and Tier 2 projects together.

Marine Aggregates and Disposal

13.14.16 There are a number of marine aggregate licenced dredging areas within 100 km of Thanet Extension. Seven of these (Cutline – 447, Longsand - 508, Longsand – 509/ 1, 509/ 2, 509/ 3, 510/ 1, and 510/ 2) are currently operational, while six (Cutline – 446, Goodwin Sands, North Falls East 501, 501/ 1 and 501/ 2 and Thames D – 524) are in the consenting or pre-dredging stages.

THANET EXTENSION OFFSHORE WIND FARM

Figure 13.28

Cumulative Impact Assessment

Legend

- Offshore Red Line Boundary
- Cumulative Impact Assessment 100 km buffer
- UK Territorial waters
- UK EEZ limit
- OSM coastline
- Marine Conservation Zone
- World Port
- Cables[1]
- Nemo cable
- UKDEAL pipeline
- CEFAS
- TCE Wind Farm
- Emodnet HA
- Emodnet HA dredging
- Emodnet HA Wind Farm

Datum: ETRS 1989
Projection: UTM31N

Notes
[1] Cables include BSH, Kis Orca and SIG

NOT FOR NAVIGATION

1:1,000,000 0 10 20 km 0 5.5 11 nm

Drg No	Fig_13.28		
Rev	3	Date	24/05/2018
By	KL	Layout	N/A

Figure 13.28

13.14.17 EIAs will have been undertaken for the existing dredging areas and are likely underway for the proposed areas. The EIAs will likely recommend avoidance of any known seabed features, not only for their historic importance but also as operational hazards. In addition, the EIAs will recommend adherence to a reporting protocol for unexpected finds. Many of the aggregate companies involved (Hanson Aggregates Marine Ltd, Tarmac Marine Ltd., CEMEX UK Marine Ltd., Britannia Aggregates Ltd., and DEME Building Materials Ltd.) participate in the Marine Aggregate Industry Archaeological Protocol (BMAPA and English Heritage, 2005) and receive associated training to mitigate for the impact on potential archaeological receptors. Therefore, any cumulative impacts of marine aggregate dredging would be of Negligible magnitude and therefore of **Minor** to **Negligible** adverse significance.

13.14.18 The ES for the Goodwin Sands dredging area (Royal HaskoningDHV, 2016) states that any previously recorded *in situ* heritage assets, including recorded wrecks, A2 anomalies and palaeochannels will be avoided, and therefore there will be no impact. In addition, any previously undiscovered *in situ* heritage assets will be recorded through geophysical assessment pre- and post-dredge, on-board monitoring and a reporting protocol.

13.14.19 The archaeological assessments of geophysical and geotechnical survey data, undertaken as part of the EIA process, have contributed to wider understanding of the palaeogeography in the area, and therefore are of **Moderate** beneficial significance. The beneficial aspect is particularly evident when the information gained through archaeological assessment is disseminated to the wider public.

13.14.20 There are 19 disposal sites and five aggregate dredging sites within French waters, within 100 km of Thanet Extension. These sites have been scoped out of the assessment due to the limited availability of comparable data regarding offshore archaeology and cultural heritage assessments. However, the likelihood is that most disposal sites, by their nature, are required to undergo a licensing process which includes a characterisation of the site. In general, deposition of fine grained materials would be considered to be positive for archaeological material on the seabed, however deposition of large material could be detrimental. In addition, sites within French waters are also likely to have undergone EIA, and that appropriate mitigation measures will have been applied.

Offshore Wind Farms

13.14.21 The cumulative assessment has reviewed the 11 OWFs within 100 km of Thanet Extension. Projects beyond this have been scoped out due to their distance from the project. In addition, projects in Belgium, France, Germany and the Netherlands have also been scoped out of the assessment, due to the limited availability of comparable data regarding offshore archaeology and cultural heritage assessments.

13.14.22 Of the 11 OWFs, eight are presently operational and one is under construction. These nine have undergone EIA, and suitable mitigation measures have been implemented. Mitigation measures have included AEZs around known offshore archaeology and cultural heritage receptors, geophysical and geotechnical surveys, and protocols for unexpected discoveries. Therefore, any cumulative impacts from existing and under construction OWFs would be of Negligible magnitude and therefore of minor to **Negligible** adverse significance.

13.14.23 The archaeological assessments of geophysical and geotechnical survey data, undertaken as part of the EIA process, have contributed to wider understanding of the palaeogeography in the area, and therefore are of **Moderate** beneficial significance. The beneficial aspect is particularly evident when the information gained through archaeological assessment is disseminated to the wider public.

13.14.24 The remaining two OWFs, East Anglia One (due to commence construction next year) and East Anglia Two (in planning), will also undergo EIA, and therefore any significant impacts will likely be mitigated against, and the likeliness of effects to occur is reduced, resulting in Minor to Negligible significance of effects. However, should impact occur, it could range from **Minor** to **Major** adverse significance, depending on the value of the receptor being impacted.

13.14.25 There is potential for indirect impacts to occur upon known and potential offshore archaeological and cultural heritage receptors as a result of changes to hydrodynamic and sediment transport regimes, during the construction phase of the proposed development and/ or the decommissioning stages of all of the projects. The potential for impact increases as the distance between sites decreases, and therefore there is highest potential relating to TOWF, London Array 1 and Kentish Flats and Kentish Flats Extension. However, the Marine Geology, Oceanography and Physical Processes assessment (Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2)) indicated that indirect impacts, such as scour, are very localised, and therefore even TOWF is unlikely to cause any indirect impacts cumulatively with Thanet Extension.

Commercial Fisheries

13.14.26 Commercial fishing in the area includes fixed netting, drift netting, bottom trawling, and pelagic trawling. Further detail is provided in the Scoping report and in Volume 2, Chapter 8: Commercial Fisheries (Document Ref: 6.2.9).

13.14.27 Trawling and netting may damage or destroy offshore archaeology and cultural heritage receptors on the seabed and in shallow seabed sediments.

13.14.28 During the construction phase, there will likely be loss of or restricted access to traditional fishing grounds as safety zones are established around construction works. Therefore, during the construction period, there will likely be displaced fishing activity, leading to increased use of other areas outside the proposed Thanet Extension development area. The loss of traditional fishing grounds and displacement of fishing activity will continue during wind farm operation, and these impacts will be explored in further detail in the EIA.

13.14.29 However, the industry is well established and is widespread throughout the region, and therefore, any changes in fishing activity that may manifest from the construction of the proposed Thanet Extension are unlikely to result in any significant new cumulative direct impacts. Therefore, any cumulative direct impacts of commercial fisheries would be of Negligible magnitude and therefore of **Minor** to **Negligible** adverse significance.

13.14.30 Commercial fisheries are unlikely to cause noticeable changes to hydrodynamic, sedimentation or erosion regimes. Therefore, any cumulative indirect effects would be of **Negligible** adverse significance.

Oil and Gas

13.14.31 All of the oil and gas installations for assessment are located beyond 100 km from Thanet Extension, and therefore have been scoped out of the assessment.

Cables and Pipelines

13.14.32 There are 16 cables and pipelines for consideration. Some of these cables, such as the nine related to export cables for wind farms, have undergone EIA, and as such, any potential impacts have been mitigated. It is unclear whether the remaining projects have undergone detailed assessment, however, it is likely that any known seabed features were avoided during construction, as these would constitute engineering hazards. In addition, impact to buried material is likely to be relatively minimal, as the impact to the seabed is relatively minimal, although over a long distance. The cables and pipelines would likely have been shallowly buried, or any covering material would have had a relatively small footprint. Although O&M activities could represent a potential cumulative impact, the mitigation measures which would likely be required for any such activity would reduce the pathway for cumulative impacts to occur. Therefore, any cumulative impacts of cables and pipelines would be of Negligible magnitude and therefore of **Minor** to **Negligible** adverse significance.

13.14.33 As cables and pipelines are likely to be buried or covered by low-lying material, they are unlikely to cause noticeable changes to hydrodynamic, sedimentation or erosion regimes. Therefore, any cumulative impacts of the indirect impacts of cables and pipelines would be of **Negligible** adverse significance.

Shipping and Navigation

13.14.34 The ports within 100 km of Thanet Extension, including Chatham Docks, Colchester, Dover Harbour, Felixstowe, Folkestone Harbour, Gravesend, Ramsgate, Rye Harbour, Sheerness, Thamesport, Tilbury and Whitstable are all operational. Dredging work at these ports is expected to be limited to maintenance dredging to existing depths. Any additional dredging works, such as channel widening or deepening, or construction works, such as new facilities or docks, would be subject to impact assessment and the application of appropriate mitigation with regards to offshore archaeology and cultural heritage.

13.14.35 Therefore, any cumulative impacts of shipping and navigation would be of Negligible magnitude and therefore of **Minor** to **Negligible** adverse significance.

Military, Aviation and Radar

13.14.36 The UK military bases have been scoped out of the offshore archaeology and cultural heritage assessment.

Coastal Developments

13.14.37 There are two coastal development for consideration, and both of these could have potential cumulative impacts with offshore archaeology and cultural heritage receptors.

13.14.38 The West Mersea Pontoon Extension (http://www.planning.colchester.gov.uk/WAM/showCaseFile.do;jsessionid=2BB605B4F1E295DC830EDF5449000F8C?action=show&appType=Planning&appNumber=170230 accessed 25th May 2017) has been approved, based on the requirement of the submission of a construction method statement, that would allow the development to be amended to mitigate any potential detrimental ecological issues (Colchester Borough Council, 2017). This would include details of any foreshore access requirements and piling methods, if required. Should piling be undertaken, there is potential for direct impact on previously unknown offshore archaeology and cultural heritage receptors, and this impact, depending on the value of the receptor could be of minor to major negative significance. Additionally, the installation of new piles in the intertidal zone, if required, could amend existing hydrodynamic, sedimentary and erosion regimes, therefore exposing or further burying any presently unknown material. Depending on the value of the archaeological material, if sediment erodes and exposes archaeological material, this could be of minor to major significance, however if sediment accrues, this would be of **Minor** beneficial significance.

13.14.39 The new disposal site for the maintenance of dredging material closer to shore than the existing disposal site at the Inner Gabbard has been issued a marine licence for works. However, the site has been scoped out of the assessment due to the limited availability of comparable data regarding offshore archaeology and cultural heritage assessments.

13.15 Inter-relationships

13.15.1 The potential inter-relationships have been assessed between the offshore archaeological environment and the assessments undertaken for:

- Volume 3, Chapter 7: Onshore Historic Environment (Document Ref: 6.3.7);
- Volume 2, Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2);
- Volume 2: Chapter 6: Fish and Shellfish Ecology; and
- Volume 2, Chapter 12: Seascape, Landscape and Visual (Document Ref: 6.2.12).

13.15.2 With regards to the onshore historic environment, assessment related to the seamless nature of the archaeological resource from onshore to offshore contexts. However, inter-related effects on these assets are not anticipated, as any effects on onshore historic environment receptors will be mitigated or offset.

13.15.3 With regards to marine geology, oceanography and physical processes, assessment focussed on how the loss of archaeological remains could impact scour and sedimentation patterns on the seabed, for example around shipwrecks. However, upstanding archaeological material will be protected through AEZs and avoidance, and therefore there are expected to be no changes to physical processes.

13.15.4 Loss of offshore archaeological remains which also function as fish and shellfish habitat would not give rise to any inter-related effects, as effects on fish and shellfish will be mitigated or offset.

13.15.5 Any adverse visual effects arising as a result of impacts to the offshore archaeological receptors would not constitute an inter-related effect to seascape, landscape and visual, as offshore archaeological receptors are only visible on the seabed, and therefore do not affect the views selected for the seascape, landscape and visual impact assessment.

13.15.6 In summary, inter-related effects with offshore archaeological receptors are not anticipated.

13.16 Mitigation

13.16.1 The following measures are designed to mitigate any predicted adverse effects upon seabed receptors from direct impacts. The measures are designed to reduce or offset any damage/ disturbance occurring as a result of the proposed development upon known sites, and to establish the presence of unknown sites.

13.16.2 As identified above in the embedded mitigation section (13-65), all aspects of any further archaeological work will be detailed in a WSI which will be prepared in time to allow for the mitigation to be informed by archaeological input, effectively completed and reported on before any construction is planned in order for plans to be informed by archaeological concerns. Once the final development scheme has been confirmed, the WSI can be finalised, setting out when how and why mitigation measures are to be implemented, and methodologies for any further work can be assessed and incorporated, or appended as separate method statements, if required. Scheme-specific mitigation will be established where appropriate. The WSI will include a strategy for monitoring the effects over all phases of the development.

13.16.3 Best practice favours the preservation *in situ* of archaeological remains, and therefore the ideal mitigation is avoidance (Wessex Archaeology, 2007; DECC, 2011b), however, if avoidance is not possible, appropriate alternative mitigation measures have also been recommended.

13.16.4 For the proposed development, impact to known sites of archaeological interest will be avoided by implementing AEZs. The TCE document *Model Clauses for Archaeological Written Schemes of Investigation* (TCE, 2010) states that AEZs are formed by establishing a buffer around the known extents of sites for which the available evidence suggests that there could be archaeological material present on the seabed. All development and related activities that could impact the seabed are prohibited within the boundaries of an AEZ. The final development layout will take into account the locations of all AEZs. All AEZs will be marked on the scheme masterplans. If impacts cannot be avoided, measures to reduce, remedy or offset disturbance will be agreed.

13.16.5 Although AEZs are fixed, provision should be made for them to refined or be removed (with agreement of HE) as the project progresses, subject to additional archaeological assessment of subsequent surveys that may be required. Surveys could include further geophysical, ROV, or diver surveys. In addition, in order to maximise the potential benefits of any further surveys, archaeological advice should be sought during the planning stages.

13.16.6 The AEZs recommended for sites in the array are summarised in Table 13.15 (Figure 13.3-Figure 13.7).

Table 13.15: Sites recommended for AEZs in the array area

WA_ID	Discrimination	Description	Buffer (m)
70018	A1	Wreck	50
70032	A3	Recorded wreck	100
70033	A3	Recorded wreck	100
70034	A1	Wreck	50
70039	A1	Debris	20
70040	A1	Wreck	50
70052	A1	Wreck	50
70056	A1	Wreck and associated debris	50
70067	A3	Recorded obstruction	100
70069	A1	Wreck	50
70085	A3	Recorded obstruction	100
70104	A1	Debris	20
70117	A1	Wreck	50
70128	A1	Wreck	50

13.16.7 Due to the potential significance of known sites, AEZs are recommended around all eightwrecks within the Thanet Extension array. The AEZs consist of 50 m around the extents of the wrecks, as recorded in the sidescan sonar and multi-beam data. Of the non-wreck A1 anomalies, four are objects of debris likely to be related to the wrecks and covered within the wreck AEZs. Anomalies 70042 and 70058 are both wreck debris, however their 20 m buffer extends slightly beyond that of the wreck, and in these cases, the wreck's 50 m AEZ has been merged with the 20 m buffer to make one buffer. Anomalies 70039 and 70104 are both debris items with associated UKHO records. Although nothing was identified on the most recent geophysical data to indicate a wreck, both features have been given a precautionary buffer based on record details. Of the five A3s, four have been given precautionary 100 m buffers based on their associated UKHO records. Anomaly 70049 has not been given an AEZ at this time, as there is no indication in the UKHO record of the feature being a wreck.

13.16.8 The sites recommended for AEZs in the OECC are summarised in Table 13.16(Figure 13.8 - Figure 13.26).

Table 13.16: Sites recommended for AEZs in the OECC

WA_ID	Discrimination	Description	Buffer (m)
70210	A3	Recorded Wreck	100
70219	A1	Wreck	50
70257	A1	Wreck	50
70346	A1	Debris – includes the aircraft crash site 70349	20
70366	A1	Wreck	50
70379	A3	Recorded wreck	100
71099	A1	Wreck	50
71130	A1	Wreck	50
NEMO_Mag_11081	N/A	Aircraft material discovered through pre-disturbance survey	100

13.16.9 In the OECC, AEZs have been implemented around all five wrecks. Of the 11 non-wreck A1 anomalies, six are objects of debris likely to be related to the wrecks and covered within the AEZs listed above. Anomalies 70346-49 are items of debris with an A1 discrimination, thought to be related to the wreckage of an American B-24 Liberator bomber and German submarine UB 12, and as such has been given an AEZ of 50 m. Anomalies 70346 and 70347 are both potentially related to UB 12, however they are slightly offset and have been recommended AEZs of 20 m. Anomaly 70349 is likely related to the wreckage of an American B-24 Liberator bomber and has a recommended AEZ of 50 m. Due to the proximity of these four anomalies, their recommended AEZs impact one another and, as a result have been merged into one large AEZ. Debris item 70486 is thought to be the spilt cargo of a stone carrier barge that sank in 1983. Although the feature is related to a wreck, no AEZ is recommended at this time as the debris is deemed to be modern, however the site should probably be avoided based on operational grounds. NEMO_Mag_11081 represents possible aircraft material identified during the pre-disturbance survey undertaken for Nemo Link, and was recommended for a temporary 100 m buffer following archaeological assessment.

13.16.10 Anomaly 71209 is the wreckage of a B-17G Flying Fortress identified in the intertidal zone and not covered by the most recent geophysical survey data. The positional data for this site is quite vague, as the NRHE position comprises a circular polygon 1 km in diameter, and could represent the recorded loss position rather than the position of aircraft material on the seabed. The position recorded in the technical reports (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1) and Volume 4, Annex 13-2: Archaeological Review of Geophysical and Geotechnical Data Technical Annex (Document Ref: 6.4.13.2)) is the centre point of that circle, not the exact location of the site. Another position for the aircraft, approximately 1.5 km to the south, has been provided by Elliott Smock (pers. comm.) who was involved in the recovery of material in the 1990s. Though the NRHE position has been retained as a precautionary measure, no AEZ is recommended at this time due to the discrepancies in the possible location. However it should be considered an area of archaeological potential. Following on from discussions with Elliott Smock, a walk over survey was undertaken by Wessex Archaeology in order to confirm the location of the wreck site. The site of the wreckage and its related debris (1035) were successfully located and recorded in the intertidal zone on Sandwich Flats to the South of Pegwell Bay by archaeologists in July 2017 (Volume 4, Annex 13-1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1)). This location placed the aircraft crash site well outside the OECC and study area (Figure 13.27). On balance, it is recommended that the NRHE footprint for this anomaly be reduced to a 100 m buffer since the original 1 km buffer around the position was in place due to the uncertainty surrounding the location of the aircraft, which is now considered to have been determined, the details of the loss actually being consistent with that of site 1035.

13.16.11 For features assigned A2 archaeological potential ratings, no AEZs are recommended at this time. However, avoidance of these features by micro-siting is recommended if there is potential for them to be impacted by the development. In order to facilitate the design of the development scheme, buffers are not currently proposed for any of these anomalies. However, if these anomalies, at any depth, will be impacted by the development, they will need to be assessed on a case-by-case basis, in agreement with HE. The methodology for assessing seabed and sub-seabed anomalies will be outlined in the WSI, as the anomalies would require further archaeological investigation to confirm their character and to allow an assessment of their relative value. It is possible that these anomalies could represent material from wreck sites of considerable age and be, from an archaeological standpoint, more important than those already suggested for AEZs, and therefore further AEZs could be instituted if required. However, it is also possible that these anomalies could comprise modern debris of no archaeological significance. The provision of archaeological advice is particularly important in areas of high sensitivity, such as where the proposed export cable route extends close to the Goodwin Sands area, and specifically Brake Sand. Additional assessment could, for example, be undertaken as part of a UXO or ROV survey undertaken for other works. Further assessment of A2 anomalies would also reduce the need to depend on ORPAD.

13.16.12 Where it is not possible to preserve *in situ* A2 geophysical anomalies or findspots, disturbance will be offset by appropriate and satisfactory measures, also known as ‘preservation by record’. In these circumstances, the effects of the development can be remedied by carrying out survey, recording and/ or excavation prior to the impact occurring (Wessex Archaeology, 2007). The impact of the development, if and where appropriate, may also be remedied by restabilising sites that have been destabilised but not destroyed, or by offsetting damage to a site by detailed analysis and safeguarding of otherwise comparable sites elsewhere.

13.16.13 The further archaeological investigation of seabed anomalies could lead to **Minor** to **Moderate** beneficial effects, through the sharing of information gained. These investigations could comprise: the archaeological assessment of UXO/ ROV survey or diver survey data gathered for other works, but with archaeological input; surveys specifically undertaken for archaeological assessment for example for characterisation or even full excavation if required; and the reporting and investigation of unexpected discoveries. The archaeological investigation of seabed anomalies would provide additional information about the historic environment resource, and the distribution of this information, and the investigative and visual outcomes, through reports to the KHER, NRHE and/ or publication if the importance of the discovery warrants it, would contribute to knowledge gain for the wider heritage sector and the general public, and provide a historic environment legacy for the project.

13.16.14 It is expected that in areas of data gap (such as where the survey area does not quite link with Nemo Link and all of Pegwell Bay (Figure 13.1)), there will be additional survey work planned, for example in conjunction with the UXO survey. Any further surveys planned, should be subject to archaeological advice at the planning stage, to ensure that the survey methods will maximise the results for archaeological investigation. Geophysical surveys will be undertaken in line with *Marine Geophysics Data Acquisition, Processing and Interpretation* (Plets *et al*., 2013). The acquired data should then be made available for archaeological assessment. One of the areas of data gap is the landfall, and should pre-construction and/ or construction methodologies facilitate it, an archaeological watching brief could be recommended in the intertidal area.

13.16.15 A number of palaeogeographic features of archaeological potential have been identified within the wind farm site. These are all associated with the offshore route of the Thames and its associated tributaries. Although previous goearchaeological investigations undertaken for TOWF produced no real results, and therefore there are no geoarchaeological results to directly compare with, the assessment of geoarchaeological data relating to these features would be beneficial. The Stage 1 geoarchaeological assessment of geotechnical logs taken within the Thanet Extension array indicated a number of vibrocores were acquired from within palaeogeographic features of archaeological potential. As such, it is recommended that samples from VC001, VC006 and VC007 (Phase 1), VC002 and VC003 (Phase 2) and VC004 (Phase 5) be subject to Stage 2 archaeological recording. The Stage 2 report will state the results of archaeological recording and will indicate whether any Stage 3 work is warranted. It has been confirmed that the vibrocores are available for further assessment, however they are likely to have been tested on for engineering purposes, and sections are therefore likely to be missing.

13.16.16 In addition, should any further geotechnical sampling be planned (e.g. vibrocore or borehole) within the Thanet Extension array area, OECC or landfall area, at the post-consent/ pre-construction phase, provision should be made for geoarchaeological advice at the planning stage, to ensure that the survey methods will maximise the results for archaeological investigation. For example, samples acquired from within identified Pleistocene/ Early Holocene features should be retrieved following the methodology set out in the *Model Clauses* document (TCE, 2010), and *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector* (Gribble and Leather, 2011), and should be made available for geoarchaeological assessment. In particular, any samples recovered from within identified Pleistocene/Early Holocene features (Unit 2), should be made available for geoarchaeological assessment. The locations of these samples should be chosen to maximise the most continuous sequence possible, and the cores recovered should be managed to ensure subsequent sampling and dating is not compromised.

13.16.17 The geotechnical survey results should provide adequate levels of information for a palaeogeographic assessment and deposit model. This will enable a detailed understanding of the significance of the recorded deposits, and past landscapes, which will lead to a coherent and comprehensive understanding of the stratigraphy of the area.

13.16.18 No palaeogeographic features of archaeological interest were identified along the OECC, and no further work is recommended in that area at this time. However, the assessed data did not include the landfall area, so should data be acquired in the intertidal zone or landfall area (either geophysical or geotechnical), it is recommended that it be made available for archaeological assessment to ensure a full assessment of the cable route is achieved.

13.16.19 The results of the survey and the deposit model should be combined with the results of any onshore archaeological geotechnical work, in order to ensure a seamless approach. However, BGS borehole data suggests that the shallow geology of the intertidal area comprises modern sediment over Tertiary deposits, and so the potential for palaeogeographic features of high archaeological potential within Pegwell Bay are relatively low. It is likely that the loess/ brickearth deposits present inland, known to be archaeologically significant, have been eroded away within Pegwell Bay and beyond, and only survive as isolated outliers, if at all.

13.16.20 If previously unknown sites or material are encountered during development works, measures will be taken to reduce the level of impact. In order to provide for these unexpected discoveries, the ORPAD (TCE and Wessex Archaeology, 2014) will be adopted. ORPAD is a system for reporting and investigating unexpected archaeological discoveries encountered during preparation activities, with Wessex Archaeology (the Implementation Service) providing guidance and advising industry staff on the implementation of the Protocol. ORPAD also makes provision for the implementation of temporary exclusion zones 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 vicinity. Its implementation is important across the development area, but in particular in areas of high archaeological potential, such as on the export cable route in proximity to Goodwin Sands. ORPAD provides a mechanism to comply with the Merchant Shipping Act 1995, including notification of the Receiver of Wreck, and accords with the *Code of Practice for Seabed Developers* (JNAPC, 1995, 1998).

13.16.21 Although no significant effects from changes to sedimentation or erosion regimes have been identified, there should be archaeological assessment of post-construction scour monitoring results to ensure that there have been no indirect impacts to known and potential archaeological receptors.

13.16.22 The proposed mitigation measures are designed to reduce or avoid adverse effects upon known and potential seabed receptors. As such, following the implementation of these measures, direct impacts of seabed preparation, construction, O&M and decommissioning works to all seabed receptors will reduce effects to **Minor** adverse negative significance.

13.16.23 In addition, the implementation of these mitigation measures could, for example with the archaeological assessment of geotechnical data lead to effects of **Minor** to **Moderate** beneficial significance, as results could contribute to a greater understanding of the extent and distribution of submerged relic land surfaces. The beneficial aspect is particularly evident when the information gained through archaeological assessment is disseminated to the wider public.

13.16.24 Apart from the mitigation measures identified above, no additional mitigation measures are recommended for potential effects to the wider setting of heritage assets, as impacts to the wider setting will be avoided through the avoidance of known wrecks and the investigation of previously unknown or unidentified sites at risk.

13.16.25 No mitigation is recommended with regards to potential indirect impacts, as these are expected to be localised, and any known sites will be protected with AEZs, and therefore no indirect impacts are expected in their immediate vicinity, as no development activities that would cause indirect impacts will take place within the exclusion zone boundary. However, should scour, and secondary scour be monitored during O&M activities immediately adjacent to any AEZs, the archaeological assessment of any resulting data would minimise effects on the offshore archaeological receptors.

13.16.26 The HSC for the array area and OECC will change, and therefore the HSC should be updated to reflect these changes.

13.17 Transboundary statement

13.17.1 Although the Scoping document indicated that there were no transboundary impacts to offshore archaeology and cultural heritage, this was questioned in the Scoping responses, and therefore transboundary effects have been assessed here.

13.17.2 There is potential for direct transboundary effects to offshore archaeology and cultural heritage receptors from the development and related activities. For example, transboundary effects may occur where wrecks of non-British 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.

13.17.3 Within the study area, there are a number of sites of known non-British nationality, including a possible German submarine dating to the Second World War (70346) and two American aircraft lost during the Second World War (70349 and 71209/ 1035), all of which were lost during military service and therefore would be of increased importance. There is also potential for further discoveries of this nature, and any further aircraft that were lost while in military service and are discovered in the study area would automatically be protected under the Protection of Military Remains Act 1986.

13.17.4 In addition, there are a number of other sites of non-British nationality, including a Canadian steamship (2102), a Belgian steamship (2104), two Norwegian steamships (2143 and 2144), as well as wrecks of undetermined nationality, in addition to potential, as yet undiscovered wreck sites. Site of this nature may also have importance in their native countries.

13.17.5 There could also be transboundary effects for ships that worked in foreign waters and gained a level of renown, prestige or character, and even for ships and aircraft with international crews.

13.17.6 In addition, there are potential transboundary effects for palaeogeographic assets, as these features were in place before the creation of modern international boundaries, and interest in the sites, due to their relative scarcity, could be international.

13.17.7 However, all direct impacts to known receptors will be prevented by AEZs, prohibiting development activities within their boundaries, and therefore, transboundary impacts to known shipwrecks and aircraft are not expected. It is possible that potential, as yet undiscovered shipwrecks and aircraft may be impacted, however the archaeological assessment of pre-construction geophysical survey reduces this likelihood, and additional mitigation strategies such as adherence to ORPAD should address these discoveries on a case-by-case basis. The WSI, and the implementation of ORPAD will ensure that If shipwrecks or aircraft that can positively be identified as being of foreign nationality are discovered during the course of the development, then further advice will be sought regarding the legal status of the remains in their home country. Therefore, with the application of appropriate mitigation, any effects would be of **Minor** to **Negligible** adverse significance.

13.17.8 In addition, the archaeological assessment of geotechnical data, and the dissemination of the results, could lead to **Minor** to **Moderate** beneficial transboundary effects. The dissemination of knowledge to an international audience, will promote detailed understanding of the significance of the recorded deposits and will lead to a coherent and comprehensive understanding of past landscapes of international importance.

13.17.9 Indirect effects identified as part of this ES are considered to occur as a result of changes to hydrodynamic, sedimentary and erosion regimes. Modelling undertaken and reported as part Volume 2 Chapter 2: Marine Geology, Oceanography and Physical Processes (Document Ref: 6.2.2) reveals that no indirect transboundary impacts are expected as any changes will be localised.

13.18 Summary of effects

13.18.1 With the implementation of the mitigation measures discussed above, all effects should be reduced to **Minor** to **Negligible** adverse significance or **Minor** to **Moderate** beneficial significance, and therefore there are no residual significant positive or adverse effects that cannot be eliminated (see Table 13.17 below).

Table 13.17: Summary of predicted impacts of Thanet Extension

Description of impact	Impact	Possible mitigation measures	Residual impact
Construction			
Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments	Seabed preparation and construction activities	Production of WSI to outline implementation of mitigation AEZs recommended around known, A1 features Avoidance of A2s or further assessment if impact cannot be avoided Archaeological input at the planning stages of any further survey, and archaeological review of any additional ROV, diver, and geophysical survey data ORPAD for unexpected discoveries	**Minor** to **negligible** adverse And/ or in some cases **Minor** to **Moderate** beneficial with appropriate pre-construction archaeological investigation
Permanent loss/ disturbance of known and potential palaeogeographic receptors	Construction activities that penetrate the seabed	Production of WSI to outline implementation of mitigation Phased archaeological assessment of existing geotechnical data Archaeological input at the planning stages of any further survey, and archaeological review of any additional geophysical and/ or geotechnical survey data	**Minor** to **Negligible** adverse and/ or **minor** to **moderate** beneficial significance
Indirect effects upon known and potential archaeological receptors	Changes to sedimentation and erosion patterns	Production of WSI to outline implementation of mitigation Extent of AEZs to protect known archaeological receptors Archaeological review of results of scour monitoring	**Minor** adverse
Indirect effects upon setting offshore and at the landfall	Impact on setting, visual impact	Production of WSI to outline implementation of mitigation For offshore: application of AEZs, avoidance, further assessment if sites will be impacted For onshore: effects are considered to be minor, no mitigation recommended	**Minor** to **Negligible** adverse
Changes to the perceptions of HSC from construction activities	Impact on HSC	Update HSC to reflect changes	**Minor** to **Negligible** adverse
Operation			
Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments	O&M activities that impact the seabed	Production of WSI to outline implementation of mitigation AEZs recommended around known, A1 features. Avoidance of A2s or further assessment if impact cannot be avoided Archaeological input at the planning stages of any further survey, and archaeological review of any additional survey data ORPAD for unexpected discoveries	**Minor** to **Negligible** adverse And/ or in some cases **Minor** to **Moderate** beneficial with implementation of ORPAD

Permanent loss/ disturbance of known and potential palaeogeographic receptors	O&M activities that penetrate the seabed	Production of WSI to outline implementation of mitigation Archaeological input at the planning stages of any further survey, and archaeological review of any additional geophysical and/ or geotechnical survey data	**Minor** to **Negligible** adverse and/ or **Minor** to **Moderate** beneficial significance
Indirect effects upon known and potential archaeological receptors	Changes to sedimentation and erosion patterns	Production of WSI to outline implementation of mitigation Extent of AEZs to protect known archaeological receptors Archaeological review of results of scour monitoring	**Minor** adverse
Indirect effects upon setting offshore and at the landfall	Impact on setting, visual impact	Production of WSI to outline implementation of mitigation For offshore: application of AEZs, avoidance, further assessment if sites will be impacted For onshore: effects are considered to be minor, no mitigation recommended	**Minor** to **Negligible** adverse
Changes to the perception of HSC from O&M	Impact on HSC	Assuming HSC has been updated during construction, no further mitigation required.	**Negligible** adverse
Decommissioning			
Permanent physical loss/ disturbance of known and potential seabed receptors in shallow sediments	Decommissioning activities that impact the seabed	Production of WSI to outline implementation of mitigation AEZs recommended around known, A1 features. Avoidance of A2s or further assessment if impact cannot be avoided Archaeological input at the planning stages of any further survey, and archaeological review of any additional ROV, diver, and geophysical survey data ORPAD for unexpected discoveries	**Minor** to **Negligible** adverse And/ or in some cases **Minor** to **Moderate** beneficial
Permanent loss/ disturbance of known and potential palaeogeographic receptors	Decommissioning activities that penetrate the seabed	Production of WSI to outline implementation of mitigation Archaeological input at the planning stages of any further survey, and archaeological review of any additional survey data	**Minor** to **Negligible** adverse and/ or **Minor** to **Moderate** beneficial significance
Indirect effects upon known and potential archaeological receptors	Changes to sedimentation and erosion patterns	Production of WSI to outline implementation of mitigation Extent of AEZs to protect known archaeological receptors Archaeological review of results of scour monitoring	**Minor** adverse
Indirect effects upon setting offshore and at the landfall	Impact on setting, visual impact	Production of WSI to outline implementation of mitigation For offshore: application of AEZs, avoidance, further assessment if sites will be impacted For onshore: effects are considered to be minor, no mitigation recommended	**Minor** to **Negligible** adverse

Changes to the perceptions of HSC from decommissioning activities	Impact to HSC	Following decommissioning HSC should be updated to reflect the changes.	**Minor** to **Negligible** adverse
Cumulative effects			
Effects on known and potential archaeological receptors	Combined impact of a number of projects on the same receptor and incremental changes over time and over a wide area	Impact from other projects unlikely due to distance, and indirect impacts from TOWF are localised Incremental changes over time managed through standard mitigation measures across the EIA process	**Minor** to **Negligible** adverse and/ or **Minor to Moderate** beneficial

13.19 References

- Amec Foster Wheeler (2017) *Thanet Extension Offshore Wind Farm: Terrestrial Archaeology Desk-based Assessment.* Doc. Ref. 39080-CGosXX. Draft version [Volume 5, Annex 7-1; Document Ref: 6.5.7.1].
- Bicket, A. and Tizzard, L. (2015), 'A review of the submerged prehistory and palaeolandcapes of the British Isles', in *Proceedings of the Geologists' Association* 126: 643-663.
- BMAPA and English Heritage (2005), *Protocol for reporting finds of archaeological interest*, prepared by Wessex Archaeology.
- British Geological Survey (1990), British Geological Survey 1:250,000 Series, Thames Estuary, Sheet 51°N - 00°, Seabed Sediments and Quaternary Geology, Copyright NERC, 1990
- CIfA (2017), *Standards and guidance for historic environment desk-based assessment*. Available at: http://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_3.pdf.
- Colchester Borough Council (2017), Extend floating pontoon by 1.6 m wide and 43 m long.
- Department of Energy & Climate Change (DECC) (2011), Overarching National Policy Statement for Energy (EN-1).
- Department of Energy & Climate Change (DECC) (2011), National Policy Statement for Renewable Energy Infrastructure (EN-3).
- DEFRA (2009), Our Seas – A shared resource: High level marine objectives.
- DEFRA (2011), UK Marine Policy Statement.
- Department of Trade and Industry (2005), Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report.
- Dix, J., Sturt, F. (2011), The Relic Palaeo-landscapes of the Thames Estuary. Unpublished report. MALSF.
- English Heritage (1998), Identifying and Protecting Palaeolithic Remains: Archaeological Guidance for Planning Authorities and Developers.
- English Heritage (2000), Managing Lithic Scatters: Archaeological Guidance for planning authorities and developers.
- English Heritage (2002), Military Aircraft Crash Sites: Guidance on their significance and future management.
- English Heritage (2005) Wind Energy and the Historic Environment.
- English Heritage (2008), *Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment*. Available at: https://www.historicengland.org.uk/images-books/publications/conservation-principles-sustainable-management-historic-environment/ .
- English Heritage (2012), Ships and Boats: Prehistory to Present: Designation Selection Guide.
- Fugro Geoconsulting Ltd. (2016), Geotechnical Report, Field Operations and Preliminary Results Report, Thanet Extension Offshore Wind Farm Geotechnical Site Investigation 2016, Wallingford, unpublished report, reference: GEO51/ WPE-01(02).
- Gaffney, V., Thomas, K., Fitch, S. (2007), Mapping Doggerland: The Mesolithic Landscapes of the Southern Norht Sea. (Oxford. Archaeopress).
- Gregory, D. (2006), Mapping Navigational Hazards as Areas of Maritime Archaeological Potential The effects of sediment type on the preservation of archaeological materials. Report No. 13808-0001-01.
- Gribble, J. and Leather S. (2011), *Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector.* Prepared by Gribble, J. and Leather S. for EMU Ltd. Commissioned by COWRIE Ltd (Project reference GEOARCH-09).
- Gupta, S., Collier, J. S., Palmer-Felgate, A., Dickenson, J., Bushe, K., Humber, S. (2004) Submerged Palaeo-Arun River: Reconstruction of Prehistoric Landscapes and Evaluation of Archaeological Resource Potential: Integrated Projects 1 and 2. Report for English Heritage (Imperial College London).
- Hamblin, R. J. O., Crosby, A., Balson, P. S., Jones, S. M., Chadwick, R. A., Penn, I. E. and Arthur, M. J. (1992), *The Geology of the English Channel*, British Geological Survey United Kingdom Offshore Regional Report, London HMSO
- Heritage Conservation Group, KCC (2013), *Dover District Heritage Strategy 2013*. Accessed through https://www.dover.gov.uk/Planning/Conservation/New-Heritage-Strategy-pdfs/DDHSVolume1(web).pdf
- HE (2015a), Managing Significance in Decision-Taking in the Historic Environment: Historic Environment Good Practice Advice in Planning: 2.
- HE (2016), Preserving Archaeological Remains: Decision-taking for Sites under Development.
- HE (2017), The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (2nd Edition).
- JNAPC (1998). *The Code of Practice for Seabed Developers* (second edition). First edition 1995.

- Merritt, O., Parham, D., McElvogue, D. M. (2007), *Enhancing our Understanding of the Marine Historic Environment: Navigational Hazards Project*. Final Report. For English Heritage and the Aggregates Levy Sustainability Fund.
- Momber, G. (2000), 'Drowned and deserted: a submerged prehistoric landscape in the Solent, England. *International Journal of Nautical Archaeology* 29 (1): 86-99.
- Momber, G., Tomalin, D., Scaife, R., Satchell, J., Gillespie, J. (Eds) (2012), *Mesolithic occupation at Bouldner Cliff and the Submerged Prehistoric Landscapes of the Solent*. Research Report 164. (Council for British Archaeology).
- Oxford Archaeology with George Lambrick Archaeology and Heritage (2008), *Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy.* Commissioned by COWRIE Ltd. (project reference CIARCH-11-2006).
- Parfitt, S. A., Aston, N.M., Lewis, S. G., Abel, R.L., Coope, G. R., Field, M.H., Gale, R., Hoare, P. G., Larkin, N. R., Lewis, M. D., Karloukovski, V., Maher, B. A., Peglar, S. M., Preece, R. C., Whittaker, J.E., Stringer, C. B. (2010), 'Early Pleistocene human occupation at the edge of the boreal zone in northwest Europe. *Nature* 466 (7303): 229-233.
- Perkins, D.R.J. (1997), An Island Gateway, in Cats, M. & Chamberlain, D., *The Maritime Heritage of Thanet*, East Kent Maritime Trust: 4-16.
- *Planning (Listed Buildings and Conservation Areas) Act* 1990. Available at: http://www.legislation.gov.uk/ukpga/1990/9/contents.
- Plets, R., Dix, J., Bates, R. (2013)
- *Protection of Military Remains Act* 1986. Available at: http://origin-www.legislation.gov.uk/ukpga/1986/35/section/2.
- *Protection of Wrecks Act* 1973. Available at: http://www.legislation.gov.uk/ukpga/1973/33.
- Ransley, J. and Sturt, F. (2013) People and the Sea: A Maritime Archaeological Research Agenda for England. Council for British Archaeology.
- Royal HaskoningDHV (2016), *Goodwin Sands Aggregate Dredging ES. Volume I – Non-Technical Summary.* For the Dover Harbour Board. Reference I&BPB2107R001D01.
- TCE (2010), Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects. Prepared by Wessex Archaeology.
- TCE (2014), Protocol for Archaeological Discoveries: Offshore Renewables Projects. Prepared by Wessex Archaeology. First edition 2010.
- PINS (2015), *Advice Note 17: Cumulative Effects Assessment.* https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf (Accessed 29/09/2017)
- PINS (2017a), Scoping Opinion Proposed Thanet Extension Offshore Wind Farm. PINS Reference: EN010084. February 2017.
- PINS (2017b), Late Scoping Consultation Responses.
- Vattenfall (2017), Thanet Extension Offshore Wind Farm: Project Design Statement Version 1. Vattenfall Document Ref: TE-TPM-DD-0011-Project Design Statement.
- Wessex Archaeology (2004), *England's Shipping. Year 2 Report.* Internal Reference 51552.05.
- Wessex Archaeology (2005), Thanet Offshore Wind Farm Project: Archaeological Assessment: Technical Report. Internal reference: 60070.03.
- Wessex Archaeology (2006a), Thanet Offshore Wind Farm Project: Archaeological Assessment of Marine Geophysical Data. Internal reference: 60070.05.
- Wessex Archaeology (2006b), *Thanet Offshore Wind Farm: Stage 1 Borehole Assessment*. Internal reference: 60070.04.
- Wessex Archaeology (2006c), *On the Importance of Shipwrecks.* Aggregate Levy Sustainability Fund, Marine Aggregates and the Historic Environment.
- Wessex Archaeology (2007a), *Historic Environment Guidance for the Offshore Renewable Energy Sector.* Commissioned by COWRIE Ltd. (project reference ARCH-11-05).
- Wessex Archaeology (2007b), Thanet Offshore Wind Farm: Stage 2 Archaeological Recording. Internal reference: 60070.06.
- Wessex Archaeology (2007c), Thanet Offshore Wind Farm: Borehole Assessment: Stage 3 Sample Assessment. Internal reference: 60070.07.
- Wessex Archaeology (2007d), Thanet Offshore Wind Farm: Archaeological Monitoring and Mitigation: Written Scheme of Investigation. Internal reference 60071.03. July 2007.
- Wessex Archaeology (2007e), *Thanet Offshore Wind Farm Project: Walkover Survey.* Internal reference: 60073.01.
- Wessex Archaeology (2008a), Thanet Offshore Wind Farm: Wind Farm Area: Geotechnical Logs and Samples: Stages 1 and 2: Archaeological Report. Internal reference: 60074.02.
- Wessex Archaeology (2008b), Thanet Offshore Wind Farm: Archaeological Assessment of Marine Geophysical Data: Pre-development Monitoring Report: Offshore Wind Farm Site: Volume 1. Internal reference: 60076.02.
- Wessex Archaeology (2008c), Thanet Offshore Wind Farm: Archaeological Assessment of Marine Geophysical Data: Pre-development Monitoring Report: Thanet Offshore Wind Farm Export Cable Route. Volume 2. Internal Reference: 60077.02.

- Wessex Archaeology (2008d), Thanet Offshore Wind Farm: Archaeological Diver Assessment of Anomaly 7069. Internal reference: 60078.01.
- Wessex Archaeology (2008e), Selection Guide: Boats and Ships in Archaeological Contexts.
- Wessex Archaeology (2008f), Aircraft Crash Sites at Sea: A Scoping Study. Archaeological Desk-based Assessment. Internal reference 66641.02.
- Wessex Archaeology (2009), Thanet Offshore Wind Farm Onshore Cable Works: Archaeological Watching Brief. Internal reference: 60079.02.
- Wessex Archaeology (2010a), Thanet Offshore Wind Farm: Archaeological Watching Brief: Offshore Cable Installation Pre-Lay Grapnel Run. Internal reference: 72230.02.
- Wessex Archaeology (2010b), Thanet Offshore Wind Farm: Archaeological Watching Brief: Onshore and Intertidal Zone Cable Installation. Internal reference: 72231.02.
- Wessex Archaeology (2010c), East of England Designated Wrecks: Marine Geophysical Survey and Interpretation. Internal reference: 71770.02.
- Wessex Archaeology (2010d), 'Appendix III-IV: Technical Report: Archaeology', in ERM 2010, *Thames Estuary Dredging Association, Marine Aggregate Regional Environmental Assessment,* Salisbury, report ref: 66061.04.
- Wessex Archaeology (2011a), Assessing Boats and Ships 1860-1913: Archaeological Desk-based Assessment. Internal reference 70861.01.
- Wessex Archaeology (2011b). Assessing Boats and Ships 1914-1938: Archaeological Desk-based Assessment. Internal reference 70861.02.
- Wessex Archaeology (2011c), Assessing Boats and Ships 1939-1950: Archaeological Desk-based Assessment. Internal reference 70861.03.
- Wessex Archaeology (2013), *Early Ships and Boats (Prehistory to 1840)*: EH 6440: Strategic Desk-based Assessment. Internal reference 84130.01.
- Wessex Archaeology (2016), Project NEMO, UK-Belgium Electrical Interconnector Richborough to West-Zeebrugge: Archaeological Environmental Impact Assessment. Volume I and II. Internal reference 73390.03.
- Wessex Archaeology (2017)*, Thanet Offshore Wind Farm: Marine Archaeological Desk-Based Assessment Technical Report.* Internal reference: 116080.01 (Volume 4, Annex 13.1: Marine Archaeological Desk-based Assessment Technical Annex (Document Ref: 6.4.13.1))
- Wessex Archaeology (2017b), *Project NEMO: Archaeological Report Form: Summary Record for the Discovery of MAG_11081/ Anomaly 70050: Possible aircraft wing.*
- Wessex Archaeology (2018a), *Thanet Extension Offshore Wind Farm Archaeological Review of Geophysical and Geotechnical Data*. Internal reference: 116080.02 (Volume 4, Annex 13.2: Archaeological Review of Geophysical Data Technical Annex (Document Ref: 6.4.13.2))
- Wessex Archaeology (2018b), *Thanet Extension Offshore Wind Farm: Offshore Archaeology: Draft Written Scheme of Investigation.* Internal reference: 116080.03.
- Wessex Archaeology and TCE (2010), Model Clauses for Archaeological Written Schemes of Investigation.
- http://www.planning.colchester.gov.uk/WAM/showCaseFile.do;jsessionid=2BB605B4F1E295DC830EDF5449000F8C?action=show&appType=Planning&appNumber=170230 accessed 25 May 2017
- https://cloud2.atriumsoft.com/KCCePlanningOPS/loadFullDetails.do?aplId=60889 accessed 25 May 2017