

The Great Grid Upgrade

Sea Link

Sea Link

Volume 9: Examination Submissions

Document 9.152: Geoarchaeological Interim Statement – Kent

Planning Inspectorate Reference: EN020026

**Version: A
April 2026**

nationalgrid

SLMK25



SEA LINK MINSTER

Geoarchaeological Interim Statement

Headland Archaeology Midlands & West
Unit 1 | Clearview Court | Twyford Rd | Hereford HR2 6JR

for Ian Farmer Associates
on behalf of Siemens Energy

Version 2
28/04/2026

SUMMARY

This interim statement presents a preliminary summary of findings from the geoarchaeological monitoring of ground investigations (GI) at Sea Link, Minster. Interpretations of the identified depositional sequences are derived from field log data and are therefore provisional. These will be reviewed and refined following completion of the deposit modelling exercise, once elevation data and as-built locations are available. Any recommendations set out herein are intended to provide general guidance on the potential scope of further targeted geoarchaeological investigation and remain subject to revision upon issue of the final report.

Table of Contents

Summary	3
1. Introduction	4
Project Background	4
2. Scope of the Work	6
3. Site Description.....	9
Location	9
Topography and soils	9
4. Geology and soils	9
Overview	9
Bedrock Geology.....	9
Superficial Geology.....	9
Modern Soils.....	10
5. Geoarchaeological and Archaeological Background.....	12
6. Aims and Objectives	13
Investigation Aims.....	13
7. Research Agenda.....	13
8. Methods	14
Trial Pits and Boreholes.....	14
Geoarchaeological Deposit Modelling	15
9. Preliminary Results.....	15
Initial Review of logs.....	15
Tentative Stratigraphy.....	16
High potential deposits	17
10. Indication of likely recommendations.....	18
11. References	19

List of Tables

Table 1: Table of monitored GI locations	7
Table 2: Summary of the previously recorded superficial deposits with estimated date range and associated geoarchaeological/palaeoenvironmental potential	10
Table 3: Table of stratigraphic units from initial review	17
Table 4: Purposive works required to address each of the research questions	18

SEA LINK - MINSTER, KENT

GEORCHAEOLOGICAL WATCHING BRIEF ON GI WORKS

1. Introduction

Project Background

- 1.1. Headland Archaeology (UK) Ltd. was commissioned by Ian Farmer Associates on behalf of Siemens Energy (hereafter the 'client') to undertake a geoarchaeological Watching Brief (WB) of preliminary Ground Investigations (GI) in advance of proposed construction works on the Kent section of the National Grid Sea Link Scheme (hereafter the 'Proposed Project').
- 1.2. The principal consent for the Proposed Project will be a Development Consent Order (DCO). A draft DCO application has been made to the Planning Inspectorate (Planning Inspectorate Reference EN020026) and contains the following condition relating to Archaeology:

14.—(1) The authorised development must be undertaken in accordance with the following documents as relevant to the location of the works unless otherwise agreed with the relevant planning authority:

(a) Outline Onshore Overarching Written Scheme of Investigation – Suffolk for onshore works within the county of Suffolk; and

(b) Outline Onshore Overarching Written Scheme of Investigation – Kent for onshore works within the county of Kent.

(2) No stage of the authorised development may commence until for that stage either a preservation in situ Historic Environment Management Plan or a site-specific written scheme of investigation (which accords with the relevant Overarching Written Scheme of Investigation and is informed by the pre-commencement archaeological surveys) has been submitted to and approved by the relevant planning authority, in consultation with Historic England.

(3) Site-specific written schemes of investigation must be in accordance with the outline written scheme of investigation and must identify areas where archaeological works are required and the measures to be taken to protect, record or preserve any significant archaeological remains that may be found and must include—

(a) an assessment of significance and research questions;

(b) the programme of methodology of site investigation and reporting;

- (c) the programme for post-investigation assessment;
- (d) proposals for providing for the analysis of site investigation and recording;
- (e) proposals for providing archive deposition of the analysis and records of the site investigation;
- (f) nomination of a competent person or persons/organisation to undertake the works set out within the detailed written scheme of investigation; and
- (g) an implementation timetable.

(4) All archaeological works must be carried out in accordance with the approved site-specific written scheme of investigation for that stage.

(5) Unless otherwise agreed with the relevant planning authority:

- (a) No later than two years following the completion of the fieldwork specified in each site specific written scheme of investigation, a site-specific post excavation assessment for that site must be completed in accordance with the Overarching Archaeological Written Scheme of Investigation and submitted to the relevant planning authority for approval;
- (b) No later than one year following the approval of the final site-specific post excavation assessment, an archaeological updated project design for all sites, must be submitted to the relevant planning authority for approval. The archaeological updated project design must be produced in general accordance with the Overarching Archaeological Written Scheme of Investigation, include details of the scope of post-excavation analysis and publication and have regard to the site-specific research agendas set out in the site specific written schemes of investigation;
- (c) Post-excavation analysis and publication must be carried out in accordance with the approved archaeological updated project design;
- (d) The full archaeological archive must be submitted to the relevant planning authority in accordance with the archaeological updated project design.

1.3. The Proposed Project currently includes the installation of a 2GW High Voltage Direct Current (HVDC) cable to reinforce the transmission network between Suffolk and Kent. The projected route is approximately 138km in length and is predominantly located offshore with onshore converter stations, substations and new underground and overhead electricity lines also required in Kent and Suffolk.

1.4. A written scheme of investigation (WSI) prepared by Headland Archaeology (HA, 2025) deals with preliminary design elements associated with onshore works, as follows:

- ▶ A landfall point on the Kent coast at Pegwell Bay.
- ▶ A TJB approximately 800 m inshore to transition from offshore HVDC cable to onshore HVDC cable, before continuing underground for approximately 1.7 km to a new converter station (below).

- ▶ A 2 GW HVDC converter station (including a new permanent access off the A256), up to 28 m high plus external equipment such as lightning protection, safety rails for maintenance works, ventilation equipment, aerials, and similar small scale operational plant near Minster. A new substation would be located immediately adjacent.
 - ▶ Removal of approximately 2.2 km of existing HVAC overhead line, and installation of two sections of new HVAC overhead line, together totaling approximately 3.5 km, each connecting from the substation near Minster and the existing Richborough to Canterbury overhead line.
- 1.5. This report presents the preliminary results of geoarchaeological monitoring undertaken between 7 October and 26 November 2025, and 26 January and 20 February 2026 (inclusive), at Minster Marshes. It provides an interim assessment of the site's geoarchaeological potential and identifies possible areas where further targeted investigation may be required.
- 1.6. The methodology for geoarchaeological monitoring and predictive deposit modelling follows the approach set out in the WSI (Headland Archaeology, 2025).
- 1.7. This document conforms to current best practice guidelines, including the following: ClfA 'Standard and Guidance for Archaeological Monitoring and Recording' (ClfA, 2014a-c); 'Geoarchaeology: using earth sciences to understand the archaeological record' (Historic England 2015a); 'Deposit Modelling and Archaeology: guidance for mapping buried deposits' (Historic England 2020), and 'Preserving Archaeological Remains' (Historic England 2016), and BABAO (2019a; 2019b).

2. Scope of the Work

- 2.1. GI works comprised a total of 32-no. cable percussion (shell and auger) boreholes, 3-no. cable percussion boreholes with rotary coring, 31-no. window sample boreholes, 6-no. window sampling probe hole locations and 67-no. machine-excavated trial pits, (Ian Farmer, forthcoming). Interventions identified as having geoarchaeological potential and therefore designated for monitoring in the WSI were as follows:
- ▶ 32-no. cable percussion (shell and auger) boreholes
 - ▶ 3-no. cable percussion boreholes with rotary coring
 - ▶ 31-no window sample boreholes
 - ▶ 6-no. window sampling probe hole locations
 - ▶ 67-no. machine-excavated geotechnical pits
- 2.2. Interventions requiring Dynamic Cone Penetration and Cone Penetration techniques (DCP, CPT) did not require monitoring.
- 2.3. Of the interventions identified as requiring monitoring in the WSI, 55 were later descoped:
- ▶ 36-no. machine-excavated geotechnical pits were descoped with agreement by the county archaeologist as the depth of the intervention did not exceed the modern soil profile.
 - ▶ 7-no. Cone Penetration interventions had been mislabelled as cable percussion (shell and auger) boreholes.
 - ▶ 12-no boreholes and trial pits (machine) were descoped by the GI contractor.
- 2.4. In total, 24-no. cable percussion (shell and auger) boreholes, 3-no. cable percussion boreholes with rotary coring, 24-no window sample boreholes, 6-no. window sampling probe hole locations and 25-no.

machine excavated geotechnical trial pits were monitored and are reported on here. A complete list of interventions is provided in Table 1.

Table 1: Table of monitored GI locations

GI-ID	GI type	Easting	Northing
WSM01	Window Sample Probeholes	633493.5	163901
CBRM02	Trial Pit (machine)	633512.8	163878.4
CBRM03	Trial Pit (machine)	633538.8	163866.2
CBRM01	Trial Pit (machine)	633550.9	163850.2
WSM02	Window Sample Probeholes	633488.9	163835.2
TPA04	Trial Pit (machine)	633385.5	163802.2
CBRM04	Trial Pit (machine)	633392.2	163786.9
WSM03	Window Sample Probeholes	633363.1	163782.7
WSF01	Window Sample Probeholes	633344.6	163636.7
CBRR01	Trial Pit (machine)	633325.2	163606.3
WSR01	Window Sample Borehole	633339.4	163599.4
WSF02	Window Sample Probeholes	633323.8	163531.7
WSR02	Window Sample Borehole	633282.1	163624.5
CBRR02	Trial Pit (machine)	633253.7	163612.5
CBRR03	Trial Pit (machine)	633206.5	163579.6
WSR03	Window Sample Borehole	633177.3	163565.7
CBRR04	Trial Pit (machine)	633080.4	163533.2
WSR04	Window Sample Borehole	633051.5	163522
CBRR05	Trial Pit (machine)	633027.5	163506.7
WSR06	Window Sample Borehole	632935.8	163408
BHR01	CP borehole	632906.5	163355
TPA01	Trial Pit (machine)	632944.9	163333.9
WSF03	Window Sample Probeholes	633378.9	163620.5
WSR05	Window Sample Borehole	632980.1	163487.2
BHR02	CP borehole	632891.2	163340
WSR07	Window Sample Borehole	632841.6	163305.3
CBRR07	Trial Pit (machine)	632930.6	163389.3
CBRR08	Trial Pit (machine)	632793.9	163264.6
TPA02	Trial Pit (machine)	632720.2	163221.7
CBRR09	Trial Pit (machine)	632735.2	163211.3
BHR03	CP borehole	632719.3	163196.6
BHR04	CP borehole	632698.5	163177.9
BHR05	CP borehole	632614	163165.2
CBRT02	Trial Pit (machine)	632544.9	163253.1
CBRT03*	Trial Pit (machine)	632493	163282.5
CBRC06*	Trial Pit (machine)	632379.7	163349.9
WST01	Window Sample Borehole	632460.9	163282.6
CBRC08	Trial Pit (machine)	632417.5	163297.5
WSC05	Window Sample Borehole	632411.6	163315.7
WSC03	Window Sample Borehole	632443.6	163342
CBRC04	Trial Pit (machine)	632435.4	163355.6

CBRC02	Trial Pit (machine)	632438.8	163405.2
WSC01*	Window Sample Borehole	632339.1	163385.4
WSC04	Window Sample Borehole	632325.8	163308.9
BHR08	CP borehole	632546.4	163218.8
BHR07	CP borehole	632546.4	163194
BHR06	CP borehole	632579.5	163165.2
TPA05	Trial Pit (machine)	632559.5	163101
WS113	Window Sample Borehole	632457.4	163151.9
WSR08	Window Sample Borehole	632506.6	163157.8
BH117	CP borehole; with Rotary Coring	632466.3	163140.9
BH114	CP borehole	632407.9	163051.3
BH116*	CP borehole	632431.7	163083.7
BH112	CP borehole	632379.8	162989.9
BH113	CP borehole	632416.4	163002.6
BH119	CP borehole	632478.4	162994.5
BH118*	CP borehole	632461.2	163051.6
TPA06*	Trial Pit (machine)	632564.9	163048.4
CBR102*	Trial Pit (machine)	632480.9	163025.1
CBR103	Trial Pit (machine)	632478.8	162964.2
BH115	CP borehole	632390	163132.6
BH110	CP borehole	632350.6	163057.1
BH111	CP borehole	632302.8	162987
BH108	CP borehole	632346.1	163158.9
BH107	CP borehole; with Rotary Coring	632269.2	163015.9
BH106	CP borehole	632230.9	163079.5
BH105	CP borehole	632226.2	162978.6
BH104	CP borehole	632176	163038.7
BH102	CP borehole; with Rotary Coring	632139.2	162953
BH103	CP borehole	632159.2	163090.3
WS101	Window Sample Borehole	632085.7	163035.6
WS102	Window Sample Borehole	632217.5	163010.4
WS104(A)	Window Sample Borehole	632231.5	162989
WS103	Window Sample Borehole	632164.5	162964.7
WS108	Window Sample Borehole	632360.9	163106.8
WS109*	Window Sample Borehole	632299.3	163012.5
WS110*	Window Sample Borehole	632429.8	163016.5
WS111	Window Sample Borehole	632387.4	163064.6
WS113	Window Sample Borehole	632457.4	163151.9
WS114	Window Sample Borehole	632436.8	163173.2
BH101	CP borehole	632104.9	163016.9
BH109	CP borehole	632364.9	163096

*These interventions are more than 2 metres away from the location proposed in the WSI

2.5. This interim statement provides a preliminary assessment of the geoarchaeological potential of these sequences and makes initial suggestions as to possible areas where further geoarchaeological mitigation may be required.

3. Site Description

Location

3.1. The Proposed Development Area (PDA) is located at the in Kent, in the parish of Minster. The site lies approx. 900m northeast of the village of Minster, 600m southwest of the village of Cliffsend, and 600m northwest of the hamlet of Ebbsfleet. The site is currently arable farmland and farm buildings, interspersed with streams (including the Minster Stream (Drain)), marshland (Minster Mashers), hedgerows and woodland. It has an irregular boundary that is bounded to the west by the Kent Coast Line railway that runs between Minster and Ramsgate.

3.2. The Weatherless Hill A & B Wastewater Treatment Works are located immediately to the south of the site, and the existing Richborough substation is located approx. 600m south of the site. The River Stour meanders c.200m south of the site. The approx. site centre is National Grid Reference TR 32373 63192. The postcode for Ebbsfleet Farm, which is within the site boundary, is CT12 5FH.

Topography and soils

3.3. The PDA is situated on land that gently slopes down to the west away from the raised embankment of the A256 (Richborough Way) and the Ebbsfleet Peninsula, towards the Minster Marshes and the River Stour. There is a topographic high of c. 14.5m AOD (above ordnance datum) in the northeast of the site and a low of c.1.6m AOD in the northwest of the site.

3.4. The River Stour flows along the course of the former Wantsum Channel to the south and west of the site, and has a marshy, wetland floodplain. It was a marine channel until at least the 17th century, after which it ceased to be navigable. The former Wantsum Channel course is visible on mapping due to the network of drains (streams and ditches) that dissect the landscape, the Minster Marshes are a coastal wetland area that have formed in proximity and on this former channel.

4. Geology and soils

Overview

4.1. An overview of the deposits mapped by the British Geological Survey (BGS) within the Site and its immediate environs is provided below and summarised. It should always be recognised that BGS mapping should be considered a guide and never definitive until confirmed through fieldwork.

Bedrock Geology

4.2. The bedrock geology is recorded as the 'Thanet Formation', which is generally described as homogenous, bioturbated, glauconitic fine sands, interbedded with silts or clays, with a cobble bed (the 'Bullhead Bed') to the base of the Formation (BGS, 2025). The Thanet Formation formed between 59.2 and 56Ma in the Thanetian Age in the late Paleocene Epoch on an inner to outer marine shelf.

Superficial Geology

4.3. The Quaternary superficial geology across the western part of the PDA to TPA01 is mapped by the BGS as 'Tidal flat deposits' of clay and silt, these are of unspecified Quaternary Period age. Tidal flat deposits

are typically unconsolidated muddy or sandy detrital sediments, potentially with peaty layers, that have formed in extensive horizontal marshy land in the intertidal zone (BGS, 2025).

- 4.4. The higher ground to the northeast of the PDA has no Quaternary superficial mapped by BGS. However, immediately to the north of the PDA boundary are mapped deposits of 'Head-1' at the 1:50,000 scale and 'Fluvic-Aeolian' deposits at the 1:625,000 scale. The Head-1 deposits are described by the BGS lexicon as poorly sorted and poorly stratified polymictic deposits with composition depending on the upslope source geology (in this case chalk and clay with flints) and distance from that source. They form primarily under cold-climate conditions by solifluction, soil creep or hill wash. They are of unspecified Quaternary Period age but are older than other locally mapped Head deposits (seen here to the South of the Wantsum Channel deposits and the site).
- 4.5. In contrast Fluvio-aeolian deposits are moved, redeposited and modified in situ by various processes including fluvial, colluvial and pedogenic (soil formation). Deposits are structureless and may be variably sandy or clayey but retain a dominant particle size within the coarse silt to very fine-grained sand range (BGS, 2025). They are loess like indicating wind-blown initial deposition.
- 4.6. Within proximity to the site (immediately east) there are also coarser composite 'Beach and Tidal flat deposits' mapped east of Sandwich Road. These composite deposits may also contain 'Beach deposits' of bedded or chaotic, shingles, sand, silt and clay, from sand sheets, dunes, or banks (BGS, 2025). Also, 'Storm Beach Deposits' which present as ridges of coarse material (gravel, cobbles and boulders) at the inland margin of the beach above the level reached by normal spring tides where they have been deposited by powerful storm waves. The exact boundary between these depositional environments is dynamic and the boundaries shown on mapping are only indicative of where these deposits may occur within the wider landscape.

Modern Soils

- 4.7. The soils are recorded as Soilscape 21: Loamy and clayey soils of coastal flats with naturally high groundwater, that typically present in wet brackish coastal flood meadows, and Soilscape 6: Freely draining slightly acid loamy soils (Cranfield University, 2025). Drainage is to local groundwater feeding into rivers.

Table 2: Summary of the previously recorded superficial deposits with estimated date range and associated geoarchaeological/palaeoenvironmental potential.

DEPOSIT TYPE	DATE	DESCRIPTION	MAPPED ON BGS ¹	POTENTIAL
Topsoil	Modern	A mixture of organic and mineral matter at the ground surface.	No	Likely to be modern so low potential.
Made Ground	Modern	Material anthropogenically deposited as either waste material or as ballast to create a level ground for development.	No	The majority is likely to be modern relating to the mid-20 th century and later developments of the area. But there is some potential for finds relating to historic periods.

DEPOSIT TYPE	DATE	DESCRIPTION	MAPPED ON BGS ¹	POTENTIAL
Alluvium	10,000 years BP to present	Alluvium is a general term for clay, silt, sand and gravel. It is the unconsolidated detrital material deposited by a river, stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope. Alluvial environments are a focus for human activity, and an effective trap for artefacts and ecofacts with good preservation potential.	Uppermost sediment deposits in nearby GI logs	High- Good organic preservation due to waterlogged conditions. Fine grained deposits likely to offer better preservation for microfossils and buried land surfaces. Scientific dating, particle size analysis, LOI and geochemical analysis can be used to understand the depositional history of the floodplain.
Peat	10,000 years BP to present. Rarely earlier.	Peat is a partially decomposed mass of semi-carbonized vegetation which has grown under waterlogged, anaerobic conditions, usually in bogs or swamps.	TR36SW81: between 4.30-4.50mbgl	Often presents as discrete units within alluvium. High preservation potential for organic archaeological and palaeoenvironmental deposits.
Tidal Flats (Saltmarsh) Deposits	10,000 years BP to present	These include sand flat and fine unconsolidated mud flat deposits that form the marshy landscape in the intertidal zone. Tidal flat deposits to the east of the site have been recorded as sandier, indicative of greater costal influence. Shallow dendritic creeks are characteristic of this type of environment and may be visible in aerial photography. Raised tidal flat deposits may record historic sea level changes, and tidal flat deposits may also cap earlier deltaic deposits. They have the potential to preserve macrofossils that may be of palaeoenvironmental interest, as well as preserving deep sequences of wetland archaeology.	Yes – relating to the former Wantsum Channel	High- potential for delineating former channels and for understanding sea level change trough analysis of diatoms and scientific dating
Organic Waterlogged Deposits	10,000 years BP to present. Rarely earlier.	Partially decayed organic matter preserved within waterlogged conditions such as in ponds, lakes, bogs and along river valleys. There is excellent preservation potential for palaeoenvironmental resources and cultural remains within such deposits.	In most previous GI logs in vicinity of site	Very High- Good organic preservation for paleoenvironmental material.

DEPOSIT TYPE	DATE	DESCRIPTION	MAPPED ON BGS ¹	POTENTIAL
Head		Poorly sorted and poorly stratified polymictic deposits with composition depending on the upslope source geology (in this case chalk and clay with flints) and distance from that source. They form primarily under cold-climate conditions by solifluction, soil creep or hill wash. Have the potential to bury sediments of geoarchaeological and palaeoenvironmental interest and may contain stratified secondary archaeological assemblages	North of site	Moderate
Fluvio-aeolian		Wind blown deposits which have been moved, redeposited and modified in situ by various processes including fluvial, colluvial and pedogenic (soil formation). Deposits are structureless and may be variably sandy or clayey but retain a dominant particle size within the coarse silt to very fine-grained sand range.	North of site	Moderate- Potential for rapid burial and therefore preservation of palaeosols and archaeological features
Beach	10,000 years BP to present	Bedded or chaotic, shingles, sand, silt and clay, from sand sheets, dunes, or banks.	East of site	Low- location of historic (old) deposits of this nature can be an indication of former sea level.
Storm Beach Deposits	10,000 years BP to present	Ridges of coarse material (gravel, cobbles and boulders) at the inland margin of the beach above the level reached by normal spring tides where they have been deposited by powerful storm waves. These may then act as a barrier, trapping ground water behind to form wetland areas.	East of site	Low- location of historic (old) deposits of this nature can be an indication of former sea level.

¹ British Geological Survey (BGS) 1:50,000 or 1:625,000 superficial geology mapping (NERC, 2024).

5. Geoarchaeological and Archaeological Background

5.1. A key feature of the north Kent landscape is the Wantsum Channel. A description of the channel was provided in the Geoarchaeological Desk-Based Assessment (Stantec, 2025). This document also provides an overview other previous ground investigations associated with Weatherless Hill A & B Wastewater Treatment Works, and the existing Richborough substation, located approx. 400-600m south of the site (ibid.) and the programme of trial trenching undertaken for the Sea Link Scheme (Stantec-Oxford Archaeology 2024).

5.2. The archaeological and historical background to the site is given in the Cultural Heritage Baseline Report - DBA (Document: 6.3.2.3.A - AECOM, 2025), which is summarised in the Geoarchaeological WSI (Headland Archaeology, 2025)

6. Aims and Objectives

Investigation Aims

- 6.1. Due to the potential impact of the proposed development on deposits of geoarchaeological and palaeoenvironmental significance associated with the Wantsum Channel, a geoarchaeological watching brief of GI was been recommended (Stantec, 2025).
- 6.2. The primary aim of the geoarchaeological monitoring and recording was to determine the potential for deposits of archaeological, geoarchaeological and paleoenvironmental significance that may be impacted by development. In general, the purpose of the exercise was to record and advance understanding of the significance of any heritage assets, to create a predictive deposit model for the site, and to inform appropriate mitigation strategies.
- 6.3. The principal objectives were to:
- ▶ Characterise the extent, nature, condition and palaeoenvironmental potential of sub-surface strata by a programme of geoarchaeological monitoring and recording.
 - ▶ Identify sedimentary horizons of potential significance through off-site deposit modelling, with particular emphasis on the identification of organic deposits, palaeosols, old land surface soils/deposits, and palaeochannels.
 - ▶ Define zones of landscape stability within the vertical sequence that may have been of sufficient stability for human occupation at various periods in the past.
 - ▶ Provide recommendations for further mitigation works.
- 6.4. These objectives were to be achieved through the monitoring of selected ground investigation works and subsequent deposit modelling.

7. Research Agenda

- 7.1. The relevant regional research framework for the region is the South East Research Framework (2019). Based on this framework, the following research questions have been highlighted as of potential relevance to the works summarised above:

Middle Bronze Age and Iron Age (Champion, 2019)

- ▶ Despite some important work, especially on coastal change, there is still great potential for further research on the later prehistoric environment, both on the coast and inland.
- ▶ There is enormous potential for research into past land use by exploiting the resources of the modern coastal zone of the Thames Estuary and the estuaries of the smaller rivers, such as the Medway, Stour, Rother, Adur and Arun, which may all contain surviving evidence for previous episodes of human activity. (Champion, 2019: 45)

The Roman and the Anglo-Saxon Period (Allen, Bird and Croxford, 2019)

- ▶ Determining the basic character of the Roman landscape using pollen and soil samples (The Roman landscape is poorly understood in terms of vegetation and coastline)
- ▶ The landscape is poorly understood in terms of vegetation (specifically woodland and whether or not it was significantly managed—see above) and coastline. More work is necessary on pollen and soil

samples to determine basic characteristics of areas during the period. (Allen, Bird and Croxford, 2019: 41).

- ▶ Maximising the potential of palaeoenvironmental studies from the Anglo-Saxon period by targeting gaps in off-site sequences and by dating existing sequences more closely.
- ▶ What impacts on the landscape came about during the later period and into the sub-Roman phase? Are there discernible changes in agricultural practices and reforestation? (Allen, Bird and Croxford, 2019: 42)

Maritime (Milne, 2019)

- ▶ Plotting sea level change in the Southeast over time.
- ▶ Plotting coastal change over time, based on sea level change.
- ▶ Development of harbours and landing places in relation sea level and coastal change and development of maritime settlements.
- ▶ Development of maritime settlements in relation to each other and to sea level and coastal change' (Milne, 2019: 28)

Geological and Environmental (Bates and Corocan, 2019)

- ▶ Timing of early Holocene pine expansion
- ▶ Timing of early Holocene hazel expansion and investigation into potential links with Mesolithic activity
- ▶ Can the 8.2 ka event be confidently identified in palaeoenvironmental sequences in southeast England and what relationship does this have with the Early-to-Mid-Holocene vegetation transition?
- ▶ Better understanding the onset of flooding in the lower reaches of our river valleys and the nature of the landscape transformation resulting from this transgression; (Bates and Corocan, 2019: 20-21)

General Themes (SERF, 2019)

- ▶ The potential for targeted prospective survey of valley edge, flood plain and periglacial landforms to recover further palaeoenvironmental sequences and establish derived regional models for environmental change.
- ▶ The reclamation of wetlands: the methods used, the resultant field patterns and management systems and the impact on the population and economy of the area.
- ▶ Use of geoarchaeology for landscape investigation.

8. Methods

Trial Pits and Boreholes

8.1. Trial pits were excavated using a tracked excavator with a 0.60m bucket. A toothed excavator bucket was used to remove any hard surfaces/demolition deposits, with all natural soft deposits removed in spits using a flat bladed ditching bucket. The total number of machine-excavated trial pits undertaken will be provided in the forthcoming GI report (Ian Farmer Associates, forthcoming).

8.2. The details of the type of rig employed for drilling and the nature of sampling will be provided in the forthcoming GI report (Ian Farmer Associates, forthcoming).

- 8.3. During geoarchaeological monitoring of selected trial pits, the attendant geoarchaeologist logged upcast from the trial pit on the site of the excavation and measured deposit boundaries without entering the pit. Recordings and photographs were taken from the section.
- 8.4. Boreholes were monitored by the attendant geoarchaeologist until refusal or bedrock, or maximum depth of intervention was reached, whichever was first. Sequences were photographed and a record made of the depth of each sedimentary unit.
- 8.5. The sediments were described on a summary proforma according to standard methodologies based on Jones et al. (1999) and with the aid of a Munsell Soil Colour Chart. This included a description of colour, compaction, texture, sorting, structure, inclusions (including abundance, shape and material) and contacts.

Geoarchaeological Deposit Modelling

- 9.1. Once final as-built location data for the monitored interventions is made available (Ian Farmer Associates, forthcoming) the geoarchaeological deposit records will be entered into industry standard borehole management software (Rockworks™) to create a model of the key Quaternary age sub-surface strata on site.
- 9.2. In the interim an initial review of the logs has been completed and a sequence of commonly occurring lithological deposits has been identified. These were correlated into stratigraphic units based on their lithological descriptions. The stratigraphy defines distinct depositional processes, associated environments, and landform types (e.g. river terraces, alluvium, etc).
- 9.3. These interpretations remain tentative, as they are partly based on elevation data derived from LiDAR. Improved confidence, and a clearer understanding of the subsurface geometry of deposits, will require finalised elevation data, which can then be used to produce 2D fence diagrams. All deposit modelling will be undertaken using RockWorks (version 20.0) and follows current best practice (Historic England, 2020).
- 9.4. The spread of data points is likely to be sufficient to allow Inverse Distance Weighted (IDW) interpolation of a point vector layer in QGIS to model key surfaces such as the Early Holocene land surface and the thickness of high potential stratigraphic units such as peat.
- 9.5. Deposit modelling will allow for the spatial interpretation of the data, identifying probable environments represented, and the determination of areas of higher and lower geoarchaeological/archaeological/palaeoenvironmental potential by extrapolating the thickness and elevation of deposits between given data points. Where deposits are laterally constrained (such as channels/ buried islands) modelling may give an erroneous impression of the distribution of deposits (e.g., elevation and thickness).

9. Preliminary Results

Initial Review of logs

Overview of Lithology

- 9.1. Logs for all interventions, with lithological descriptions of the deposits and their depths, will be provided in Appendix 1 of the final report.
- 9.2. Local variation in lithology occurs between the higher ground to the northeast of the site and the lower ground to the southwest. At the base of the sequence across the site was consolidated (firm) SILTY SAND with moderate ferrous staining and a few flecks of degraded shell fragments with decreasing

consolidation up sequence becoming plastic or friable. On higher ground this was overlain by very friable mid yellow-brown sandy silt. The sand fraction of this unit was notably very fine to fine and occasionally also had a clay fraction and rare fine chalk granules. Intermittently there was also a layer of very similar lithology to that just described with occasional larger chalk granules, flint gravel, rootlets and shell fragments.

9.3. On the lower ground the consolidated (firm) SILTY SAND was overlain by soft greenish grey slightly silty SANDY CLAY/CLAYEY SAND with greenish brown mottling which is similar in description to the sandy silt described above but with a generally greater clay content. From CBRR07 west the predominantly sandy material was covered in a blanket of fine grained minerogenic SILTY CLAY. Generally, this material was described as 'Very soft, plastic and amorphous dark grey SILTY CLAY with occasional humic lenses'. However, local variations within this 'blanket' were observed:

- ▶ Gravel and shell inclusions at the base of the SILTY CLAY; BHR01, BH110 and BH108.
- ▶ Laminations or lenses of peat; CBRR07, BHR01, TPA01, BHR02, BHR03, BHR06, WSR08, WS113, BH117, WSC01, WSC03, BHR08, BH116, BH115, BH114, WS111, BH110, BH108, WS108, BH109, WS109, BH111, BH107, BH106, BH105, WS103, WS101, BH112, WS110, and BH119, BH104.

9.4. The upper part of the SILTY CLAY across this western part of the site was described as 'Soft pale brown SILTY CLAY (gleyed) with diffuse ferrous staining', there were no notable inclusions with the exception of occasional rooting. Chalk granules were identified in this material at CBRR08, WSR07, TPA01 and CBRR07. A modern soil was observed at the surface of the sequence across the whole site.

Tentative Stratigraphy

9.5. The basal lithology described above broadly aligns with the geology as mapped by BGS with Thanet Sand Formation as the bedrock which in places has a reworked surface. The exact nature of the processes and date of the reworking remains to be explored. Both Fluvio-aeolian and Head deposits appear to be present on the eastern (higher) part of the site. The Fluvio-aeolian stratigraphic unit is identified as the very friable mid yellow-brown sandy silt described above. The Head deposits are very similar in lithology but with inclusions of chalk granules, flint gravel, rootlets and shell fragments.

9.6. Estuaries are complex environments. The BGS generally map estuarine deposits as a single geological unit of estuarine alluvium. However, estuarine environments comprise a range of different deposit types that vary according to the proximity of the location to the shoreline and to the coast and river, and relative to the tidal range. In order of decreasing energy of deposition (and corresponding particle size), these are as follows:

- ▶ Storm beach
- ▶ Sand bar
- ▶ Beach/ sand flat
- ▶ Flood-tidal deltas
- ▶ Tidal flat/ salt marsh
- ▶ Alluvial
- ▶ Central basin- soft mud flats

9.7. Depositional energy is highest at the marine- and fluvial-dominated margins of the estuary and lowest within the central basin (Dyer, 1997, pp. 12; Masselink and Hughes, 2003, pp. 166–168). Within this system, tidal channels incise existing intertidal deposits and commonly migrate across the basin. The nature of

the tidal intrusion front also influences patterns of sediment deposition and erosion during tidal cycles (Dyer, 1997, pp. 130–134).

9.8. There is typically a gradual transition between most of these environments; however, general lithological trends can be used to assign units to their most probable depositional environment:

- ▶ Sand lenses- beach to mudflat transition or channel within mudflat
- ▶ Organic lenses, occasional plant remains- Salt marsh to mudflat transition
- ▶ Soft to very soft sterile mud possibly with bivalve inclusions- central basin

9.9. Based on these trends, the SILTY CLAY with gravel and shell inclusions at the base of the SILTY CLAY units in BHR01, BH110 and BH108 may represent channel deposits. A similar interpretation may also apply to reworked Thanet Sand Formation in the western part of the site. The SILTY CLAY with laminations or lenses of peat identified above likely represent saltmarsh build up. It will be informative to examine how these deposits relate spatially to the possible channel deposits.

9.10. Elsewhere, the soft sterile nature of the SILTY CLAY alludes to deposition in a low energy environment akin to an estuary basin. The upper gleyed SILTY CLAY has been interpreted as alluvium likely deposited when the River Stour was in flood. This is supported by the variation in soil thickness across the site, which has evidently been influenced by past ploughing.

Table 3: Table of stratigraphic units from initial review

UNIT	ORDER OF DEPOSITION
Thanet Sand Formation	1
Reworked Thanet Sand Formation	2
Fluvio-aeolian deposits	3
Head	4
Estuary (channel)	5
Estuary (saltmarsh)	6
Estuary (basin)	7
Alluvium	8
Modern Soil	9

High potential deposits

9.11. In addition to the broad stratigraphy outlined above, several deposits of note have been identified.

9.12. Substantial peat layers are present at BHR03 (1.4 to 1.45m bgl), WS111 (3.85–4.56m bgl) and WS110 (4.45 to 4.8m bgl). Those at BHR03 and WS110 appear to have formed on saltmarsh while at WS111 they have formed on reworked Thanet formation. Such deposits have the potential for preservation of microfossils such as pollen, which can be used to model landscape vegetation, and plant macrofossils which can be used to infer local vegetation and, where appropriate, can be used for radiocarbon dating.

9.13. Several deposits may contain evidence of anthropogenic activity within the wider landscape. However, it should be noted that any charcoal present may derive from natural fires rather than deliberate burning. Furthermore, it is not currently possible to determine whether these materials are in situ, due to the site's topography and the dynamic nature of the depositional environments in which they occur:

- ▶ BH105- charcoal at 0.9 to 1.2m bgl
- ▶ WS104(A)- charcoal at 2.17 to 2.27m bgl
- ▶ WS103- charcoal from 3.35m bgl
- ▶ BHR07- possible burnt deposit in alluvium at 1.2 to 1.4m bgl
- ▶ CBRR05- possible burnt flint in topsoil
- ▶ TPA04- palaeosol at 1.3 to 1.4m bgl

9.14. At present, it is difficult to determine precisely how these deposits relate to one another and to the broader stratigraphy. Once elevation data is available for the tops of each intervention, modelling can be undertaken, allowing comparison of the elevations of individual deposits and stratigraphic units.

10. Indication of likely recommendations

10.1. Given the stratigraphy and the presence of high potential deposits, targeted geoarchaeological investigations are likely to be required in certain areas of the site to address the research questions outlined above, and the considerations set out in the geoarchaeological DBA (Stantec, 2025).

10.2. Table 4 presents an outline of potential mitigation requirements. All recommendations are preliminary and will be reviewed and updated following completion of the final deposit model. The method of intervention (e.g., borehole or geoarchaeological sondage) will depend on the depth and characteristics of the targeted deposits within the sequence.

Table 4: Purposive works required to address each of the research questions

Research Question	Mitigation
Determining the basic character of the Roman landscape using pollen and soil samples (The Roman landscape is poorly understood in terms of vegetation and coastline)	Boreholes or geoarchaeological trial pits to recover cores or monoliths which are then subjects to a suitable programme of pollen analysis and radiocarbon dating.
The landscape is poorly understood in terms of vegetation (specifically woodland and whether or not it was significantly managed—see above) and coastline. More work is necessary on pollen and soil samples to determine basic characteristics of areas during the period. (Allen, Bird and Croxford, 2019: 41).	As above- the period such work is relevant to would depend on the results of the scientific dating
Maximising the potential of palaeoenvironmental studies from the Anglo-Saxon period by targeting gaps in off-site sequences and by dating existing sequences more closely.	As above- the period such work is relevant to would depend on the results of the scientific dating
What impacts on the landscape came about during the later period and into the sub-Roman phase? Are there discernible changes in agricultural practices and reforestation? (Allen, Bird and Croxford, 2019: 42)	As above- the period such work is relevant to would depend on the results of the scientific dating
Maximising the potential of palaeoenvironmental studies from the Anglo-Saxon period by targeting gaps in off-site sequences and by dating existing sequences more closely.	As above- the period such work is relevant to would depend on the results of the scientific dating

Timing of early Holocene pine expansion	Dependant on this period of time being incorporated in samples.
Timing of early Holocene hazel expansion and investigation into potential links with Mesolithic activity	As above
Can the 8.2 ka event be confidently identified in palaeoenvironmental sequences in southeast England and what relationship does this have with the Early-to-Mid-Holocene vegetation transition?	As above
Plotting sea level change in the Southeast over time.	Boreholes or geoarchaeological trial pits to recover cores or monoliths which are then subjects to a suitable programme of diatom analysis, radiocarbon dating or Optically Stimulated Luminescence (OSL) dating.
Plotting coastal change over time, based on sea level change.	Refinement of models produced for forthcoming report following results of above.
Development of harbours and landing places in relation sea level and coastal change and development of maritime settlements.	Limited potential but the above two points may contribute
Development of maritime settlements in relation to each other and to sea level and coastal change'	Landscape modelling following the above phases of work to incorporate HER data
Better understanding the onset of flooding in the lower reaches of our river valleys and the nature of the landscape transformation resulting from this transgression	Boreholes or geoarchaeological trial pits to recover cores or monoliths which are then subjects to a suitable programme of diatom analysis, radiocarbon dating or Optically Stimulated Luminescence (OSL) dating

11. References

AECOM. 2025. *Sea Link. Volume 6. Environmental Statement. Document 6.3.2.A., Part 3 Kent, Chapter 3. Cultural Heritage Desk Based Assessment.* Unpublished Client Report.

Allen, M., Bird, D., and Croxford, B. 2019. *South East Research Framework Resource Assessment and Research Agenda for the Roman period (2013 with additions in 2018 and 2019).* Available at: < <https://www.kent.gov.uk/leisure-and-community/history-and-heritage/south-east-research-framework> >. [Accessed: 29/08/2025]

BABAO 2019a BABAO Code of Ethics <https://www.babao.org.uk/assets/Uploads/BABAO-Code-of-Ethics-2019.pdf> accessed 18/02/2025

BABAO 2019b BABAO Code of Practice <https://www.babao.org.uk/assets/Uploads/BABAO-Code-of-Practice-2019.pdf> accessed 18/02/2025

Bates, M., and Corocan, J. 2019. *South East Research Framework Resource Assessment and Research Agenda for Geology and Environmental Background (2018 with additions in 2019).* [online] Available at: < <https://www.kent.gov.uk/leisure-and-community/history-and-heritage/south-east-research-framework> >. [Accessed: 29/08/2025]

BGS, 2025. British Geological Survey UKRI: GeoIndex Onshore Map Viewer. [online] Available at: < <https://mapapps2.bgs.ac.uk/geoindex/home.html> > [Accessed: 28/08/25]

Champion, T. 2019. *South East Research Framework Resource Assessment and Research Agenda for the Middle Bronze Age to Iron Age periods (2011 with additions in 2018 and 2019)*. Available at: < <https://www.kent.gov.uk/leisure-and-community/history-and-heritage/south-east-research-framework> >. [Accessed: 29/08/2025]

ClfA. 2014a. Code of Conduct. Chartered Institute for Archaeologists (Revised 2022)

ClfA. 2014b. Standard of and guidance on the collection, documentation, conservation and research of archaeological materials. Chartered Institute for Archaeologists (Revised 2020)

ClfA. 2014c. Standards & Guidance Documents for an Archaeological Watching Brief. Chartered Institute for Archaeologists (Revised 2020)

Cranfield University, 2023. Cranfield Soil and Agrifood Institute: Soilscales Map. [online] Available at: < <http://www.landis.org.uk/soilscales/> > [Accessed May 2023]

Headland Archaeology (UK) Ltd 2025- Minster on-shore cable link, Geoarchaeological monitoring and recording : *Written Scheme of Investigation* Project Output for Ian Farmer Associates LTD

Historic England 2015a. *Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record*. Swindon. Historic England.

Historic England 2015b. *MoRPHE (Management of Research Projects in the Historic Environment, Project Planning Note (PPN) 3: Archaeological Excavation* Swindon. Historic England.

Historic England 2020. *Deposit Modelling and Archaeology. Guidance for Mapping Buried Deposits*. Swindon. Historic England.

Ian Farmer Associates, forthcoming. Report of Ground Investigations at Minster Marshes (SeaLink)

Jones, A.P, Tucker, M.E, & Hart, J., 1999. The description & analysis of quaternary stratigraphic field sections. In: (1999) *The description & analysis of Quaternary stratigraphic field sections*. Technical Guide No. 7 Quaternary Research Association.

Milne, G. 2019. *South East Research Framework Resource Assessment and Research Agenda for Maritime (2012 with additions in 2013 and 2019)*. Available at: < <https://www.kent.gov.uk/leisure-and-community/history-and-heritage/south-east-research-framework> >. [Accessed: 29/08/2025]

NERC, 2024. British Geological Survey UKRI: GeolIndex Onshore Map Viewer. [online] Available at: < <https://mapapps2.bgs.ac.uk/geolindex/home.html> > [Accessed: 26/08/2025]

South East Research Framework 2019. *South East Research Framework - Kent County Council (KCC)* [online] Available at: < <https://www.kent.gov.uk/leisure-and-community/history-and-heritage/south-east-research-framework> >. [Accessed: 29/08/2025]

Stantec. 2025. *Sea Link: Volume 6: Environmental Information. Part 3 Kent, chapter 3, Appendix 3.3.G Geo-archaeological Desk-Based Assessment [Document 6.3.3.3.G]. Planning Inspectorate Reference: EN020026. Version A.*

Stantec- Oxford Archaeology, 2024. *Sea Link Scheme: Kent Section. Archaeological Evaluation report*. Unpublished client report.

Page intentionally blank

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom

Registered in England and Wales
No. 4031152
nationalgrid.com