NORTH FALLS

Offshore Wind Farm

ENVIRONMENTAL STATEMENT

Appendix 25.12: Five Estuaries & North Falls Onshore Substation Area Palaeolithic Evaluation Report: Phase 2

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NORTH FALLS
Offshore Wind Farm

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Five Estuaries Offshore Wind Farm Onshore Substation Area

Palaeolithic Geoarchaeological Evaluation – Phase 2

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wessexarchaeology

Logix House,
Wrotham Road,
Meopham,
Kent
DA13 0QB

www.wessexarch.co.uk

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Document compiled by	Dr Jack Oughton and Dr Andrew Shaw
Graphics by	Kitty Foster

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Summary

Wessex Archaeology was commissioned by Five Estuaries Offshore Wind Farm Ltd and North Falls Offshore Wind Farm Ltd to undertake a Palaeolithic geoarchaeological evaluation through a programme of test pitting at the proposed location of an onshore substation for the wind farm projects ('the Site'). The Site is located north of Little Bromley Road, Little Bromley, Tendring, Essex and is centred on National Grid Reference (NGR) TM 08143 28898.

A staged approach has been taken to determining the Palaeolithic geoarchaeological potential of the Site. A Geoarchaeological Desk-based Assessment (GDBA) for the onshore cable route of the wind farm projects (Wessex Archaeology 2022a) included the area of the present Site. An initial phase of evaluation (11 machine-dug test pits) was carried out in the north of the Site and reported on (Wessex Archaeology 2023b). This report relates to a second phase of evaluation (19 test pits) in the south-west and south of the Site.

The combined phases of evaluation have characterised the Quaternary deposits in the Site and mapped their lateral and horizontal extent. This has enabled the provision of a Geoarchaeological Landscape Characterisation (GLC) that divides the Site into two Palaeolithic Geoarchaeological Character Zones (GCZs). The geoarchaeological potential of deposits in each GCZ has been assessed. The evaluation has demonstrated that the earliest Pleistocene deposits in the site belong to the Ardleigh Gravel of the Kesgrave Sands and Gravels (MIS 16-14; 676-524 Kya), of the River Thames. These occurred across the Site (both GCZ 1 and GCZ 2). The upper c. 3.0 m of these deposits has been evaluated, which typically comprised high energy fluvial deposits, likely deposited in a braided river. These deposits were extensively sampled for artefacts. No archaeology was recovered. The palaeoenvironmental potential of these deposits was assessed as generally low, with the exception that finer-grained silts were locally present in GCZ 2. These have greater potential and samples suitable for palaeoenvironmental assessment were taken.

Across both GCZ 1 and 2, the Ardleigh Gravel was overlain by Pleistocene slope deposits comprising Head-Gravel and Head-Brickearth. The archaeological and palaeoenvironmental potential of these sediments has been assessed as generally low. In GCZ 2 a gully incised into the top of the Ardleigh Gravel was infilled with a basal Sand and overlying Head-Gravel. Although no archaeology was recovered from these deposits, they have not previously been identified in the area, are poorly understood and are undated. This raises some uncertainties regarding their Palaeolithic geoarchaeological potential and their significance as a geoarchaeological resource.

The combined Phase 1 and 2 evaluation of the Site has characterised much of the Palaeolithic geoarchaeological resource present and demonstrated generally low potential for significant Palaeolithic geoarchaeological evidence. The evaluation has however delimited selected Pleistocene deposits in the Site where data is insufficient to fully characterise the Palaeolithic geoarchaeological resource and, dependent on detailed development proposals, further investigations may be required as part of geoarchaeological mitigation and/or the production of a management strategy. These are:

- The Ardleigh Gravel, and any underlying deposits, beneath 3.20m bgl in GCZ 1 and GCZ 2;
- Localised fine-grained deposits in the Ardleigh gravel < 3.20m bgl in GCZ 2, and
- Deposits, particularly Sands, infilling a gully in GCZ 1.

Recommendations for further Palaoelithic geoarchaeological work that may be required are provided. These include recommendations for palaeoenvironmental assessment of the localised fine-grained deposits within the Ardleigh Gravel sampled during Phase 2 of the evaluation.

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The fieldwork was directed by Dr Jack Oughton and Dr Andrew Shaw, with the assistance of Miriam Weinbren and Hayley Hawkins. This report was written by Dr Jack Oughton and edited by Dr Andrew Shaw. Figures were prepared by Kitty Foster. The report was reviewed by Dr Daniel Young. The project was managed by Dr Daniel Young on behalf of Wessex Archaeology.

Five Estuaries Offshore Wind Farm
Onshore Substation Area

Palaeolithic Geoarchaeological Evaluation – Phase 2

1 INTRODUCTION

1.1 Project and planning background

1.1.1 Wessex Archaeology was commissioned by Five Estuaries Offshore Wind Farm and North Falls Offshore Wind Farm Ltd (the 'Client') to undertake a second phase of Palaeolithic geoarchaeological evaluation through a program of test pitting of a c. 20 hectares (ha) parcel of land located just north of Little Bromley Road, Little Bromley, Tendring, Essex ('the Site'). The evaluation area was centred on National Grid Reference (NGR) 608639 229215 (TM 08639 29215) (**Figure 1**).

1.1.2 The evaluation was carried out at the proposed location of an onshore substation (OnSS) associated with the offshore wind farm (OSWF) projects. The OnSS will consist of the substation buildings, connected to the offshore wind farm arrays via an Onshore and Offshore Export Cable Corridor. The OnSS will additionally connect to a National Grid Substation located to the west of the Site via another section of underground cable. Landscaping and planting will also be undertaken in the OnSS area as part of the proposals.

1.1.3 A staged approach has been taken to determining the Palaeolithic geoarchaeological potential of the Site. A Geoarchaeological Desk-based Assessment (GDBA) for the onshore cable route of the wind farm projects (Wessex Archaeology 2022a) included the area of the Site. An initial phase of evaluation was subsequently carried out in the north of the Site **(Figure 1**) and reported on (Wessex Archaeology 2023b). This report related to a second phase of evaluation of the south-west and south of the Site (the 'Evaluation Area') (**Figure 1**). The Phase 2 evaluation was carried out between 10th October and 18th October 2023.

1.1.4 The results of both phases of evaluation will be included in an Environmental Statement and Habitats Regulation Assessment in order to inform a future planning application.

1.2 Scope of works

1.2.0 The prior GDBA (Wessex Archaeology 2022a) identified the likely presence of landforms associated with Pleistocene geological deposits within the Evaluation Area. Such geological deposits may have potential to contain Palaeolithic archaeology, as well as environmental remains reflective of past human activity, landscapes and environments.

1.2.1 Assessment of the archaeological resource associated with Pleistocene deposits is 'deposit-led', with the aim to provide lithostratigraphic and chronostratigraphic frameworks and to assess the archaeological and palaeoenvironmental records associated with different deposits. A multidisciplinary 'geoarchaeological' approach combining archaeological, geological, geophysical and palaeoenvironmental investigative techniques is required.

1.2.1 The agreed program of the Phase 2 Palaeolithic geoarchaeological evaluation works comprised the excavation, investigation and recording of 19 machine-dug test pits.

1.2.2 All evaluation works undertaken were in accordance with Written Schemes of Investigation (WSI) which detailed the aims, objectives, methodologies and standards to be employed (Wessex Archaeology 2023a). The Historic Environment Officer, Place Services, Essex County Council, approved the WSI, on behalf of the Local Planning Authority (LPA), prior to fieldwork commencing.

1.3 Scope of document

1.3.0 The purpose of this report is to provide a detailed description of the results of the Palaeolithic geoarchaeological evaluation, to interpret the results within a local, regional or wider archaeological context, and to assess whether the aims of the evaluation have been met.

1.3.1 The presented results will provide further information on the Palaeolithic geoarchaeological resource that may be impacted by the proposed development and facilitate an informed decision with regard to the requirement for, and methods of, any further geoarchaeological works; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

1.3.2 To help frame Palaeolithic geoarchaeological investigations, Wessex Archaeology has developed a four-stage approach, encompassing different levels of investigation appropriate to the results obtained, accompanied by formal reporting of the results at the level achieved. The stages are summarised below (**Table 1**). This evaluation represents Stage 2 of this process.

Table 1 Staged approach to Palaeolithic archaeological investigations

Stage 1: Geoarchaeological deposit model and Desk-based Assessment (GDBA)	A geoarchaeological deposits model and desk-based assessment (GDBA) examines a range of information (published and unpublished ("grey literature"), geological mapping, Ground Investigation data, historic maps etc.) to inform on the geoarchaeological potential of deposits within a Site The GDBA may include a Geoarchaeological Landscape Characterisation (GLC) which divides the Site into different zones (Geoarchaeological Characterization Zones – GCZs) based on variations in deposits and potential. The GDBA establishes the requirements for and scope of Stage 2 geoarchaeological field investigations. Should Stage 2 work be required, appropriate and proportionate recommendations for each GCZ are provided. The GDBA highlights any areas of a Site where Pleistocene deposits with possible Palaeolithic geoarchaeological potential may occur.
Stage 2: Palaeolithic geoarchaeological evaluation	Field evaluation to establish the Palaeolithic geoarchaeological potential of Pleistocene deposits within a defined Evaluation Area, which informs on the requirements and scope of Stage 3 palaeoenvironmental assessment and/or Stage 4 mitigation. The principal methods of evaluation are through targeted machine-dug test pits and boreholes. An evaluation report is produced, which includes updated deposit modelling and an updated GLC. If required, recommendations for Stage 3 sample assessment and/or Stage 4 mitigation are made.
Stage 3: Sample assessment	Palaeoenvironmental samples and/or sediment samples recovered during Stage 2 are assessed to inform on the geoarchaeological potential of deposits and guide the scope and need for Stage 4 mitigation. Dating of samples taken during Stage 2 may be required to inform on the geoarchaeological potential of deposits and to guide the scope and need for Stage 4 mitigation. If this is the case, dating will be carried out at this stage. Alternatively dating samples will be retained for Stage 4 mitigation, if required.

	Recommendations for dating requirements during Stage 3 are made in the Stage 2 report. A sample assessment report is produced outlining the palaeoenvironmental and dating potential of the deposits including targeted and proportionate recommendations for Stage 4 mitigation.
Stage 4: Palaeolithic geoarchaeological mitigation	Based on the results of the Stage 2 and 3 investigations Palaeolithic geoarchaeological mitigation may be required to offset development impacts. Mitigation may include targeted geoarchaeological sampling for palaeoenvironmental assessment and scientific dating, potentially alongside archaeological excavation. A final mitigation report is provided on completion of mitigation program.
Publication	The scope and location of a publication report will be agreed in consultation with the client and LPA advisor. The publication report may comprise a note in a local journal or a larger publication article or monograph, dependant on the significance of the archaeological work.

2 BACKGROUND

2.1 Introduction

2.1.0 Background on the Site and the local Palaeolithic resource was assessed in a prior Geoarchaeological Desk-based Assessment (GBDA) Wessex Archaeology 2022a), with information relevant to the current program of works summarised in a WSI (Wessex Archaeology 2023a). This information is outlined below.

2.2 Location and landscape context

2.2.1 The Site is located within the Tendring District, c. 1.7 km to the west of Little Bromley and c. 2.4 km to the east of Ardleigh. The Site is bounded to the west by Grange Road, to the north and east by agricultural fields and to the south by Ardleigh Road. The Site covers 38 ha and is currently used as agricultural land.

2.2.1 The Evaluation Area is located to the south and west of the Site. The topography of the Evaluation Area is generally flat and existing ground levels within the Evaluation Area are approximately 35 m above Ordnance Datum (OD).

2.3 Chronology

2.3.1 Palaeolithic geoarchaeological investigations are typically undertaken with reference to geological periods (e.g. Quaternary), epochs (e.g. Pleistocene) and sub-epochs (e.g. Devensian) that reflect major climate sea-level and/or environmental changes. Here we adopt British nomenclature correlated to the Marine Isotope Stage (MIS) record to distinguish between different climatic periods, with dates given in thousands of years before present (Kya).

2.3.2 Marine Isotope Stages are deduced from marine palaeoclimatic records and reflect alternating warm (interglacial and interstadial) and cold (glacial and stadial) periods throughout the Quaternary (**Table 2**).

2.3.3 Where age estimates are available these are expressed in millions of years (Mya), thousands of years (Kya) and within the Holocene epoch as either years Before Present

(BP), Before Christ (BC) and Anno Domini (AD). These are linked to the global Marine Isotope Stage (MIS) chronological framework.

Table 2 British Quaternary chronostratigraphy

Geological Period	Chronostratigraphy		Age (Kya)	MIS
Holocene	Holocene interglacial		11.7 – present	1
Late Pleistocene	Devensian Glaciation	Loch Lomond Stadial	11.7 – 12.9	2 – 5d
		Windermere Interstadial	12.9 – 15	
		Dimlington Stadial	15 – 26	
		Upton Warren Interstadial	40 – 43	
		Early Devensian	60 – 110	
	Ipswichian interglacial		115 – 130	5e
Middle Pleistocene		Unnamed cold stage	130 – 374	6
		Aveley interglacial		7
		Unnamed cold stage		8
		Purfleet interglacial		9
		Unnamed cold stage		10
	Hoxnian interglacial		374 – 424	11
	Anglian glaciation		424 – 478	12
	Cromerian Complex		478 - 780	13 – 19

2.4 Previous investigations

2.4.1 Previous investigations relevant to the evaluation are listed in **Table 3** and summarised below.

Table 3 Previous investigations relevant to the evaluation

Report type	Title	Report no	Reference
Geoarchaeological Desk-based Assessment	North Falls Offshore Wind Farm – Onshore Project Area Geoarchaeological Desk-based Assessment	265330.01	Wessex Archaeology 2022a
Phase 1 Palaeolithic Archaeological Evaluation	Five Estuaries Offshore Wind Farm Onshore Substation Area, Essex	231916.04	Wessex Archaeology 2023b

Geoarchaeological Desk-based Assessment (Wessex Archaeology 2022a)

2.4.2 A GDBA was undertaken for the onshore project area associated with the North Falls OSWF. This included the area of the current Site. The purpose of the GDBA was to consider the distribution of Quaternary deposits and provide an initial assessment of their possible

archaeological potential. This included an assessment of the Pleistocene deposits and their potential to contain Palaeolithic archaeology.

2.4.3 The GDBA utilised BGS archive boreholes, mapping of superficial deposits, analysis of Lidar data and consideration of previous relevant archaeological discoveries to define nine Geoarchaeological Character Zones (GCZs) based on variations in the Quaternary geology, linked to the assessment of their archaeological potential.

2.4.4 The present evaluation area is located in GCZ 9. The Quaternary stratigraphy identified as likely underlying GCZ 9 included the Ardleigh Gravel (MIS 16–14) of the Kesgrave Sands and Gravels, overlain by deposits of Pleistocene Brickearth and/or Pleistocene to Holocene Head/Colluvium. The Ardleigh Gravels were identified as having potential to contain nationally significant *in situ* (high significance) or reworked (moderate significance) Lower Palaeolithic archaeology, and in places to contain deposits (organic sediments, fine-grained alluvial silts and clays) with potential to preserve palaeoenvironmental evidence.

2.4.5 The archaeological and palaeoenvironmental potential of any overlying Brickearth in GCZ 9 was determined as unknown, although broad potential to contain Palaeolithic archaeology was identified. The significance of any archaeology from the Head-Brickearth would be dependent on taphonomic history and date. Palaeoenvironmental potential of Head-Brickearth is variable, however, where calcareous deposits occur these can include molluscs and vertebrates.

2.4.6 Head deposits reflect the downslope reworking of sediments, which can incorporate reworked Palaeolithic artefacts. Additionally, they can contain and seal archaeological layers associated with minimally disturbed/*in situ* archaeology. Similarly, Holocene colluvium is a slope deposit which can contain reworked archaeology of multiple dates but can also bury archaeological features and layers.

Palaeolithic Archaeological Evaluation (Wessex Archaeology 2023b)

2.4.7 A prior phase of Palaeolithic evaluation was carried out in the north of the Site. This comprised 11 machine-dug test pits. The evaluation found a consistent sedimentary sequence of Quaternary deposits across the Site.

2.4.8 The basal Quaternary deposits were high energy Pleistocene fluvial sands and gravels of the Ardleigh Gravel (MIS 16-14; 676-524 Kya). The upper 3.0m of these sediments were evaluated. British Geological Survey (BGS) boreholes suggest that approximately 10 m of these deposits may be present within the Site, above London Clay Formation bedrock.

2.4.9 A gully was recorded incised into the fluvial sands and gravels, which were infilled with a basal Sand, possibly deposited through water run-off or slope deposits, overlain by coarser deposits (Head-Gravel), likely formed via slope processes, including periglacial solifluction. These deposits were of an undetermined age, but Pleistocene burnt, unworked flint was identified from the Head-Gravel within the gully.

2.4.10 The Sand and Head Gravel were post-dated by Head-Brickearth deposits. How these were deposited was uncertain, but they are likely to include colluvial and possibly aeolian sediments. No archaeology was recovered from these deposits.

2.4.11 In places colluvial clay silts of likely Holocene date were also identified.

2.5 Pleistocene deposits and Palaeolithic archaeological context

2.5.1 The solid geology underlying the Site is mapped by the BGS (GeoIndex) as Palaeogene deposits broadly classified as belonging to the Thames Group (56.0-47.8 Mya) (**Figure 2**). Descriptions in historic boreholes suggests that the bedrock in the area of the Site is London Clay Formation.

2.5.2 Based on a review of BGS mapping (BGS GeoIndex) (**Figure 3**) and the previous GDBA (Wessex Archaeology 2022a), the following Quaternary deposits could potentially occur in the Evaluation Area:

- Kesgrave Sands and Gravels (Pleistocene)
- Head-Gravel (Pleistocene)
- Head-Brickearth / Coversand (Pleistocene)

2.5.3 Relevant background information on these deposits, including their broad potential to preserve Palaeolithic archaeology and palaeoenvironmental datasets, and previous discoveries of archaeological and palaeoenvironmental records associated with them, is outlined below.

Kesgrave Sands and Gravels

2.5.4 The Kesgrave Sands and Gravels are pre-Anglian (MIS 12; 478-424 Ka) sediments associated with the River Thames. At the time of their deposition this river system flowed south eastwards from Wales and the West Midlands, eastwards through the middle Thames valley, north eastwards into East Anglia, then progressively eastwards to a contemporaneous shoreline in Suffolk and Essex (Bridgland 1994, Bridgland and Allen 1996, Rose et al. 1999, Allen et al 2022).

2.5.5 Terraces associated with this river system were formed between c. 1.81 Mya and 460 Kya (late Early to early Middle Pleistocene), forming the older Sudbury and younger Colchester Formations, until they were overridden by the Anglian ice sheet (Rose et al 1999). On the basis of their altitude and position, Whiteman (1992) identified 10 terrace landforms associated with the Sudbury and Colchester Formations. The deposits underlying the Five Estuaries OSWF and North Falls OSWF Scheme belong to the Colchester Formation (c. 860-460 Kya). **Table 4** provides a summary of the lithostratigraphy of deposits mapped as Kesgrave sands and Gravels by the BGS in Essex.

Table 4 Kesgrave Sands and Gravels stratigraphy (after Bridgeland and Allen 1996; Bridgeland et al 1990; 1999; and Westaway 2014)

High-Level East Essex Gravel				**Thames**	**Thames-Medway confluence**
Postulated MIS	**Southend area**	**Dengie Peninsula**	**Mersea Island**	**Tendring Peninsula**	**Tendring Peninsula**
MIS 12-11-10	Southchurch Gravel	Asheldham Lower and Upper Gravel	Mersea Island Gravel		Wigborough Channel
MIS 11	Southend Channel	Asheldham Channel			Clacton Channel
MIS 12 (Anglian Ice)	Chalkwell Gravel	Caigde Gravel		Upper St Osyth Gravel	Upper Holland Gravel
MIS 12 (early)				Lower St Osyth Gravel	Lower Holland Gravel
MIS 13	Canewdon Gravel	St Lawrence Gravel		Wivenhoe Upper Gravel	Cooks Green Gravel

MIS 13				Wivenhoe Interglacial deposits	
MIS 14				Wivenhoe Lower Gravel	
MIS 14	Belfairs Gravel	Mayland Gravel		Ardleigh Upper Gravel	Colluvium
MIS 15				Ardleigh interglacial deposits	Little Oakley Silts and Sands
MIS16	Ashingdon Gravel			Ardleigh Lower Gravel	
MIS 16	Oakwood Gravel			Waldringfield Gravel	(Offshore)
MIS 18	Daws Heath Gravel				
MIS 20/22	Claydon Gravel				

2.5.6 The deposits of the Kesgrave Sands and Gravels underlying the Site belong to the Ardleigh Gravel Member of the Colchester Formation (Wessex Archaeology 2022a). The Ardleigh Gravels consist of a complex sequence of cold climate gravels, with intervening geoarchaeologically significant temperate climate organic-rich deposits (Ardleigh Interglacial deposits). At the type-site for the Ardleigh Gravels, these organic deposits have been highlighted as containing a diverse animal and plant assemblage. These rich assemblages are likely associated with lower energy channels eroding into the cold climate sands and gravels (Rose et al. 1999). The stratigraphy of the Ardleigh Gravel Member, encompassing an Upper and Lower Gravel and intervening Interglacial deposits, is highlighted in **Table 4**.

2.5.7 The Palaeolithic archaeological potential of the Ardleigh Gravel Member is poorly understood, but the deposits have broad potential to contain nationally rare evidence of Lower Palaeolithic activity predating the Anglian Glaciation. The nearest Palaeolithic findspot to the Site (2.1 km to the south) comprises an isolated find noted as a small broken Lower Palaeolithic handaxe recovered at Badley Hall, Great Bromley. Although the artefact does not have a recorded depositional context, its condition has been assessed as rolled and stained (Wymer 1985), indicating that it originates from Pleistocene fluvial deposits.

2.5.8 Additionally, a nationally significant collection of Lower Palaeolithic artefacts is associated with the Wivenhoe/Cooks Green Gravel at Daking's Pit, located 8.5 km southeast of the Site. Five handaxes, eight cores and 17 flakes were collected in the early 1930s from Daking's Pit (Warren 1933). An additional 39 Palaeolithic artefacts were recovered from the site following a further excavation of the gravels by Wymer (1985). The Wivenhoe/Cooks Green Gravel is temporally constrained to MIS 14–13 (563–478 Kya) and therefore the timing of deposition may overlap with the Upper Ardleigh Gravels (MIS 16–14; 676–524 Kya).

Head-Gravel

2.5.9 Although not mapped by the BGS in the area of the Site, BGS boreholes from the region (BGS GeoIndex) record gravelly clays and silts overlying the Kesgrave Sands and Gravels, in particular in areas of steeper topography at the sides of and within dry or stream valleys. These are likely to be deposits reworked down-slope by colluviation, solifluction and/or water run-off, and are often referred to by the BGS as Head deposits.

2.5.10 Head is defined as Pleistocene slope deposits containing sediments reworked downslope from earlier formations through colluvial and/or solifluction processes (alternate freeze

thawing). Head deposits are therefore most widely recorded at the base of slopes and along river valleys.

2.5.11 These slope deposits may also include Holocene colluvium. Colluvium represents unconsolidated material which has been deposited downslope by either rainwash, sheetwash and/or slow continuous downslope creep during the Holocene. Colluviation is likely in areas of topographic relief where soil instability has been brought on by activities such as clearance of woodland, agricultural activity and soil degradation, leading to downslope movement of sediment.

2.5.12 Slope deposits can include archaeology reworked downslope within these sediments. More significantly they can also seal stratigraphy, including stable land surfaces and buried soil horizons associated with minimally disturbed/in situ archaeological layers, features and/or lithic scatters. The palaeoenvironmental potential of these slope deposits is generally low, except where calcareous units occur which can preserve evidence such as molluscs and vertebrate remains.

Head-Brickearth/Coversand

2.5.13 The BGS maps deposits of clay, silt and sand overlying the Kesgrave Sands and Gravels across the Site. These overlying sediments, recorded by the BGS as Coversand. These deposits are often more generally referred to as Head-Brickearth, with Coversands within such sequences relating specifically to sand sized wind-blown sediments.

2.5.14 Head-Brickearth is a generic term used to describe Pleistocene sediments that have been deposited by a wider range of depositional processes, including aeolian (wind-blown), colluvial (slope) and alluvial (transported by water). The Brickearth deposits in the area of the Site are likely to include an aeolian (loess) component, but may also include deposits formed through both colluvial and alluvial processes.

2.5.15 O'Connor (2015) describes the basal element of the Brickearth throughout much of the Tendring District as a thin, fine sand (Coversand). Overlying this is a predominantly silty deposit (loess), usually less than 0.75 m thick but reaching over 1.0 m in thickness at Walton (O'Connor 2015). In places the Brickearth contains small stones worked upwards from the underlying gravels due to frost action (O'Connor 2015).

2.5.16 Coversands and loess are Pleistocene wind-blown sediment, predominantly transported in periglacial conditions close to the margins of ice sheets (Antoine et al 2003). Where dated, the majority of cover sands and loess in southern England are Late Devensian (MIS 2) between 18.8–14.6 Kya (e.g. Parks and Rendell 1992; Bateman 1998). Older deposits principally dated to MIS 6 and MIS 12 are known, however.

2.5.17 Primary coversands and loess are directly lain down as windblown sediment. These have often been subsequently reworked downslope by colluvial processes. In both instances these deposits can contain or bury stabilisation horizons (which can be associated with soil formation) that may be associated with minimally disturbed Palaeolithic archaeology and palaeoenvironmental evidence. Calcareous Head-Brickearth sequences can preserve palaeoenvironmental evidence, including molluscs and vertebrates.

3 AIMS AND OBJECTIVES

3.1 Overarching aims

3.1.1 The overarching aims (or purpose) of the evaluation, in compliance with the CIfA' *Standard and guidance for archaeological field evaluation* (CIfA 2020a), were to:

- provide information about the Palaeolithic geoarchaeological potential of the evaluation area;
- inform either the scope and nature of any further Palaoelithic geoarchaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

3.2 Overarching objectives

3.2.1 In order to achieve the above aims, the overarching objectives of the evaluation were to:

- to establish the broad presence/absence, nature and distribution of Pleistocene deposits within the evaluation area;
- to establish the potential of Pleistocene deposits to preserve Palaeolithic archaeology;
- to establish the potential of Pleistocene deposits to preserve paleoenvironmental evidence;
- to establish the potential of the Pleistocene deposits for scientific dating;
- to place the results of the evaluation within a wider archaeological and geoarchaeological context, including consideration of the possible significance of archaeological and geoarchaeological resources in relation to national and regional research priorities and agendas, and
- to make recommendations for further work, where appropriate, including for Stage 3 assessment of retained samples (see **Table 1**).

3.3 Specific objectives

3.3.1 Following consideration of the Palaeolithic archaeological background to the evaluation (**Section 2**), the following specific objectives of the evaluation were identified:

- to establish, within the constraints of the evaluation, the potential of the Kesgrave Sands and Gravels to preserve significant Palaeolithic archaeology, and to contain units preserving significant palaeoenvironmental evidence, and;
- to determine the depositional process(es) associated with any deposits overlying the Kesgrave Sands and Gravels, and to assess their archaeological, palaeoenvironmental and dating potential.

4 FIELDWORK METHODS

4.1 Introduction

4.1.1 All works will be undertaken in accordance with the detailed methods set out within the WSI (Wessex Archaeology 2023a) and in general compliance with the standards outlined in the relevant CIfA and Historic England guidance (CIfA 2020a, Historic England 2015). Any significant variations to these methods were agreed in writing with the Historic Environment Consultant, Place Services, and the client, prior to being implemented.

4.1.2 The evaluation comprised the excavation, investigation and recording of 19 machine dug test pits.

4.2 Setting out of interventions

4.2.1 All interventions were set out using GNSS in the positions shown in **Figure 1** (see Phase 2). Prior to fieldwork commencing the client provided information regarding the presence of any below/above-ground services, and any ecological, environmental or other constraints.

4.2.2 Before excavation began the evaluation area was walked over and visually inspected to identify, where possible, the location of any below/above-ground services. All intervention locations were scanned before and during excavation with a Cable Avoidance Tool (CAT) to verify the absence of any live underground services.

4.3 Test Pits

Excavation methods

4.3.1 The test pits were excavated using a 360º mechanical excavator with a toothless bucket. Machine excavation was under the constant supervision and instruction of a geoarchaeological specialist experienced in interpreting Pleistocene sediments and identifying Palaeolithic lithic artefacts, who recorded and number the sequence of sedimentary units as excavation progressed following standard descriptive practices. The textural characteristics (grain-size, consolidation, colour, material and sedimentary structures) of sedimentary units were recorded, and the shape and nature of their lithostratigraphic contacts (dip, conformity and overall geometry).

4.3.2 Machine excavation proceeded in level spits of approximately 50-100 mm, respecting the interface between sedimentary units, until either the solid geology was exposed, or further excavation became impractical.

4.3.3 Test pits were entered at the maximum safe depth (c. 1.2m) to record the upper stratigraphy. After excavation progressed beyond this depth, recording took place without entering the test pit.

4.3.4 Sediment samples of at least 100 litres were taken at regular intervals in stratigraphic succession through the Pleistocene stratigraphy in each test pit and sieved on-site through a 10 mm mesh to investigate whether artefacts and/or macro vertebrate faunal remains were present. When sediments encountered were not suitable for dry-sieving (i.e. too clayey), excavation proceeded in shallower spits of c. 50 mm, looking carefully for the presence of any archaeological or geoarchaeological evidence, and the spit samples carefully investigated by hand (using archaeological trowels) for any archaeological or geoarchaeological evidence.

4.3.5 Consideration was given to the suitability of any sediment units for luminescence dating. Deposits suitable for luminescence were identified but occurred at depths that were not accessible for sampling.

4.3.6 No human remains were uncovered during the evaluation.

Recording

4.3.7 The test pits were recorded in the form of a measured sketch sections of at least one face and accompanying geoarchaeological descriptions and interpretations.

4.3.8 Descriptions included information such as:

- *Depth*
- *Texture*
- *Composition*
- *Colour*
- *Inclusions*

- *Structure*
- *Shape and nature of contacts between deposits*

4.3.9 Interpretations included, where possible, probable depositional environments and formation processes.

4.3.10 All samples were individually numbered. The location, size, stratigraphic context, purpose and whether retained or processed on-site were recorded.

4.3.11 A full photographic record was made using digital cameras equipped with an image sensor of not less than 10 megapixels. This recorded both the detail and the general context of the principal lithostratigraphic features of the sediments, and the evaluation areas as a whole. Digital images are subject to managed quality control and curation processes which will embed appropriate metadata within the image and ensure long term accessibility of the image set. Photographs were taken of all areas, including access routes, to provide a record of conditions prior to and on completion of the evaluation.

Reinstatement

4.3.12 Test pits were immediately backfilled on completion using excavated materials in the order in which they were excavated. No further reinstatement was carried out.

4.4 Survey

4.4.1 The real time kinematic (RTK) survey of all as dug test pits was carried out using a Leica GNSS connected to Leica's SmartNet service. All survey data was recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of at least 50 mm.

4.5 Monitoring

4.5.1 The client informed the Historic Environment Consultant, Place Services, of the start of the evaluation. The Historic Environment Consultant monitored the evaluation on behalf of the LPA.

5 POST-EXCAVATION METHODS

5.1 Stratigraphic evidence

5.1.1 All written and drawn records from the evaluation have been collated, checked for consistency. Where possible, probable depositional environments, formation processes and chronostratigraphic context have been considered.

5.1.2 A written description was made of all geoarchaeological deposits, ordered by intervention and lithostratigraphy. Details of all lithostratigraphic contexts are provided in the geoarchaeological test pit logs in **Appendix 1**.

5.2 Deposit modelling

5.2.0 The data has been utilised to provide an updated deposit model for the Quaternary deposits in the Site, expanding on that provided by the initial Phase of evaluation (Wessex Archaeology 2023b).

5.2.1 Deposit modelling identifies the range of Quaternary deposits that may be present in a defined area and maps their lateral extent and depth The deposit modelling has been

carried out in accordance with *Deposit modeling and archaeology: guidance for mapping buried deposits* (Historic England 2020).

5.2.2 Only lithostratigraphic records with sufficiently detailed descriptive terminology and location data (including surface elevation) were included in the model. In total 32 deposit records were used in the deposit modelling.

5.2.3 All available data points were entered into industry standard geological utilities software (Rockworks™ 23). Each stratigraphic unit was given a colour and pattern allowing cross correlation and grouping of the different sedimentary units. The grouping of these deposits is based on lithological descriptions, which define distinct depositional environments referred to as 'stratigraphic units' (e.g., Bedrock, Alluvium and Made Ground)

5.2.4 Sedimentary units from the boreholes were classified into five stratigraphic units: (1) topsoil, (2) Head-Brickearth, (3) Sands, (4) Head-Gravel and (5) Ardleigh Gravel. The classified data for groups 1 to 5 were then input into a database within the RockWorks 23™ program.

5.2.5 Models of surface height and thickness were generated using an inverse-distance weighted (IDW) algorithm for the stratigraphic units present within the evaluation area. These include surface plots for the Ardleigh Gravel (**Figure 4**) and thickness plots for the Sands (**Figure 5**), Head-Gravel (**Figure 6**) and Head-Brickearth (**Figure 7**).

5.2.6 Two-dimensional stratigraphic profiles ('transects') of selected interventions across the evaluation area have also been generated using RockWorks 23™. These include east-west Transect 1 (**Figure 8**), Transect 3 (**Figure 10**) and Transect 4 (**Figure 11**) and north-south Transect 2 (**Figure 9**).

5.2.7 Where data points are not uniformly distributed over the area of investigation the reliability of the models is variable. In order to account for this, the modelling algorithm has been adjusted to include a maximum distance cut-off filter, so that only those areas for which sufficient stratigraphic data is present will be included in the model. A maximum distance cut-off filter equivalent to a 150m radius around each data point is applied to the models from the present site.

5.3 Finds evidence

5.3.1 All retained finds were washed, weighed, counted and identified. They were recorded to a level appropriate to the aims and objectives of the evaluation.

5.3.2 Finds have been suitably bagged and boxed in accordance with the guidance given by the relevant museum and generally in accordance with the standards of the CIfA (2020b).

5.4 Palaeoenvironmental, sedimentological and scientific dating samples

5.4.1 Two samples suitable for palaeoenvironmental assessment were obtained during the evaluation. These will be utilised in accordance with the staged approach outlined in **Table 1**. These samples represent fine-grained deposits present within TP225, which occurred at 2.75-2.90m bgl. The two samples represent samples from the upper interface of these deposits (2.75m bgl) and bulk samples from 2.80-2.90m bgl.

5.4.2 Recommendations for Stage 3 sample assessment of retained samples (see **Table 1**) are made in **Section 8**.

5.4.3 No scientific dating samples were taken during the evaluation.

6 RESULTS

6.1 Introduction

6.1.1 This section outlines the results of the evaluation. It includes summaries of the deposits identified during both this and the previous phase of evaluation (Wessex Archaeology 2022a), integrated within an updated deposit model for the Site, an assessment of any archaeological finds recovered and reviews of any palaeoenvironmental, sedimentological and/or scientific dating samples retained.

6.2 Deposits

6.2.0 The lithostratigraphy of deposits encountered during the evaluation is listed and summarised below. The specific lithologies and lithostratigraphic succession encountered in each intervention are outlined in **Appendix 1**.

6.2.1 The generalised lithostratigraphic sequence encountered within the Evaluation Area comprised:

- Topsoil (Recent)
- Colluvium (Holocene)
- Head-Brickearth (Pleistocene)
- Head-Gravel (Pleistocene)
- Sands (Pleistocene)
- Ardleigh Gravel (Pleistocene)

6.2.2 The distribution of the deposits is illustrated by deposit modelling outputs, comprising three transects (**Figures 4**–**7**), a Digital Elevation Model (DEM) of the surface of the Ardleigh Gravel (**Figure 8**), and thickness plots of the Sands, Head-Gravel and Head-Brickearth (**Figures 9–11**).

Ardleigh Gravel

6.2.3 The earliest Quaternary deposits identified in the Site are the Pleistocene fluvial sands and gravels. These coarse-grained deposits were recorded in all 30 test pits, appearing at depths between 33.59m OD (TP228) and 34.54m OD (TP224), with an average appearance at depths of 34.15m OD. These deposits belong to the Ardleigh Gravel of the Kesgrave Sands and Gravels. While these deposits were not bottomed within the test pits, within archive BGS boreholes in the wider area they have a thickness of 6.40-8.50m.

6.2.4 The Ardleigh Gravel largely comprised of reddish-brown to yellowish-brown sandy gravels to sands. Sands were typically medium to coarse. Gravel clasts were typically fine to coarse flint, predominantly subangular to subrounded, but occasionally low relative concentrations of rounded or angular clasts are present. Mudstone clasts, reworked from local Palaeogene bedrock, were rarely present within the gravels. Gravels were typically matrix supported, but coarser grained gravels were occasionally clast supported. These deposits were typically moderately well to moderately poorly sorted. Sub-horizontal fluvial bedding structures were often observed within these sands and gravels.

6.2.5 The fluvial sands and gravels are characteristic of high energy deposition in a braided river system, with occasional intervening sand banks and bars as represented by the sandier units.

6.2.6 Within TP225 a reddish-brown to yellowish-brown fine sandy clayey silt was present within the Ardleigh Gravel at 32.59–32.44m OD. This represents an interval in which a lower energy environment was present, possibly reflecting a finer grained channel fill or overbank floodplain deposits.

6.2.7 Transects through the deposits and a Digital Evaluation Model (DEM) of the surface of the Ardleigh Gravel (**Figure 8**) demonstrate that in the north of the Site (Phase 1 Evaluation Area), post-deposition they have been eroded and incised into by a significant gully/valley form (c. 300m in width) and most evident in bTP203 and TP206 (see **Figures 4** and **5**).

Sands

6.2.8 A clear, sub-horizontal contact separates the Sands and Gravels from the oldest overlying unit, collectively termed as 'Sands'. These deposits differ lithologically from the underlying coarser Sands and Gravels as they are typically fine-medium sands containing rare to very occasional fine to medium (<20mm) flint clasts. This unit was recorded in six test pits (TP201–TP206) at depths of between 0.90m bgl (34.56m OD; TP204) and 3.20m bgl (32.47m OD; TP203), and only recorded in the Phase 1 area. The Sands were structureless and ranged from moderately well-sorted to well-sorted.

6.2.9 The mode of deposition of the Sands is uncertain but may have been through low-energy water flow, potentially with a colluvial input.

6.2.10 Transects (**Figures 4**–**6**), a DEM of the surface of the Ardleigh Gravel (**Figure 8**) and a thickness plot for the Sands (**Figure 9**) demonstrate that the distribution of the Sands was restricted to the gully incised into the Ardleigh Gravel in the north of the Site (Phase 1 Evaluation Area). These Sands are the basal deposits infilling this landform.

Head-Gravel

6.2.11 Overlying the Ardleigh Gravel and, where present the Sands, were sequences of clayey sands and gravels. These coarse-grained deposits were present across all 30 test pits, and varied in thickness between 0.12m (TP218) to 2.17m (TP206), and appeared at depths ranging from 34.15m OD (TP218) to 35.05m OD (TP219).

6.2.12 These deposits generally consisted of grey to reddish-brown clayey sandy gravels to clayey gravelly sands. Sand was typically medium to coarse. Gravel was typically fine to coarse, predominantly medium, subangular to subrounded flint. These deposits were matrix supported, and typically moderately poorly to moderately well sorted. The contact between these deposits and the underlying Ardleigh Gravel was erosive and occasionally undulating.

6.2.13 These clayey sandy gravels and clayey gravelly sands are characteristic of sediments that have been remobilised down-slope through colluviation and/or solifluction processes resulting from seasonal freeze-thaw processes in periglacial environments. Such deposits are often referred to as 'Head' (see **Section 2.5**) and are grouped here under Head-Gravel.

6.2.14 **Figure 10** illustrates the thickness and distribution of Head-Gravel across the Site. These deposits are widespread, but the deepest sequences were found infilling the gully in the north of the Site.

Head-Brickearth

6.2.15 Overlying the Head-Gravel deposits were fine-grained deposits, present within all but a single test pit (being absent from TP208). They varied in thickness between 0.15m (TP225) to 1.20m (TP201). these sediments occurred at depths ranging from 34.60m OD (TP230) to 35.34m OD (TP219).

6.2.16 The deposits generally consisted of slightly gravelly clayey sandy silts to slightly sandy clayey silts. Sand was fine and gravel was typically fine to medium subangular flint. These sediments are equivalent with 'Coversands' mapped across the area by the BGS (see **Figure 3**).

6.2.17 The fine-grained component is likely to have derived from wind-blown sediments ('Coversands'/'loess'). However, the lack of structures indicative of primary aeolian deposition and the frequent presence of gravel clasts, suggests that this consists of windblown sediments which have subsequently been remobilised through downslope processes such as solifluction, colluviation and/or water run-off (cf. 'Head-Brickearth'). As these deposits are therefore not actually windblown coversands, they are referred to here as Head-Brickearth (see **Section 2.5**).

6.2.18 Occasional modern rooting was present within the Head-Brickearth.

6.2.19 **Figure 11** illustrates the thickness and distribution of Head-Brickearth Across the Site. This occurred uniformly across the Site. A much deeper sequence of similar deposits are recorded in a BGS borehole south of the (TM02NE15). It is unclear as to what this reflects, although it may be related to a similar landform as the gully recorded in the north of the Site.

Colluvium

6.2.20 Dark brown, structureless, slightly sandy silt and silty clay with rare to occasional subangular to subrounded flint clasts and heavy rooting were observed in four test pits (TP201, TP203, TP207 and TP208). This upper surface of this deposit was uniformly recorded across the evaluation area at 0.30m bgl, extending to 0.50m bgl in three test pits and 0.65m bgl in TP203. In the majority of interventions, this deposit stratigraphically overlies Brickearth, however in a single test pit (TP208) it was underlain by Head-Gravel.

6.2.21 These silts and clays occur at the top of the Quaternary stratigraphic sequence and are typically overlain by recent Topsoil. They are collectively interpreted as Holocene Colluvium and reflect the downslope remobilisation of sediments resulting from landscape instability brought on by a lack of vegetation cover due to Holocene landscape-use and agricultural practices.

6.2.22 While these deposits were observed during Phase 1 of this investigation (Wessex Archaeology 2023b), no such deposits were observed during the Phase 2 investigation. As the isolated occurrences where these sediments occurred are within the area of the gully in the north of the Site, this colluvium ay represent the final phase of infilling of low points in the landscape created by this land form.

Topsoil

6.2.23 Recent topsoil with frequent roots capped the superficial geology in all test pits. The topsoil thickness ranged from 0.30 to 0.45m.

6.3 Archaeology

6.3.1 Seven pieces of flint identified as possible artefacts were obtained from samples sieved during the Phase 2 Palaeolithic evaluation, and retained for assessment. Six were from the Ardleigh Gravel and one from the Head-Gravel.

6.3.2 Six pieces exhibit conchoidal fractures and features similar to those produced through anthropogenic flint working, however, none are definitive artefacts. The pieces are small (<30mm), platforms are natural, angles of flaking are low and the orientation of scars tend to be from the same direction as final fracture/removal. This suggests natural processes (thermal starch fractures and clast collision) are responsible.

6.3.3 The other piece, which is from the Ardleigh Gravel, is a thermal flake which has been burnt and subsequently rolled within a fluvial gravel. This suggests that the burning is contemporary with, or earlier, than the Ardleigh Gravel. Whether the burning is anthropogenic or natural in origin cannot be determined.

6.4 Palaeoenvironmental, sedimentological and scientific dating samples

6.4.1 The sequence of Quaternary deposits identified during the evaluation generally had low palaeoenvironmental potential. Localised deposits with some potential were identified, and bulk samples taken.

6.4.2 Within TP225, fine sandy clayey silts were found within the sequence of fluvial sands and gravels, at 2.75-2.90m bgl. These fine-grained deposits have potential to contain microfossil remains such as diatoms, ostracods and/or foraminifer. Samples from the boundary between the top of the deposit and the overlying sands were taken, including bulk samples from 2.80-2.90m bgl.

6.4.3 Sand layers and lenses within the Sand and Head-Gravel would be suitable for luminescence dating. The Sands were not encountered during the Phase 2 evaluation, whilst suitable deposits within the Head-Gravel were at depths exceeding the maximum depth of entry to test pits and no samples could be taken. Sands and silts also occurred within the Ardleigh Gravel but these sediments date to earlier than the age limits of currently available luminescence dating techniques.

7 DISCUSSION

7.1 Introduction

7.1.1 The evaluation has successfully characterised the Pleistocene deposits present within the Evaluation Area and assessed their Palaeolithic archaeological potential. The results of the Phase 2 evaluation can be combined with those from the first phase of evaluation (Wessex Archaeology 2023b) to provide an updated Palaeolithic Geoarchaeological Landscape Characterisation (GLC) for the Site.

7.1.2 The GLC works on the same principles as a Historic Landscape Characterisation (English Heritage 2004) and Landscape Character Assessment (Natural England 2014), but in this case largely considers the buried and outcropping Quaternary, and this case specifically Pleistocene, geological elements of the landscape and their Palaeolithic geoarchaeological potential.

7.1.3 The GLC combines the results of the desk-based assessment and deposit modelling to sub-divide the Site into different Geoarchaeological Characterisation Zones (GCZs) based on the differences in Quaternary geology.

7.1.4 The Palaeolithic geoarchaeological potential of the Quaternary deposit in each GCZ is assessed. This assessment includes consideration of potential to contain geoarchaeological evidence (specifically archaeological remains and palaeoenvironmental data relevant for contextualising past settlement history) and its significance in relation to national (e.g., EH 2008) and regional (Medlycott ed. 2011) research themes and priorities.

7.1.5 This GLC provides a framework for more precisely determining the Palaeolithic geoarchaeological resource in each GCZ at a scale which can most effectively inform future decision making. This includes establishing where current data is insufficient to characterise the geoarchaeological resource and where work may be required. The information can be used to establish requirements for geoarchaeological mitigation and/or management strategies based on future detailed development proposals.

7.2 Geoarchaeological Character Zones (GCZs)

7.2.1 This GLC for the Site comprises two GCZs. These zones are illustrated on **Figure 12** and summarised in **Table 5,** and are described in more detail below.

Table 5 Geoarchaeological Character Zones

GCZ	Lithostratigraphic unit	MIS	Geological Period	Archaeological Period	Depth of deposits (m bgl)
1	Head-Brickearth	Unknown	?Middle to Late Pleistocene	?Lower to Middle Palaeolithic	0.30-1.70
	Head-Gravel	Unknown	?Middle to Late Pleistocene	?Lower to Middle Palaeolithic	0.60-2.55
	Sands	Unknown	?Middle to Late Pleistocene	?Lower to Middle Palaeolithic	0.90-3.20
	Ardleigh Gravel	MIS 16-14	Early Middle Pleistocene	Lower Palaeolithic	1.60-3.30+
2	Head-Brickearth	Unknown	?Middle to Late Pleistocene	?Lower to Middle Palaeolithic	0.27-1.00
	Head-Gravel	Unknown	?Middle to Late Pleistocene	?Lower to Middle Palaeolithic	0.45-1.80
	Ardleigh Gravel	MIS 16-14	Early Middle Pleistocene	Lower Palaeolithic	0.50-3.20+

GCZ 1

7.2.2 GCZ 1 is in the north of the site and defined by a gully incised into the Ardleigh Gravel, and containing deposits infilling that gully.

7.2.3 The earliest Pleistocene deposits identified in GCZ 1 consist of high energy fluvial sands and gravels, belonging to the Ardleigh Gravel of the Kesgrave Sands and Gravels (MIS 16-14; 676-524 Kya) of the River Thames. Test pits evaluated the upper c. 3.0m of these deposits. BGS archive boreholes from the area (TM02NE/14 and TM02NE/15) suggest that c. 9-10m of Ardleigh Gravels are likely to occur beneath GCZ 1. Only high energy, coarse fluvial sands and gravels have been recorded in this zone.

7.2.4 Subsequent to deposition, the surface of the Ardleigh Gravels has been truncated and incised into and the resulting gully is infilled with basal Sands, overlain by clayey, sandy gravels and clayey gravelly sands (Head-Gravel). How the basal Sands were deposited is uncertain, but may include low energy water flow. The overlying gravelly units are characteristic of sediments deposited through slope processes, which may include colluvial

and/or solifluction processes. The Sands only occurred in the base of the gully, whilst the Head-Gravel was more widespread, but are thickest within the gully. The age of these sediments is uncertain, and they may post-date the Ardleigh Gravels by a considerate period.

7.2.5 The youngest Pleistocene sediments in GCZ 1 comprise Head-Brickearth. These deposits likely have a significant aeolian component, but have been reworked via colluviation and/or solifluction processes. These deposits are the equivalent to the 'Coversands' mapped by the BGS, however, the lack of any distinct aeolian sedimentary structures and the presence of coarser grained clasts within the deposits indicate they have not been formed by exclusive aeolian processes. Head-Brickearth deposits seal the Head-Gravel, and are therefore younger, but no chronology is currently available to date the Head-Brickearth.

7.2.6 Within GCZ 1, occasional occurrences of Holocene colluvium overlying the Head-Brickearth were recorded.

GCZ 2

7.2.7 The Quaternary deposits in this zone exclusively consist of Pleistocene deposits of the Ardleigh Gravel and overlying Head-Gravel and Head Brickearth.

7.2.8 As in GCZ 1, the Ardleigh Gravel was principally coarse sands and gravels deposited in high energy fluvial environments. A finer-grained deposit within the Ardleigh Gravel was locally recorded within the west of the zone (Phase 2 evaluation), which reflects lower-energy fluvial deposition.

7.2.9 The Head-Gravel and Head-Brickearth are widely distributed across the zone. These deposits are analogous with those in GCZ 1.

7.3 Assessment of archaeological potential and significance

7.3.0 The two phases of Palaoelithic evaluation have allowed the Palaeolithic geoarchaeological potential of Quaternary deposits within each GCZ of the GLC to be assessed and the significance of the geoarchaeological resource to be considered. This enables informed decisions regarding future requirements for geoarchaeological field evaluation (to establish the potential and significance of the geoarchaeological resource); or the formation of a mitigation strategy (to offset the impact of the development on the geoarchaeological resource); or a management strategy.

7.3.1 A Palaoelithic geoarchaeological potential rating has been assigned to Pleistocene deposits, representing a measure of probability. This has been determined via the application of professional judgement, informed by the evidence from the Site itself and equivalent deposits in the surrounding area. The Palaoelithic geoarchaeological potential rating comprises two variables, an assessment of potential to preserve archaeological evidence and to preserve paleoenvironmental remains. '*Potential'* is expressed on a four-point scale, assigned in accordance with the following criteria:

- **High** Situations where evidence is known or strongly suspected to be present within deposits and which are likely to be well preserved.

- **Moderate** Includes cases where there are grounds for believing that evidence may be present, but for which conclusive evidence is not currently available.

- **Low** Circumstances where the available information indicates that evidence is unlikely to be present, or that their state of preservation is liable to be severely compromised.

- **Unknown** Cases where currently available information does not provide sufficient evidence on which to provide an informed assessment with regard to the potential for material to be present.

7.3.2 The relative '*Significance'* of known and potential geoarchaeological evidence has been determined in accordance with the criteria set out in **Table 6.** These criteria are related to national (e.g. EH 2008) and regional (Medlycott ed. 2011) research themes and priorities.

Table 6 Generic schema for classifying the significance of geoarchaeological assets (based on HE 2015)

Significance	Categories
Very High	World Heritage Sites (including nominated sites) Assets of recognised international importance Assets that contribute to international research objectives
High	Scheduled Monuments Non-designated assets of national importance Assets that contribute to national research agendas (for Palaoelithic assets these are likely to be contemporary with the deposits)
Moderate	Assets that contribute to regional research objectives (for Palaoelithic assets these are likely to be reworked to some degree)
Low	Assets compromised by poor preservation and/or poor contextual associations Assets with importance to local interest groups (for Palaoelithic assets these are likely to be reworked to a significant degree)
Negligible	Little or no archaeological or geoarchaeological interest
Unknown	The importance of the asset has not been ascertained from available evidence

7.3.1 The geoarchaeological potential of deposits in each GCZ is summarized in **Table 7** and discussed below.

Table 7 Assessment of Palaeolithic geoarchaeological potential and significance

GCZ	Unit	Geological Period	Archaeological Period	Depth m bgl	Archaeological potential of deposits	Paleoenvironmental potential of deposits	Geoarchaeological significance
1	Head-Brickearth	?Middle to Late Pleistocene	Unknown	0.30-0.70	Low	Low	Moderate-Low
	Head-Gravel	?Middle to Late Pleistocene	Unknown	0.60-1.50	?Low-Moderate/Low	Low	Unknown
	Sands	?Middle to Late Pleistocene	Unknown	0.90-3.20	Low	Unknown	Unknown
	Ardleigh Gravel	Early Middle Pleistocene	Lower Palaeolithic	1.60-3.20	Low	Low	High
	Ardleigh Gravel	Early Middle Pleistocene	Lower Palaeolithic	3.20+	Unknown	Unknown	High
2	Head-Brickearth	?Middle to Late Pleistocene	Unknown	0.27-1.00	Low	Low	Moderate-Low

	Head-Gravel	?Middle to Late Pleistocene	Unknown	0.45-1.80	?Low-Moderate/Low	Low	Unknown
	Ardleigh Gravel (sands and gravels)	Early Middle Pleistocene	Lower Palaeolithic	1.60-3.20	Low	Low	High
	Ardleigh Gravel (fine-grained deposits)	Early Middle Pleistocene	Lower Palaeolithic	2.75-2.90	Low	Moderate	High
	Ardleigh Gravel	Early Middle Pleistocene	Lower Palaeolithic	3.20+	Unknown	Unknown	High

Ardleigh Gravel

7.3.2 The geoarchaeological investigations across GCZ 1 and 2 have evaluated the upper c. 3.0m of what is likely to be a c. 9.0-10.0m sequence of Pleistocene fluvial deposits belonging to the Ardleigh Gravel.

7.3.3 The two-phased evaluation has investigated the archaeological potential of these deposits through controlled artefact sieving of samples of the Ardleigh gravel from 29 test pits distributed across GCZ 1 and GCZ 2. No clear artefacts have been identified, which indicates that the Palaeolithic archaeological potential of these deposits is low. Any archaeology from these deposits would relate to the earliest period of Lower Palaeolithic human occupation of Britain, with the result that any archaeology may have high significance for regional and national Palaoelithic research themes and priorities.

7.3.4 The palaeoenvironmental potential of the coarse high-energy sand and gravel units of the Ardleigh Gravel is generally low. However, fine-grained deposits that were locally present within GCZ 2 (TP225) are of moderate palaeoenvironmental potential, and may contain micropaleontological remains reflective of landscapes and environments. These may be of high significance for assessing the climatic and environmental context of Lower Palaeolithic activity in the wider region.

7.3.5 The Ardleigh Gravel beneath c. 3.2m bgl could not be evaluated and has been assessed as having an unknown archaeological and palaeoenvironmental potential.

Sands and Head-Gravel

7.3.6 Sands and Head-Gravel were recorded infilling a gully incised into the Ardleigh Gravel in GCZ 1.

7.3.7 Erosional features incised into Pleistocene terrace deposits and containing Pleistocene sediments are known from younger Pleistocene terraces of the Middle Thames (Wessex Archaeology 2022b). These range from hollows and small gullies up to significant valley forms, and are likely to be more widespread than currently documented. The associated Pleistocene deposits and their Palaeolithic geoarchaeological potential is currently poorly understood. In the Middle Thames they have been shown to contain deposits dating from immediately after the formation of a terrace, through to the Holocene, and may be capture points associated with younger Palaeolithic archaeology post-dating the terraces (Wessex Archaeology 2022b).

7.3.8 Evaluation of the Sands and overlying Head-Gravel infilling the gully in GCZ 1 did not produce archaeology (although burnt, unworked flint was recovered). This suggests that their archaeological potential may be limited, whilst their palaeoenvironmental potential was

similarly judged to be low. However, the fact that these deposits have not been recognised previously in the area and the lack of chronology for these deposits provides some uncertainty when judging geoarchaeological potential and significance. Based on this assessment, the archaeological potential of the Sands and Head-Gravel has been tentatively assessed as low and significance as unknown.

Head-Brickearth

7.3.9 Clayey sandy silts to slightly sandy clayey silts were the youngest Pleistocene deposits occurring across GCZ 1 and GCZ 2, sealing all of the underlying stratigraphy. These deposits are equivalent to 'Coversands' widely document by the BGS in the area. Although the deposits in the Site likely have a reworked aeolian component, the evaluation suggests that they have principally been deposited via slope process (colluvium/solifluction).

7.3.10 The deposits were extensively evaluated across GCZ 1 and GCZ 2 and shown to have low archaeological and palaeoenvironmental potential. The significance of any archaeology they do contain would be dependent on their age and the taphonomic history of the archaeology; *in situ*/minimally disturbed material would be of greater significance than archaeology reworked within the slope deposits, although the latter may be indicative of locations upslope where minimal disturbed material could occur.

7.3.11 The evaluation did not identify potential for buried stable surfaces that could preserve minimally disturbed/*in situ* archaeology. Overall, the Palaeolithic geoarchaeological potential of the Head-Brickearth is assessed as low, whilst the likely significance of any material is unlikely to be more than moderate.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

8.1.0 The evaluation has characterised Pleistocene deposits in the Site and mapped their lateral and horizontal extent. This has enabled the provision of Palaeolithic Geoarchaeological Landscape Characterisation (GLC) that divides the Site into two Palaoelithic Geoarchaeological Character Zones (GCZs). The Palaeolithic geoarchaeological potential of deposits in each GCZ has been assessed.

8.1.1 The evaluation has demonstrated that the earliest Pleistocene deposit in the site belong to the Ardleigh Gravel of the Kesgrave Sands and Gravels (MIS 16-14; 676-524 Kya) of the River Thames. These occurred across the Site. The evaluation investigated the upper c. 3.0 m of these deposits, which typically comprised of high energy fluvial deposits, likely deposited in a braided river environment. These deposits were extensively sampled for artefacts. No archaeology was recovered. The palaeoenvironmental potential of these deposits was assessed as generally low, with the exception that finer-grained silts were locally present in GCZ 2. These have greater potential and samples suitable for palaeoenvironmental assessment were taken.

8.1.2 Across both GCZ 1 and 2, the Ardleigh Gravel was overlain by Pleistocene slope deposits comprising Head-Gravel and Head-Brickearth. The archaeological and palaeoenvironmental potential of these sediments has been assessed as generally low. In GCZ 2 a gully was recorded incised into the top of the Ardleigh Gravel and infilled with a basal Sand and overlying Head-Gravel. Although no archaeology was recovered from these deposits, they have not previously been identified in the area, are poorly understood and are undated. This raises some uncertainties regarding the Palaoelithic archaeological potential of these deposits and the significance of them as a geoarchaeological resource.

8.2 Recommendations

8.2.1 The evaluation has characterised much of the Palaoelithic geoarchaeological resource beneath the Site and demonstrated generally low potential for significant Palaeolithic geoarchaeological evidence.

8.2.2 The evaluation has delimited selected Pleistocene deposits in the Site where data is insufficient to fully characterise the Palaeolithic geoarchaeological resource and, dependent on detailed development proposals, further investigations may be required as part of geoarchaeological mitigation and/or the production of a management strategy. These are:

- Ardleigh Gravel, and any underlying deposits, beneath 3.20m bgl in GCZ 1 and GCZ 2;
- Localised fine-grained deposits in the Ardleigh gravel < 3.20m bgl in GCZ 2, and
- Deposits, particularly Sands, infilling a gully in GCZ 1.

8.2.3 The Ardleigh Gravel and underlying sediments beneath 3.20m bgl could not be evaluated, and their Palaeolithic geoarchaeological potential is uncertain. The principal Palaeolithic geoarchaeological potential is for the presence of fine-grained and organic deposits, which can occur at depth in the Ardleigh terrace (c.f. the Ardleigh Channel or equivalent deposits; see **section 2.5**). These are a highly significant Palaoelithic geoarchaeological resource.

8.2.4 Should development proposals impact on deposits beneath 3.20m bgl, assessment for the presence of such deposits through a borehole survey is recommended. This would also enable sampling to mitigate against any potential impacts. Should any Ground Investigation (GI) works (including boreholes) be carried out in the Site, it is recommended that these are geoarchaeologically monitored to inform on the potential for finer-grained/organic deposits with geoarchaeological potential.

8.2.5 The evaluation has identified the localised presence of sediments with palaeoenvironmental potential in the top 3m of the Ardleigh Gravel. These have been sampled as part of the evaluation. It is recommended that that these samples are assessed to establish their potential for analysis. Given the localised nature of these deposits, the samples taken and a program of assessment and analysis are considered sufficient to mitigate against any development impacts. Specific recommendations for assessment are provided in **Table 8**.

Table 8 Recommendations for palaeoenvironmental assessment

Sample number	Description	Recommendations
091	Fine sandy clayey silt within fluvial sands and gravels. TP225. 2.75m bgl. Contact between fine-grained deposits and overlying sands. 1 litre sample.	Foraminifera, ostracods
092	Fine sandy clayey silt within fluvial sands and gravels. TP225. 2.75m bgl. Contact between fine-grained deposits and overlying sands. 1 litre sample.	Diatoms, pollen
093	Fine sandy clayey silt within fluvial sands and gravels. 20 litre bulk samples.	Diatoms, foraminifera, ostracods, pollen

8.2.6 There is some uncertainty regarding the geoarchaeological resource that may be associated with deposits within a gully cut into the Ardleigh Gravel in GCZ 1, particularly the basal Sands. In order to mitigate against development impacts on these sediments, a stepped geoarchaeological test pit in this area is recommended to record in detail and

geoarchaeologically sample the deposits and to facilitate a program of geoarchaeological sample assessment and dating.

9 ARCHIVE STORAGE AND CURATION

9.1 Museum

9.1.1 The archive resulting from the evaluation is currently held at the offices of Wessex Archaeology in Salisbury. Colchester Museum has agreed in principle to accept the archive on completion of the project. Deposition of any finds with the museum will only be carried out with the full written agreement of the landowner to transfer title of all finds to the museum.

9.2 Preparation of archive

Physical archive

9.2.1 The archive, which includes paper records, graphics, artefacts and ecofacts, will be prepared following the standard conditions for the acceptance of excavated archaeological material by Colchester Museum, and in general following nationally recommended guidelines (Brown 2011; CIfA 2020c; SMA 1995).

9.2.2 All archive elements are marked with the site code LAWGR23, and a full index will be prepared. The physical archive currently comprises the following:

- 01 cardboard boxes or airtight plastic boxes of artefacts and ecofacts, ordered by material type
- 01 files/document cases of paper records

Digital archive

9.2.3 The digital archive generated by the project will be deposited with a Trusted Digital Repository, in this instance the Archaeology Data Service (ADS), to ensure its long-term curation. Digital data will be prepared following ADS guidelines (ADS 2013 and online guidance) and accompanied by metadata.

9.3 Selection strategy

9.3.1 It is widely accepted that not all the records and materials (artefacts and palaeoenvironmental data) collected or created during the course of an archaeological project require preservation in perpetuity. These records and materials will be subject to selection in order to establish what will be retained for long-term curation, with the aim of ensuring that all elements selected to be retained are appropriate to establish the significance of the project and support future research, outreach, engagement, display and learning activities, i.e. the retained archive should fulfil the requirements of both future researchers and the receiving Museum.

9.3.2 The selection strategy, which details the project-specific selection process, is underpinned by national guidelines on selection and retention (Brown 2011, section 4, CIfA 2022) and generic selection policies (SMA 1993; Wessex Archaeology's internal selection policy) and follows CIfA's *Toolkit for Selecting Archaeological Archives*. It should be agreed by all stakeholders (Wessex Archaeology's internal specialists, external specialists, local authority, museum) and fully documented in the project archive.

9.3.3 Project-specific proposals for selection are presented below. These proposals are based on recommendations by Wessex Archaeology's internal specialists and will be updated in line with any further comment by other stakeholders (museum, local authority). The selection strategy will be fully documented in the project archive.

9.3.4 Any material not selected for retention may be used for teaching or reference collections by Wessex Archaeology.

Finds

9.3.5 It is recommended that the possible flake recovered during the Phase 1 evaluation is retained, whilst all other material is documented and disposed of.

Palaeoenvironmental, sedimentological and scientific dating samples

9.3.6 Samples shall be retained for the recommended palaeoenvironmental assessment. If assessment goes ahead, samples and residues shall be retained for the duration of the project.

Documentary records

9.3.7 Paper records comprise site registers (other pro-forma site records are digital), drawings and reports (Written Scheme of Investigation, client report). All will be retained and deposited with the project archive.

Digital data

9.3.8 The digital data comprise site records (tablet-recorded on site) in spreadsheet format; finds records in spreadsheet format; survey data; photographs; reports. All will be deposited, although site photographs will be subject to selection to eliminate poor quality and duplicated images, and any others not considered directly relevant to the archaeology of the site.

9.3.9 Wessex Archaeology follows national guidelines on selection and retention (SMA 1993; Brown 2011, section 4). In accordance with these, and any specific guidance prepared by the museum, a process of selection and retention will be followed so that only those artefacts or ecofacts that are considered to have potential for future study will be retained. The selection policy will be agreed with the museum and is fully documented in the project archive.

9.4 Security copy

9.4.1 In line with current best practice (e.g., Brown 2011), on completion of the project a security copy of the written records will be prepared in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital preservation of electronic documents through omission of features ill-suited to long-term archiving.

9.5 OASIS

9.5.1 An OASIS (online access to the index of archaeological investigations) record (http://oasis.ac.uk) has been initiated, with key fields completed (**Appendix 2**). A .pdf version of the final report will be submitted following approval by the Historic Environment Consultant at Place Services on behalf of the LPA. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service (ADS) ArchSearch catalogue.

10 COPYRIGHT

10.1 Archive and report copyright

10.1.1 The full copyright of the written/illustrative/digital archive relating to the project will be retained by Wessex Archaeology under the *Copyright, Designs and Patents Act 1988* with all rights reserved. The client will be licenced to use each report for the purposes that it was produced in relation to the project as described in the specification. The museum, however, will be granted an exclusive licence for the use of the archive for educational purposes, including academic research, providing that such use conforms to the *Copyright and Related Rights Regulations 2003*.

10.1.2 Information relating to the project will be deposited with the Historic Environment Record (HER) where it can be freely copied without reference to Wessex Archaeology for the purposes of archaeological research, or development control within the planning process.

10.2 Third party data copyright

10.2.1 This document, the evaluation report and the project archive may contain material that is non-Wessex Archaeology copyright (e.g., Ordnance Survey, British Geological Survey, Crown Copyright), or the intellectual property of third parties, which Wessex Archaeology are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Wessex Archaeology. Users remain bound by the conditions of the *Copyright, Designs and Patents Act 1988* with regard to multiple copying and electronic dissemination of such material.

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APPENDICES

Appendix 1 Geoarchaeological test pit logs

The stratigraphic succession encountered in each test of the Phase 2 Palaeolithic geoarchaeological evaluation are outlined below. Both heights and coordinates were taken at the centre of each trench. Depth m bgl = metres below ground level.

Site Code: 286890	**Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting**	**Test pit ID: 212**
Coordinates (NGR) X: 608138.05	**Coordinates (NGR) Y:** 228972.46	**Level (top): 35.46m OD**
Length: 5.76m	**Width: 2.42m**	**Depth: 2.90m**

Context Number	**Description**	**Interpretation**	**Depth m bgl**	**Depth m OD**	**Samples**
21201	Moderately firm, greyish brown slightly gravelly clayey silty sand. Sand is fine. Gravel is medium subangular to subrounded flint. Rooting present. Rare black mottling associated with iron. Structureless. Sharp to 21202	Topsoil	0.00-0.38	35.46-35.08	
21202	Slightly firm reddish brown to yellowish brown, slightly gravelly silty sand. Sand is fine. Gravel is medium subrounded to subangular flint. Structureless. Some reddish mottling associated with iron. Sharp but undulating contact with 21203 between 0.57 and 0.76m bgl.	Head-Brickearth	0.38-0.76	35.08-34.80	
21203	Moderately firm reddish brown clayey sandy gravel. Sand is medium to coarse. Gravel is fine to medium (predominantly medium), subangular (60%) to subrounded (40%) flint. Matrix supported. Moderately well sorted. Some iron nodules. Structureless	Head-Gravel	0.57-1.30	34.80-34.16	106, 107
21204	Moderately firm yellowish brown to grey very sandy gravel to sand. 30:70 gravel-sand ratio. Sub-horizontal bedding. Beds 20-40cm thick. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (45%), subrounded (45%) to rounded (10%) flint. Moderately low sphericity. Matrix supported. Moderately well sorted.	Ardleigh Gravel	1.30-2.90	34.16-32.56	108, 109, 110, 111

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 213
Coordinates (NGR) X: 608098.98	Coordinates (NGR) Y: 228752.19	Level (top): 35.35m OD
Length: 6.21m	Width: 2.39m	Depth: 2.70m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
21301	Moderately firm to firm greyish brown slightly gravelly silty clay. Gravel is fine subangular flint. Rooting present. Structureless. Sharp to 21302	Topsoil	0.00-0.36	35.35-34.99	
21302	Moderately firm pale yellowish brown silty sand. Sand is fine. Structureless. Sharp but undulating contact to 21303 between 0.52 and 0.60m bgl.	Head-Brickearth	0.36-0.60	34.99-34.79	
21303	Moderately firm yellowish brown clayey sandy gravel. Sand is medium to coarse. Gravel is fine to medium (predominantly medium), subangular (65%), subrounded (30%) to rounded (5%) flint. Clasts low to moderately low sphericity. Matrix supported. Moderately well sorted. Sharp to 21304	Head-Gravel	0.52-1.12	34.79-34.23	100, 101, 102
21304	Reddish brown to yellowish brown bedded sandy gravels and sands. 15:85 gravel-sand ratio. Sub-horizontal bedding with beds 15-25cm (gravels) to 30-40cm (sands). Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (65%) to subrounded (45%) flint. Matrix supported. Moderately well sorted. Structureless.	Ardleigh Gravel	1.12-2.70	34.23-32.65	102, 103, 104, 105

Site Code: 286890	**Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting**	**Test pit ID: 214**
Coordinates (NGR) X: 608105.95	**Coordinates (NGR) Y:** 228584.46	**Level (top): 34.96m OD**
Length: 5.17m	**Width: 2.36m**	**Depth: 2.50m**

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
21401	Moderately firm greyish brown slightly gravelly, silty clay. Gravel is fine to medium subangular to subrounded flint. Rooting common. Structureless. Sharp to 21402	Topsoil	0.00-0.30	34.96-34.66	
21402	Moderately firm pale grey to yellowish brown slightly sandy silt. Some brownish mottling. Structureless. Sharp to 21403	Head-Brickearth	0.30-0.50	34.66-34.46	
21403	Moderately firm yellowish brown to grey sandy clayey gravel. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular (60%), subrounded (35%) to rounded (5%) flint. Clasts moderately low sphericity. Matrix supported. Moderately well sorted. Some black speckling associated with iron nodules.	Head-Gravel	0.50-0.85	34.36-34.11	95
21404	Moderately firm reddish brown to yellowish brown bedded slightly gravelly sands to sandy gravels. 20:80 sands-gravels ratio. Sub-horizontal bedding. Beds 20-30cm thick. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (60%) to subrounded (40%) flint. Clasts moderately low sphericity. Matrix supported. Sharp to 21405	Ardleigh Gravel	0.85-2.30	34.11-32.66	96, 97, 98
21405	Moderately firm yellowish brown slightly clayey sandy gravel. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular (60%), subrounded (30%) to rounded (10%) flint. Clasts moderately low sphericity. Moderately well sorted. Clast supported. Strucureless	Ardleigh Gravel	2.30-2.50	32.66-32.46	99

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 215
Coordinates (NGR) X: 608067.78	Coordinates (NGR) Y: 228899.79	Level (top): 35.51m OD
Length: 5.92m	Width: 2.34m	Depth: 3.20

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
21501	Moderately firm greyish brown, very slightly gravelly slightly sandy silt. Sand is fine. Gravel is fine subangular flint. Rooting common. Structureless. Sharp to 21502.	Topsoil	0.00-0.40	35.51-35.11	
21502	Moderately firm slightly sandy silt. Sand is fine. Rare subrounded medium flint clasts. Black mottling associated with iron nodules present. Structureless. Sharp but undulating boundary to 21503 between 0.68 and 0.75m bgl.	Head-Brickearth	0.40-0.75	35.11-34.80	
21503	Moderately firm to firm reddish brown clayey sandy gravels. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular (60%) to subrounded (40%) flint. Moderately low sphericity. Moderately poorly sorted. Matrix supported. Structureless. Sharp to 21504	Head-Gravel	0.68-1.25	34.80-34.26	113, 114
21504	Moderately firm yellowish brown to reddish brown sandy gravels to slightly gravelly sands. 40:60 gravel-sand ratio. Sub-horizontal bedded, with beds 30-40cm thick. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular (40%), subrounded (50%) to rounded (10%) flint. Moderately low to moderately high sphericity. Moderately well sorted. Matrix supported.	Ardleigh Gravel	1.25-3.20	34.26-32.31	115, 116, 117, 118, 119, 120

Site Code: 286890	**Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting**	**Test pit ID: 216**
Coordinates (NGR) X: 608009.53	**Coordinates (NGR) Y:** 228999.24	**Level (top):** 35.54m OD
Length: 5.59m	**Width: 2.33m**	**Depth: 2.90**

Context Number	**Description**	**Interpretation**	**Depth m bgl**	**Depth m OD**	**Samples**
21601	Firm greyish brown slightly gravelly silty clay. Gravel is medium to coarse subangular flint. Some rooting present. Structureless. Sharp to 21602.	Topsoil	0.00-0.44	35.54-35.10	
21602	Yellowish brown slightly gravelly clayey sandy silt. Sand is fine. Gravel is fine to medium subangular flint to rounded flint. Some black mottling. Structureless. Sharp but undulating contact to 21603 between 0.67 and 0.86m bgl.	Head-Brickearth	0.44-0.86	35.10-34.77	61
34.77-321603	Moderately firm reddish brown to grey clayey sandy gravel to clayey gravelly sand. 50:50 gravels-sands ratio. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular (65%) to subrounded (35%) flint. Moderately well sorted. Matrix supported. Structureless. Sharp to 21604	Head-Gravel	0.67-1.50	34.77-34.04	61, 62, 63
21604	Moderately firm yellowish brown slightly clayey sandy gravel to slightly clayey gravelly sand. 60:40 gravel-sands ratio. Sub-horizontal bedding, with sands 20-30cm thick and gravels 30-40cm thick. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular (60%) to subrounded (40%) flint. Low sphericity. Moderately well sorted. Matrix supported.	Ardleigh Gravel	1.50-2.90	34.04-32.64	64, 65, 66, 67, 68

Site Code: 286890	**Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting**	**Test pit ID: 217**
Coordinates (NGR) X: 608000.98	**Coordinates (NGR) Y:** 228846.23	**Level (top):** 35.39m OD
Length: 6.44m	**Width: 2.26m**	**Depth: 2.90m**

Context Number	**Description**	**Interpretation**	**Depth m bgl**	**Depth m OD**	**Samples**
21701	Moderately firm to firm greyish brown slightly gravelly slightly sandy clayey silt. Sand is fine. Gravel is medium subangular to subrounded flint. Some iron nodules. Rooting common. Sharp to 21702.	Topsoil	0.00-0.37	35.39-35.02	
21702	Moderately soft pale grey to yellowish brown slightly gravelly slightly sandy silt. Sand is fine. Gravel is fine to medium subangular to subrounded flint. Structureless. Sharp but undulating contact with 21703 between 0.62 and 0.76m bgl.	Head-Brickearth	0.37-0.76	35.02-34.70	
21703	Moderately firm reddish brown to grey clayey sandy gravel. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular (60%) to 40%) flint. Moderately low sphericity. Moderately poorly sorted. Matrix supported. Structureless. Sharp to 21704.	Head-Gravel	0.62-1.30	34.70-34.09	121, 122, 123
21704	Moderately firm reddish brown to yellowish brown slightly gravelly sand and sandy gravel. 50:50 gravel-sand ratio. Sub-horizontal bedding 20-40cm thick. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular (65%) to subrounded (35%) flint. Low to moderately low sphericity. Moderately well sorted. Matrix supported. Structureless.	Ardleigh Gravel	1.30-2.90	34.09-32.49	123, 124, 125, 126, 127

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 218
Coordinates (NGR) X: 608010.58	Coordinates (NGR) Y: 228634.26	Level (top): 34.98m OD
Length: 5.67m	Width: 2.37m	Depth: 2.40

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
21801	Moderately firm slightly gravelly silty clay. Gravel is medium to coarse subrounded to subangular flint. Rooting present. From 0.24m bgl very firm. Structureless. Sharp to 21802.	Topsoil	0.00-0.36	34.98-34.62	
21802	Moderately firm yellowish grey to reddish grey clayey sandy silt. Sand is fine. Some black mottling. Pocket of clayey gravelly sandy silt from 0.36-0.56m bgl but not horizontally continuous. Sharp but undulating contact to 21803 between 0.55 to 0.70m bgl.	Head-Brickearth	0.36-0.70	34.62-34.15	
21803	Moderately firm reddish brown to light grey clayey sandy gravel. Sand is medium to coarse. Gravel is fine to medium (predominantly medium), subangular (60%), subrounded (35%) to rounded (5%) flint. Low sphericity. Moderately well sorted. Matrix supported. Structureless. Sharp to 21804.	Head-Gravel	0.55-0.95	34.15-34.03	
21804	Moderately firm bedded yellowish brown to reddish brown slightly gravelly, slightly clayey sands and slightly clayey sandy gravels. 35:65 gravel-sand ratio. Sub-horizontally bedded. Sand is coarse. Gravel is fine to coarse (predominantly medium) subrounded (55%) to subangular (45%) flint. Low sphericity. Moderately well sorted. Matrix supported. Sharp to 21805	Ardleigh Gravel	0.95-2.20	34.03-32.78	69, 70, 71, 72, 73
21805	Moderately firm yellowish brown silty sandy gravel. Gravel is fine to coarse, subangular (60%), subrounded (35%) to rounded (5%) flint. Low to moderately low sphericity. Moderately poorly sorted. Clast supported.	Ardleigh Gravel	2.20-2.40	32.78-32.58	74

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 219
Coordinates (NGR) X: 607951.74	Coordinates (NGR) Y: 228941.17	Level (top): 35.66m OD
Length: 5.88m	Width: 2.29m	Depth: 3.00m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
21901	Moderately firm greyish brown slightly gravelly silty clay. Gravel is medium to coarse subangular flint. Rooting present. Structureless. Sharp to 21902.	Topsoil	0.00-0.32	35.66-35.34	
21902	Moderately firm yellowish brown to reddish brown slightly gravelly sandy clayey silt. Sand is fine. Gravel is fine to medium subangular flint. Structureless. Increases in sand content with depth. Sharp to 21903.	Head-Brickearth	0.32-0.61	35.34-35.05	51
21903	Firm reddish brown clayey gravelly sand. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular to subrounded flint (90%) and sandstone (10%). From 0.88-1.20m bgl is slightly gravelly clayey sand. Sharp to 21904.	Head-Gravel	0.61-1.25	35.05-34.41	52, 53, 54
21904	Yellowish brown to reddish brown slightly clayey sandy gravel to slightly clayey sands. 60:40 gravel-sand ratio). Sub-horizontally bedded. Sand is coarse. Gravel is fine to coarse (predominantly medium/coarse), subangular (50%), subrounded (45%) to rounded (5%) flint. Low to moderately low sphericity. Moderately well sorted. Matrix supported. Sharp to 21905	Ardleigh Gravel	1.25-1.80	34.41-33.86	55, 56
21905	Yellowish brown to reddish brown sandy gravels to sand. 55:45 gravel-sand ratio. Sub-horizontally bedded. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (65%) to subrounded (35%) flint (95%) and sandstone (5%). Low to moderately low sphericity. Moderately well sorted. Matrix supported. Structureless.	Ardleigh Gravel	1.80-3.00	33.86-32.66	57, 58, 59, 60

Site Code: 286890	**Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting**	**Test pit ID: 220**
Coordinates (NGR) X: 607892.01	**Coordinates (NGR) Y:** 229026.77	**Level (top):** 35.47m OD
Length: 5.23m	**Width: 2.44m**	**Depth: 2.60m**

Context Number	**Description**	**Interpretation**	**Depth m bgl**	**Depth m OD**	**Samples**
22001	Firm greyish brown slightly gravelly silty clay. Gravel is medium subangular to subrounded flint. Some rooting present. Structureless. Sharp to 22202.	Topsoil	0.00-0.40	35.47-35.07	
22002	Moderately firm light yellowish grey slightly sandy silt. Sand is fine. Occasional black mottling. Some fine rooting. Structureless. Sharp but undulating boundary to 22003 between 0.47 and 0.66m bgl.	Head-Brickearth	0.40-0.66	35.07-34.90	41
22003	Moderately firm reddish to orangish brown silty sandy gravels. Sand is coarse. Gravel is fine to coarse (predominantly medium) rounded (10%), subrounded (50%) to subangular (40%) flint. Low to moderately low sphericity. Moderately well sorted. Matrix supported. Structureless.	Head-Gravel	0.47-0.95	34.90-34.52	41, 42
22004	Moderately firm reddish brown to yellowish brown sandy gravels to sands. Bedding sub-horizontal. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (40%), subrounded (50%) to rounded (10%) flint. Low to moderately low sphericity. Moderately well sorted. Matrix supported. Structureless. Light grey clayey sand at 1.70-2.00m bgl on western edge of test pit, in vertical (c.30cm wide) column.	Ardleigh Gravel	0.95-2.60	34.52-32.87	43, 44, 45, 46, 47, 48, 49, 50

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 221
Coordinates (NGR) X: 607889.27	Coordinates (NGR) Y: 228847.14	Level (top): 35.34m OD
Length: 6.82m	Width: 2.39m	Depth: 2.90m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22101	Moderately firm to firm greyish brown slightly gravelly slightly sandy clayey silt. Sand is fine. Gravel is fine to medium subangular flint and subrounded brick material. Rooting abundant. Structureless. Sharp to 22102.	Topsoil	0.00-0.35	35.34-34.99	
22102	Moderately firm yellowish brown to reddish brown slightly sandy silty clay. Sand is fine. Structureless. Some rooting. Sharp to 22103.	Head-Brickearth	0.35-0.58	34.99-34.76	
22103	Moderately firm clayey gravelly sand. Sand is coarse. Gravel is fine to medium, subangular to rounded flint with moderately low to moderately high sphericity. Structureless. Sharp but undulating boundary to 22104 between 0.92 and 1.02m bgl.	Head-Gravel	0.58-1.02	34.76-34.42	135, 136
22104	Moderately loose reddish brown to yellowish brown slightly gravelly sands to sandy gravels. Sub-horizontal bedding, 60:40 gravel-sand ratio. Initial sand unit 50cm thick then beds of 20-30cm thick sands and gravels. Sand is coarse. Gravel is fine to coarse (predominantly medium) angular (5%), subangular (50%), subrounded (40%) to rounded (5%) flint. Low to moderately low sphericity. Moderately well sorted. Matrix supported. Sharp to 22105.	Ardleigh Gravel	0.92-2.30	34.42-33.04	136, 137, 138, 139, 140, 141
22105	Moderately firm pale yellowish brown sandy gravel. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular (20%) to subrounded (80%) flint. Moderately low to moderately high sphericity. Clast supported.	Ardleigh Gravel	2.30-2.90	33.04-32.44	142, 143

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 222
Coordinates (NGR) X: 607899.43	Coordinates (NGR) Y: 228727.00	Level (top): 35.09m OD
Length: 5.41m	Width: 2.32m	Depth: 2.40

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22201	Moderately firm brownish grey slightly gravelly silty clay. Gravel is medium subrounded to subangular flint. Rooting present. Structureless. Very firm 0.18-0.30m bgl. Sharp to 22202.	Topsoil	0.00-0.30	35.09-34.79	
22202	Moderately firm yellowish brown sandy silt. Sand is fine. Red mottling, associated with iron inclusions, present. Structureless. Sharp but undulating boundary to 22203 between 0.44 and 0.56m bgl.	Head-Brickearth	0.30-0.56	34.79-34.59	
22203	Moderately firm reddish brown slightly gravelly sand. Sand is medium to coarse. Gravel is fine to medium subrounded to subangular flint. Structureless. Some black mottling associated with iron. Sharp to 22204.	Head-Brickearth	0.44-0.84	34.59-34.25	75
22204	Moderately firm light grey to reddish brown clayey gravelly sands. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular to subrounded flint. Low sphericity. Poorly sorted. Frequent medium to coarse iron nodules between 1.00-1.10m bgl. Structureless. Sharp to 22205.	Head-Gravel	0.84-1.30	34.25-33.79	76, 81
22205	Bedded moderately firm reddish brown to yellowish brown slightly gravelly sands and very sandy gravels. 20:80 gravel-sand ratio. Sub-horizontal bedding. Sand is coarse. Gravel is fine to medium (predominantly medium) subangular (60%), subrounded (30%) to rounded (10%) flint. Low to moderately low sphericity. Moderately well sorted. Matrix supported. Structureless.	Ardleigh Gravel	1.30-2.40	33.79-32.69	77, 78, 79, 80

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 223
Coordinates (NGR) X: 607879.45	Coordinates (NGR) Y: 228641.44	Level (top): 35.03m OD
Length: 6.70m	Width: 2.47m	Depth: 2.50m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22301	Light grey slightly gravelly slightly sandy silt. Gravel is fine to medium (2-15mm) subrounded flint clasts. Occasional manganese flecks. Sharp slightly undulating lower boundary to 22302.	Topsoil	0.00-0.35	35.03-34.68	
22302	Dark brownish grey mottled orangish brown slightly gravelly slightly silty sand. Sand is fine. Gravel is few (<15%) fine to coarse (2-20mm) subrounded (80%) to subangular (20%) flint clasts. Structureless. Sharp undulating boundary to 22303.	Head-Brickearth	0.35-0.55	34.68-34.48	
22303	Light grey mottled dark orangish brown clayey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse (2-27mm) subangular to subrounded flint. Frequent coarse pockets of manganese flecks. Thick bed of black manganese flecks at lower boundary. Sharp lower boundary.	Head-Gravel	0.55-0.94	34.48-34.09	151
22304	Mid-orangish brown very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse (2-32mm) subrounded (30%) to subangular (70%) flint. Sharp slightly undulating boundary to 22305	Ardleigh Gravel	0.94-1.50	34.09-33.53	152, 153
22305	Light orangish brown slightly gravelly silty sand. Sand is fine to medium. Gravel is fine to medium (2-12mm) subrounded (40%) to subangular (60%) flint. Well sorted. Structureless. Sharp to 22306	Ardleigh Gravel	1.50-1.90	33.53-33.13	154
22306	Dark orangish brown sandy gravel. Sand is fine to coarse. Gravel is fine to coarse (2-36mm) with common cobble-sized (<80mm) subrounded 30%) to subangular (70%) flint. Occasional nodular clasts. Sub-horizontal bedding.	Ardleigh Gravel	1.90-2.50	33.13-32.53	155, 156, 157

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 224
Coordinates (NGR) X: 607801.94	Coordinates (NGR) Y: 228914.31	Level (top): 35.40m OD
Length: 6.84m	Width: 2.39m	Depth: 2.70m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22401	Moderately firm to firm greyish brown slightly gravelly slightly sandy silt. Sand is fine. Gravel is fine to medium subrounded to subangular flint and brick material. Rooting abundant. Structureless. Sharp to 22402.	Topsoil	0.00-0.35	35.40-35.05	
22402	Moderately firm yellowish brown slightly clayey sandy silt. Sand is fine. Some fine iron nodules. Structureless. Sharp but undulating boundary to 22403 between 0.55 and 0.60m bgl.	Head-Brickearth	0.35-0.60	35.05-34.82	
22403	Moderately firm reddish brown to light grey clayey sandy gravel. Sand is coarse. Gravel is fine to medium (predominantly medium) subangular (60%) to subrounded (40%) flint. Moderately low sphericity. Moderately well sorted. Matrix supported. Structureless. Sharp but undulating contact to 22404 between 0.70 and 1.02m bgl.	Head-Gravel	0.55-1.02	34.82-34.54	128, 129
22404	Moderately loose bedded yellowish brown to greyish brown slightly gravelly sands to sandy gravels. 50:50 ratio of gravels-sands. Sub-horizontally bedded, with units between 15-20cm (gravels) and 30-40cm (sands). Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (70%) to subrounded (30%) flint. Moderately low sphericity. Moderately well sorted. Matrix supported.	Ardleigh Gravel	0.70-2.70	34.54-32.70	129, 130, 131, 132, 133, 134

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 225
Coordinates (NGR) X: 607791.28	Coordinates (NGR) Y: 228789.73	Level (top): 35.34m OD
Length: 5.70m	Width: 2.56m	Depth: 2.90

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22501	Firm greyish brown slightly gravelly silty clay. Gravel is medium subangular flint. Rooting present. Structureless. Sharp to 22502.	Topsoil	0.00-0.45	35.34-34.89	
22502	Moderately firm yellowish brown to reddish brown sandy silt. Sand is fine. Some reddish mottling. Some rooting. Structureless. Sharp but undulating boundary to 22503 between 0.55 to 0.65m bgl.	Head-Brickearth	0.45-0.65	34.89-34.74	
22503	Moderately firm grey to reddish brown clayey gravelly sand. Sand is medium. Gravel is fine to coarse (predominantly medium) subangular (60%), subrounded (35%) to rounded (5%) flint. Low sphericity. Moderately poorly sorted. Matrix supported. Reddish and black mottling associated with iron nodules. Structureless. Sharp to 22504,	Head-Gravel	0.55-1.30	34.74-34.04	82, 83, 84
22504	Moderately firm reddish brown to yellowish brown sandy gravels to slightly gravelly sands. 20:80 gravel-sand ratio. Sub-horizontal bedding of 20-40cm thick units. Sand is coarse. Gravel is fine to coarse (predominantly medium-coarse) subangular (60%) to subrounded (40%) flint. Low sphericity. Moderately well sorted. Sharp to 22505	Ardleigh Gravel	1.30-2.75	34.04-32.59	85, 86, 87, 88, 89
22505	Slightly firm reddish to yellowish brown to grey sandy clayey silt. Sand is fine. Some iron staining and rare fine iron nodules. Structureless except banding associated with iron staining,	Ardleigh Gravel	2.75-2.90	32.59-32.44	91, 92, 93

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 226
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top):

607760.41	228717.07	35.38m OD
Length: 7.16m	**Width: 2.49m**	**Depth:**

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22601	Moderately firm grey-brown slightly gravelly clayey silt. Gravel is medium subrounded to rounded flint. Structureless. Rooting common. Sharp to 22602.	Topsoil	0.00-0.36	35.38-35.02	
22602	Moderately firm yellowish brown to reddish brown slightly gravelly slightly sandy silt. Sand is fine. Gravel is fine to medium subangular to subrounded flint. Some black mottling. Structureless. Sharp to 22603.	Head-Brickearth	0.36-0.62	35.02-34.76	
22603	Mid orangish brown mottled light grey clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse (2.-26mm) subangular (80%) to subrounded (20%) flint. Common bioturbation in upper boundary. Poorly sorted. Structureless. Sharp to 22604.	Head-Gravel	0.62-1.00	34.76-34.38	144, 145
22604	Dark orangish brown mottled bluish grey very sandy gravel with thick beds of fine to coarse sands. Sand is fine to coarse. Gravel is fine to coarse (2-34mm) subrounded (40%) to subangular (60%) with rare rounded clasts. Sub-horizontal bedding. Unclear lower boundary to 22605	Ardleigh Gravel	1.00-2.30	34.38-33.08	146, 147, 148
22605	Dark orangish brown sandy gravel. Sand is fine to coarse. Gravel is fine to coarse (2-40mm) with common cobble-sized subangular (50%) to subrounded (50%) flint. Sub-horizontally. Poorly sorted.	Ardleigh Gravel	2.30-2.90	33.08-32.48	149, 150

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 228
Coordinates (NGR) X: 608609.06	Coordinates (NGR) Y: 228838.91	Level (top): 35.24m OD
Length: 5.89m	Width: 2.29m	Depth: 2.50m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22801	Moderately firm light grey slightly gravelly silty clay. Gravel is fine to medium subrounded to subangular flint. Rooting present. Structureless. Sharp to 22802.	Topsoil	0.00-0.34	35.24-34.90	
22802	Slightly firm light grey clayey silt. Gradual to 22803.	Head-Brickearth	0.34-0.57	34.90-34.67	
22803	Moderately firm clayey gravelly sand. Sand is medium to coarse. Gravel is fine to medium subangular flint. Black mottling 0.60-0.70m bgl. Structureless. Sharp to 22804	Soliflucted sands and gravels	0.57-1.16	34.67-34.08	31, 32, 33
22804	Moderately firm light grey clayey sandy gravels. Sand is medium to coarse. Gravel is fine to coarse (predominantly medium) subangular to subrounded flint. Structureless. Sharp to 22805.	Soliflucted sands and gravels	1.16-1.65	34.08-33.59	34, 35, 36
22805	Yellowish brown gravelly sands. Sand is coarse. Gravel is fine to coarse subrounded to subangular flint. Structureless. Sharp to 22805.	Ardleigh Gravel	1.65-2.00	33.59-33.24	36, 37
22806	Yellowish brown sandy gravel. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subrounded to subangular flint. Structureless.	Ardleigh Gravel	2.00-2.50	33.24-32.74	38. 39, 40

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 229
Coordinates (NGR) X: 608431.59	Coordinates (NGR) Y: 228774.30	Level (top): 35.17m OD
Length: 5.41m	Width: 2.32m	Depth: 3.00m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
22901	Moderately firm greyish brown slightly gravelly silty clay. Gravel is fine to medium subangular to subrounded flint. Rooting present. Structureless. Sharp to 22902.	Topsoil	0.00-0.33	35.17-34.84	
22902	Slightly firm yellowish brown sandy clayey silt. Sand is fine. Some black mottling. Structureless. Sharp but undulating contact to 22903 between 0.44 and 0.67m bgl.	Head-Brickearth	0.33-0.67	34.84-34.61	
22903	Moderately firm reddish brown slightly clayey sandy gravel. Sand is medium. Gravel is fine to coarse subangular to subrounded flint (90%) and sandstone (10%). Occasional lenses of grey brown clayey sandy gravel. Gradual to 22904	Head-Gravel	0.44-0.90	34.61-34.27	20, 21
22904	Moderately firm reddish brown slightly silty sandy gravel to reddish brown sand. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular to subrounded flint (90%) and sandstone (10%). Sharp to 22905.	Ardleigh Gravel	0.90-2.35	34.27-32.82	21, 22, 23, 24, 25, 26, 27, 28
22905	Light greyish brown gravelly clayey sand. Sand is coarse. Gravel is fine to coarse subangular to subrounded flint (90%) and sandstone (10%). Structureless. Sharp to 22906	Ardleigh Gravel	2.35-2.50	32.82-32.67	28, 29
22906	Greyish brown sandy gravel. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular to subrounded flint (90%) and sandstone (10%). Structureless.	Ardleigh Gravel	2.50-3.00	32.67-32.17	29, 30

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 230
Coordinates (NGR) X: 608293.98	Coordinates (NGR) Y: 228715.42	Level (top): 34.87m OD
Length: 4.78m	Width: 2.48m	Depth: 2.30

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
23001	Moderately firm slightly gravelly silty clay. Gravel is fine to medium subangular flint. Rooting present. Structureless. Sharp to 23002.	Topsoil	0.00-0.27	34.87-34.60	
23002	Moderately firm greyish brown slightly sandy clayey silt. Sand is fine. Structureless. Sharp to 23003.	Head-Brickearth	0.27-0.45	34.60-34.42	
23003	Light greyish brown slightly gravelly silty sand. Sand is medium. Gravel is fine to medium subrounded flint. Reddish and brown mottling. Structureless. Sharp to 23004.	Head-Gravel	0.45-0.60	34.42-34.27	11
23004	Orangish brown to mid-brown slightly clayey sandy gravel. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular to subrounded flint (90%) and sandstone (10%). Some iron nodules. Lens of light whitish grey coarse sand 0.80-0.84m bgl. Sharp to 23005	Head-Gravel	0.60-1.05	34.27-33.82	11, 12, 13
23005	Greyish white to yellowish brown sand. Sand is coarse. Some iron nodules. Structureless. Sharp to 23006	Ardleigh Gravel	1.05-1.15	33.82-33.72	
23006	Reddish brown sandy gravels to sands. Sub-horizontally bedded. Sand is coarse. Gravel is fine to coarse (predominantly coarse) subangular to subrounded flint (85%) and sandstone (15%). Structureless.	Ardleigh Gravel	1.15-2.30	33.72-32.57	14, 15, 16, 17, 18, 19

Site Code: 286890	Site Name: Five Estuaries OSWF, Substation – Phase 2 test pitting	Test pit ID: 231
Coordinates (NGR) X: 608192.53	Coordinates (NGR) Y: 228622.03	Level (top): 34.99m OD
Length: 4.72m	Width: 2.35m	Depth: 2.40

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
23101	Moderately firm light grey slightly sandy silty clay. Sand is fine. Rooting present. Structureless. Sharp to 23102.	Topsoil	0.00-0.36	34.99-34.63	
23102	Moderately firm pale yellowish brown slightly gravelly silty sand. Sand is medium to coarse. Gravel is fine to medium subrounded flint. Occasional iron nodules. Structureless. Sharp to 23103	Head-Brickearth	0.36-0.55	34.63-34.44	
23103	Moderately firm slightly clayey sandy gravel. Sand is medium to coarse. Gravel is fine to coarse subrounded to subangular flint (predominantly medium subrounded). Some iron nodules. Rooting rare. Sharp to 23104.	Head-Gravel	0.55-0.95	34.44-34.04	1, 2
23104	Very firm reddish orange sandy gravel. Sand is coarse. Gravel is fine to coarse (predominantly medium) subangular (60%) to subrounded (40%) flint. Iron-like matrix.	Head-Gravel	0.95-1.10	34.04-33.89	3
23105	Yellow slightly gravelly slightly clayey sands. Sand is coarse. Gravel is fine subrounded to subangular flint. Structureless. Sharp to 23106	Ardleigh Gravel	1.10-1.45	33.89-33.54	4, 5
23106	Moderately firm yellowish brown sandy gravel. Sand is coarse. Gravel is fine to coarse subrounded (70%) to subangular (30%) flint (90%), mudstone (<5%) and quartz (<5%). Becomes coarser with depth. Lens of structureless sand at 1.90-2.10m bgl.	Ardleigh Gravel	1.45-2.40	33.54-32.59	6, 7, 8, 9, 10

Appendix 2 OASIS form

OASIS Summary for wessexar1-517235

OASIS ID (UID)	wessexar1-517235
Project Name	Evaluation at Five Estuaries OSWF & North Falls OSWF Onshore Substation Area
Sitename	Five Estuaries OSWF & North Falls OSWF Onshore Substation Area
Sitecode	LAWGR23
Project Identifier(s)	231916, 286890
Activity type	Evaluation
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Wessex Archaeology
Project Dates	15-May-2023 - 18-Oct-2023
Location	Five Estuaries OSWF & North Falls OSWF Onshore Substation Area NGR : TM 08639 29215 LL : 51.92234629854591, 1.032739973504795 12 Fig : 608639,229215
Administrative Areas	Country : England County/Local Authority : Essex Local Authority District : Tendring Parish : Lawford
Project Methodology	Wessex Archaeology was commissioned by Five Estuaries Offshore Wind Farm Ltd and North Falls Offshore Wind Farm Ltd to undertake a Palaeolithic geoarchaeological evaluation through a programme of test pitting at the proposed location for an onshore substation for the wind farm projects. The Site is located north of Little Bromley Road, Little Bromley, Tendering, Essex and is centred on NGR 608143, 228898 (TM 08639 29215). A staged approach has been taken to determining the Palaeolithic geoarchaeological potential of the Site. A Geoarchaeological Desk-based Assessment (GDBA) for the onshore cable route of the wind farm projects (Wessex Archaeology 2022) included the Site. An initial phase of evaluation (11 machine-dug test pits) was carried out in the north of the Site (231916). This this was followed by a second phase of evaluation (19 test pits) of the south-west and south of the Site (286890).

Project Results	The combined phases of evaluation have characterised the Quaternary deposits in the Site and mapped their lateral and horizontal extent. This has enabled the provision of Geoarchaeological Landscape Characterisation (GLC) that divides the Site into two Palaeolithic Geoarchaeological Character Zones (GCZs). The geoarchaeological potential of deposits in each GCZ has been assessed. The evaluation has demonstrated that the earliest Pleistocene deposit in the site belong to the Ardleigh Gravel of the Kesgrave Sands and Gravels (MIS 16-14; 676-524 Kya), of the River Thames. These occurred across the Site (both GCZ 1 and GCZ 2). The upper c.3.0 m of these deposits has been evaluated, which typically comprised of high energy fluvial deposits, likely deposited in a braided river. These deposits were extensively sampled for artefacts. No archaeology was recovered. The palaeoenvironmental potential of these deposits was assessed as generally, low, with the exception finer-grained silts were locally present in GCZ 2. These have greater potential and samples suitable for palaeoenvironmental assessment were taken. Across both GCZ 1 and 2, the Ardleigh Gravel was overlain by Pleistocene slope deposits comprising Head-Gravel and Head-Brickearth. The archaeological and palaeoenvironmental potential of these sediments has been assessed as generally low. In GCZ 2 a gully incised into the top of the Ardleigh Gravel was infilled with a basal Sand and overlying Head-Gravel. Although no archaeology was recovered from these deposits, they have not previously been identified in the area, are poorly understood and are undated. This raises some uncertainties regarding their Palaeolithic geoarchaeological potential and their significance as a geoarchaeological resource. The combined Phase 1 and 2 evaluation of the Site has well characterised much of the Palaeolithic geoarchaeological resource present and demonstrated generally low potential for significant Palaeolithic geoarchaeological evidence. The evaluation has delimited selected Pleistocene deposits in the Site where data is insufficient to fully characterise the Palaeolithic geoarchaeological resource and, dependent on detailed development proposals. further investigations may be required as part of geoarchaeological mitigation and/or the production of a management strategy. These are: Ardleigh Gravel, and any underlying deposits, beneath 3.20m bgl in GCZ 1 and GCZ 2; Localised fine-grained deposits in Ardleigh gravel < 3.20m bgl in GCZ 2, and Deposits, particularly Sands, infilling gully in GCZ 1 Recommendations for further Palaoelithic geoarchaeological work that may be required are provided. These include recommendations for palaeoenvironmental assessment of the localised fine-grained deposits within the Ardleigh Gravel sampled during Phase 2 of the evaluation.
Keywords	
Funder	Private or public corporation Five Estuaries Offshore Wind Farm
HER	Essex HER - unRev - STANDARD
Person Responsible for work	Nina Olofsson, Daniel Young
HER Identifiers	HER Event No - LAWGR23
Archives	Physical Archive, Documentary Archive, Digital Archive - to be deposited with Colchester & Ipswich Museum Sevice (Colchester Collection); Digital Archive - to be deposited with Archaeology Data Service Archive;

Report generated on: 05 Dec 2023, 09:25

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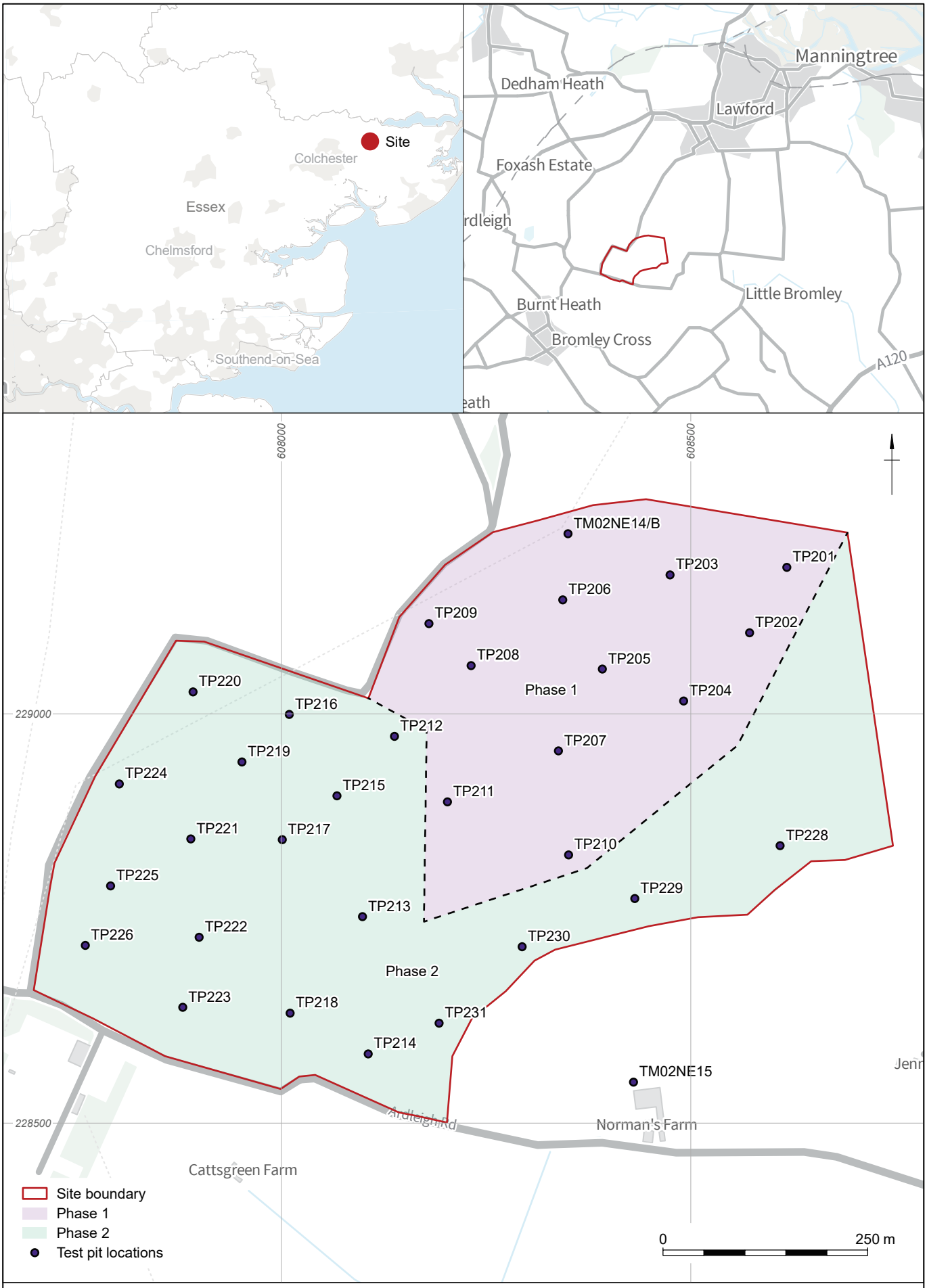
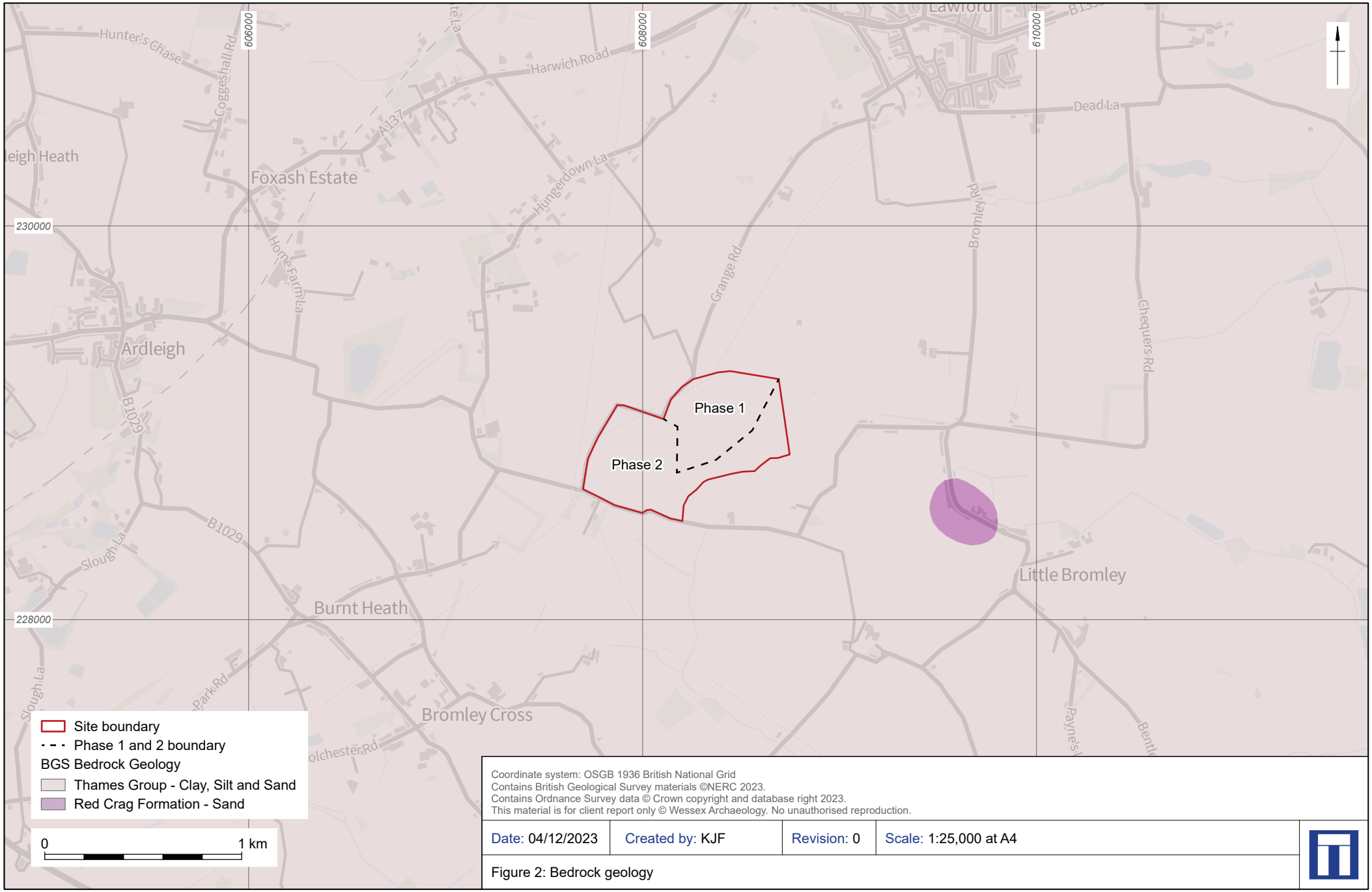


Coordinate system: OSGB 1936 British National Grid

Date: 28/11/2023	Created by: KJF	Revision: 0	Scale: 1:6,250 at A4

Figure 1: Site location and phases of evaluation



Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:25,000 at A4

Figure 2: Bedrock geology

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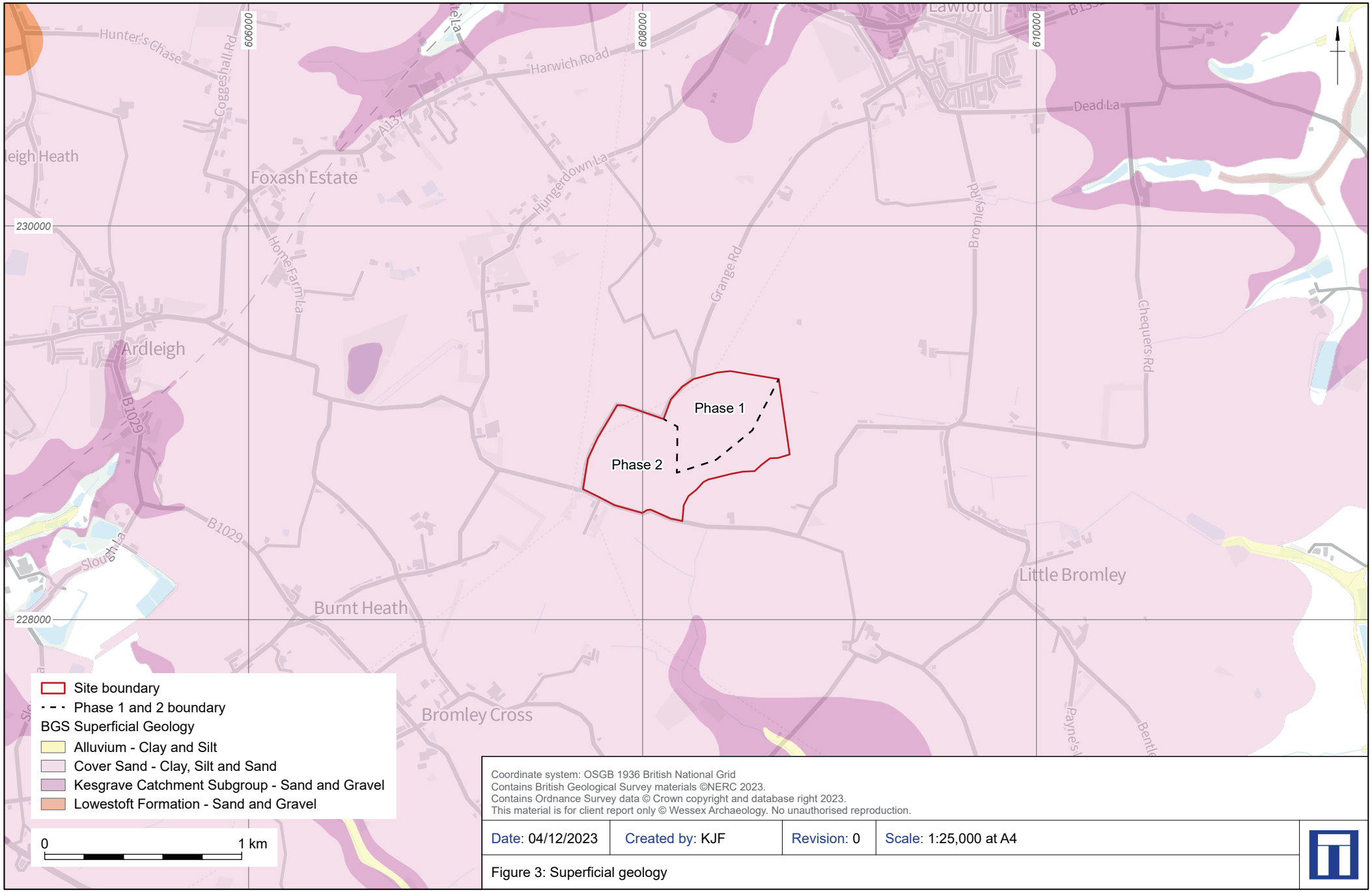

Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:25,000 at A4

Figure 3: Superficial geology

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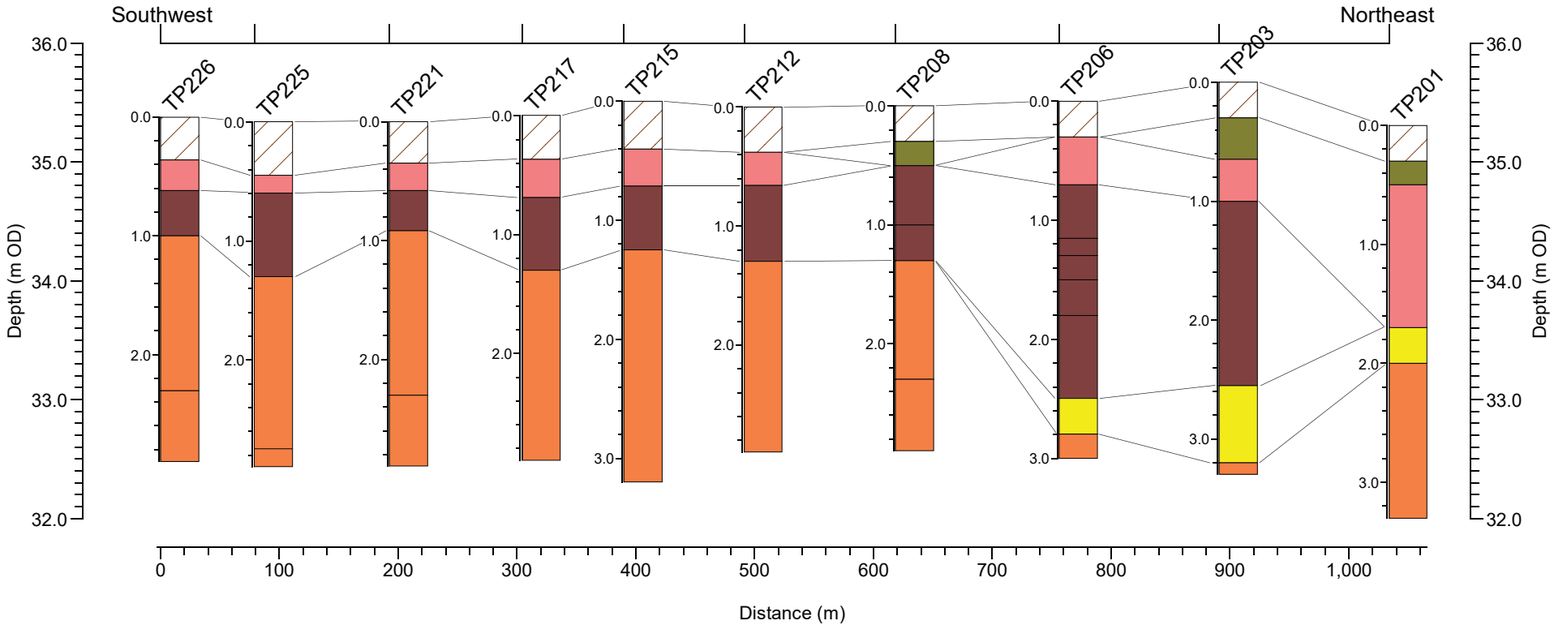
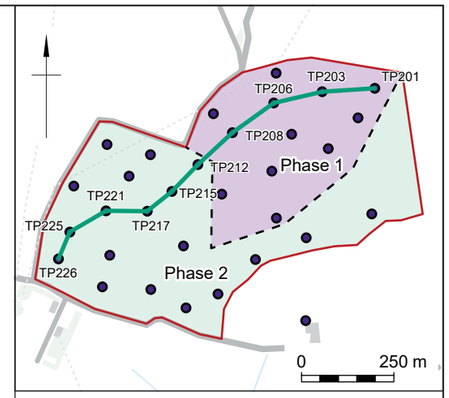


Stratigraphy

- Topsoil
- Colluvium
- Head-Brickearth
- Head-Gravel
- Sands
- Ardleigh Gravel
- Bedrock
- Void



- Site boundary
- Phase 1
- Phase 2
- Test pit locations
- Transect 1

Coordinate system: OSGB 1936 British National Grid

Created by: KJF	Date: 28/11/2023	
Scale: NTS at A3	Revision: 0	

Figure 4: Transect 1

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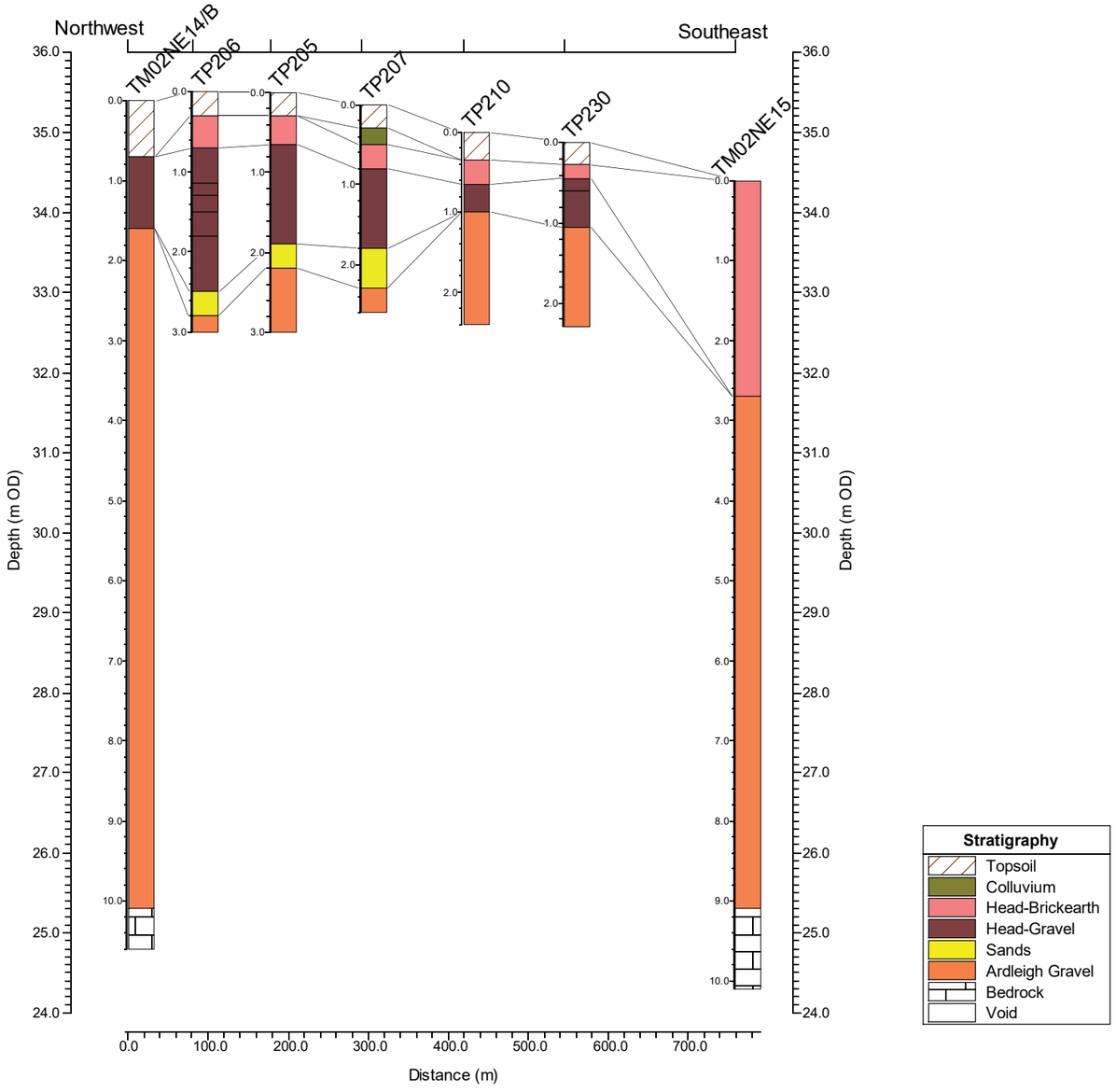
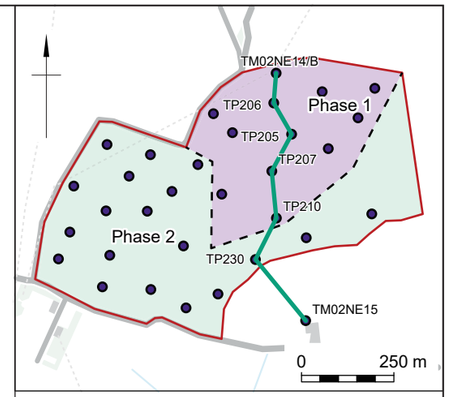


Stratigraphy

- Topsoil
- Colluvium
- Head-Brickearth
- Head-Gravel
- Sands
- Ardleigh Gravel
- Bedrock
- Void



- Site boundary
- Phase 1
- Phase 2
- Test pit locations
- Transect 2

Coordinate system: OSGB 1936 British National Grid

Created by: KJF	Date: 28/11/2023
Scale: NTS at A3	Revision: 0

Figure 5: Transect 2

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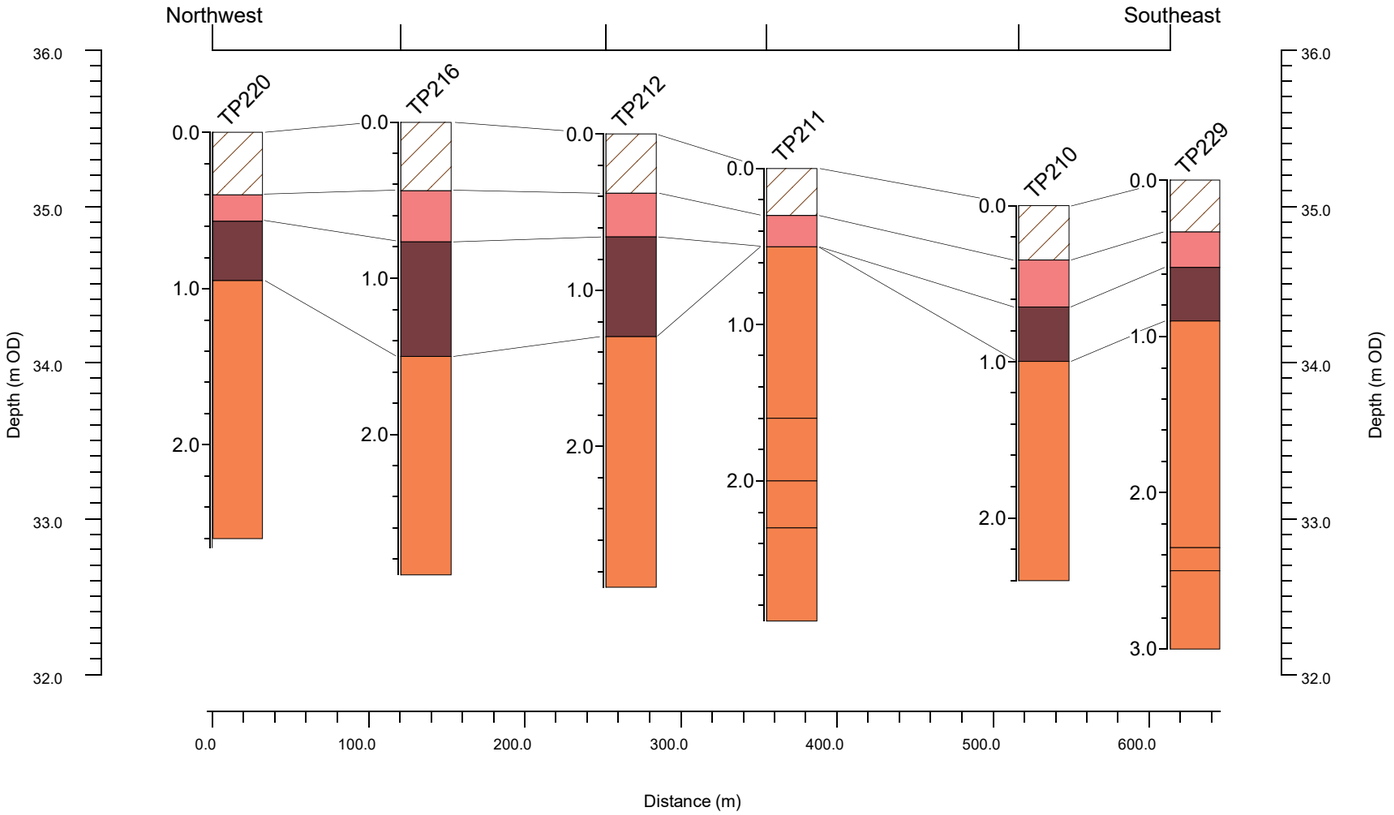
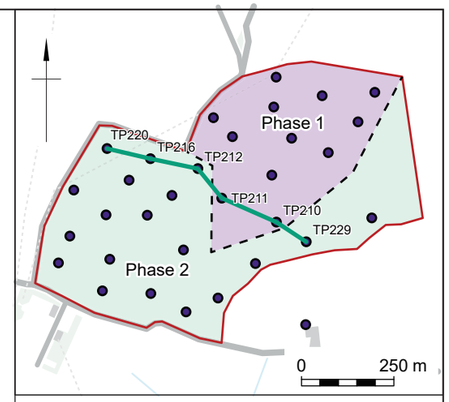


Stratigraphy

- Topsoil
- Colluvium
- Head-Brickearth
- Head-Gravel
- Sands
- Ardleigh Gravel
- Bedrock
- Void



- Site boundary
- Phase 1
- Phase 2
- Test pit locations
- Transect 3

Coordinate system: OSGB 1936 British National Grid

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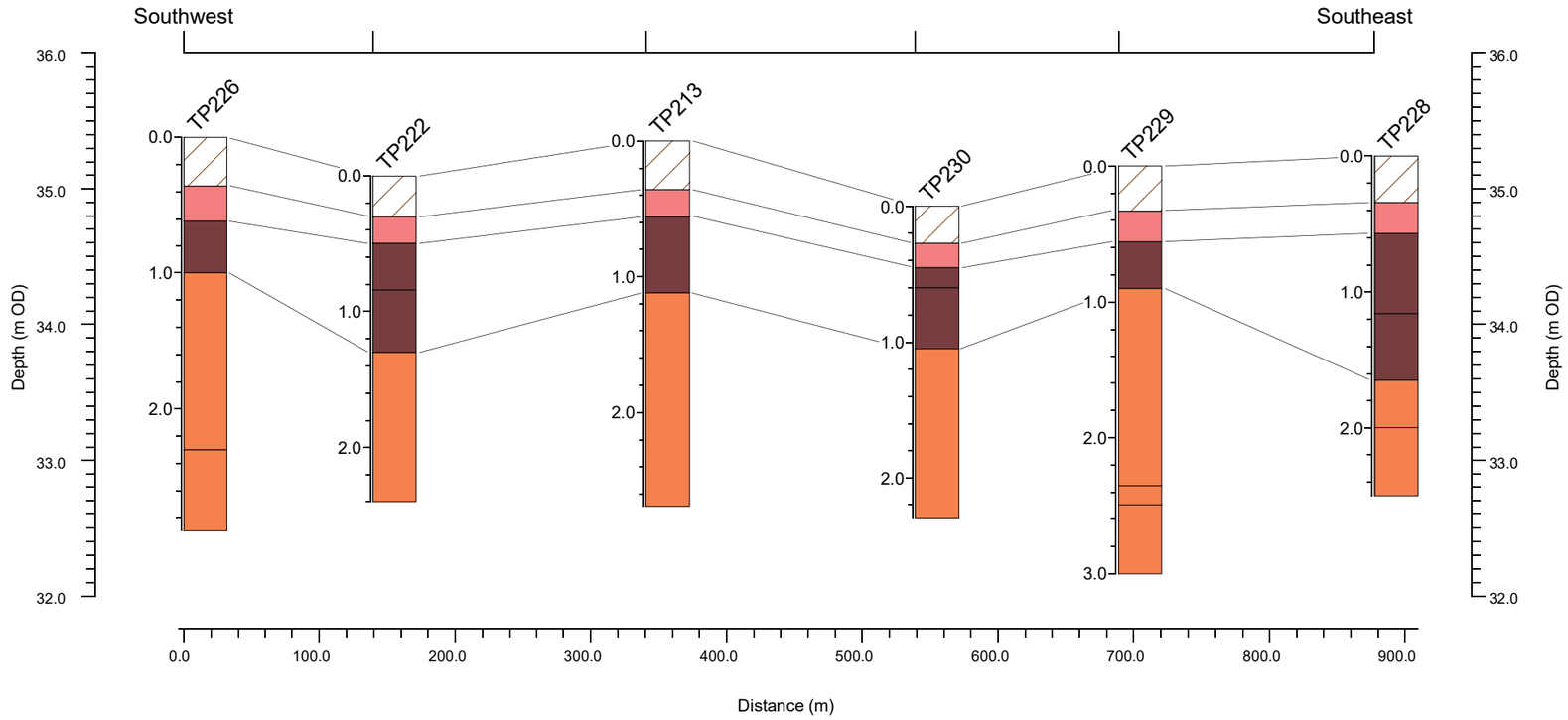
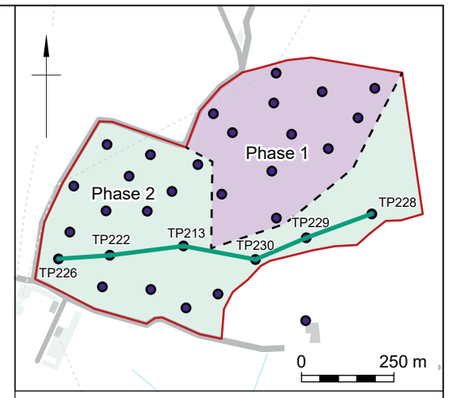
Scale: NTS at A3	Revision: 0	

Figure 6: Transect 3





Site boundary
Phase 1
Phase 2
Test pit locations
Transect 4

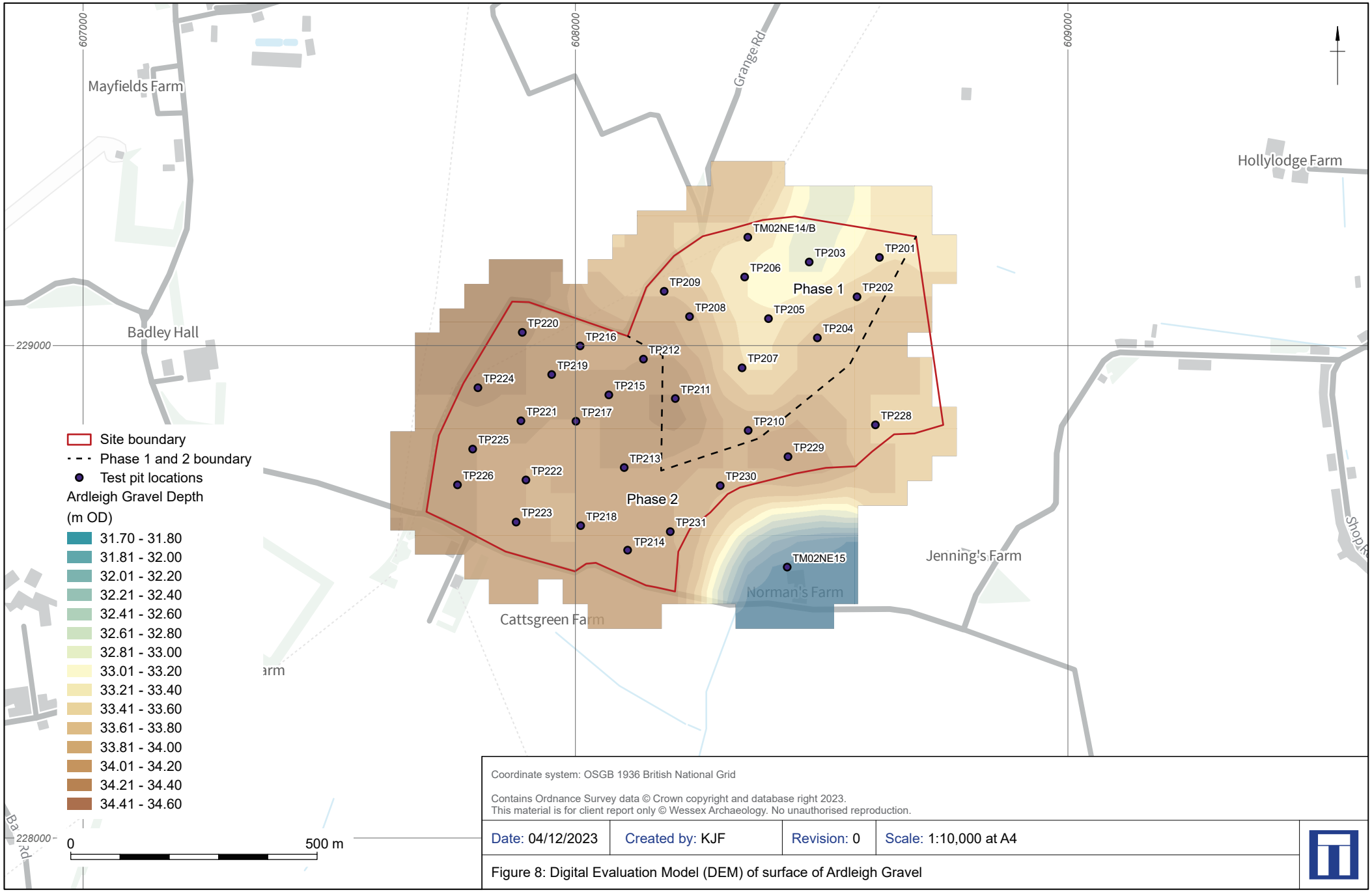
Stratigraphy

- Topsoil
- Colluvium
- Head-Brickearth
- Head-Gravel
- Sands
- Ardleigh Gravel
- Bedrock
- Void

Coordinate system: OSGB 1936 British National Grid

Created by: KJF	Date: 28/11/2023	
Scale: NTS at A3	Revision: 0	

Figure 7: Transect 4



Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:10,000 at A4

Figure 8: Digital Evaluation Model (DEM) of surface of Ardleigh Gravel

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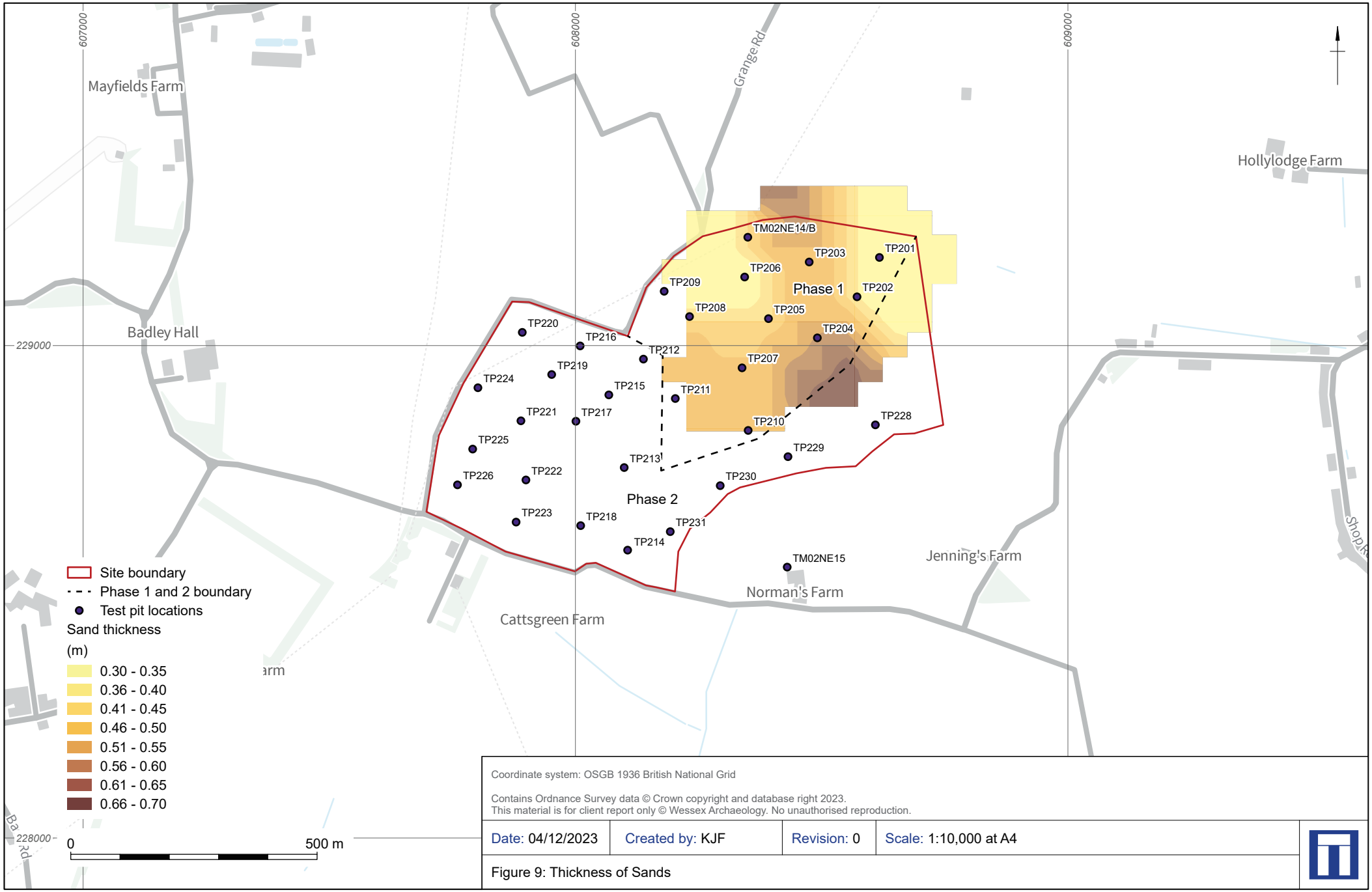

Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:10,000 at A4

Figure 9: Thickness of Sands

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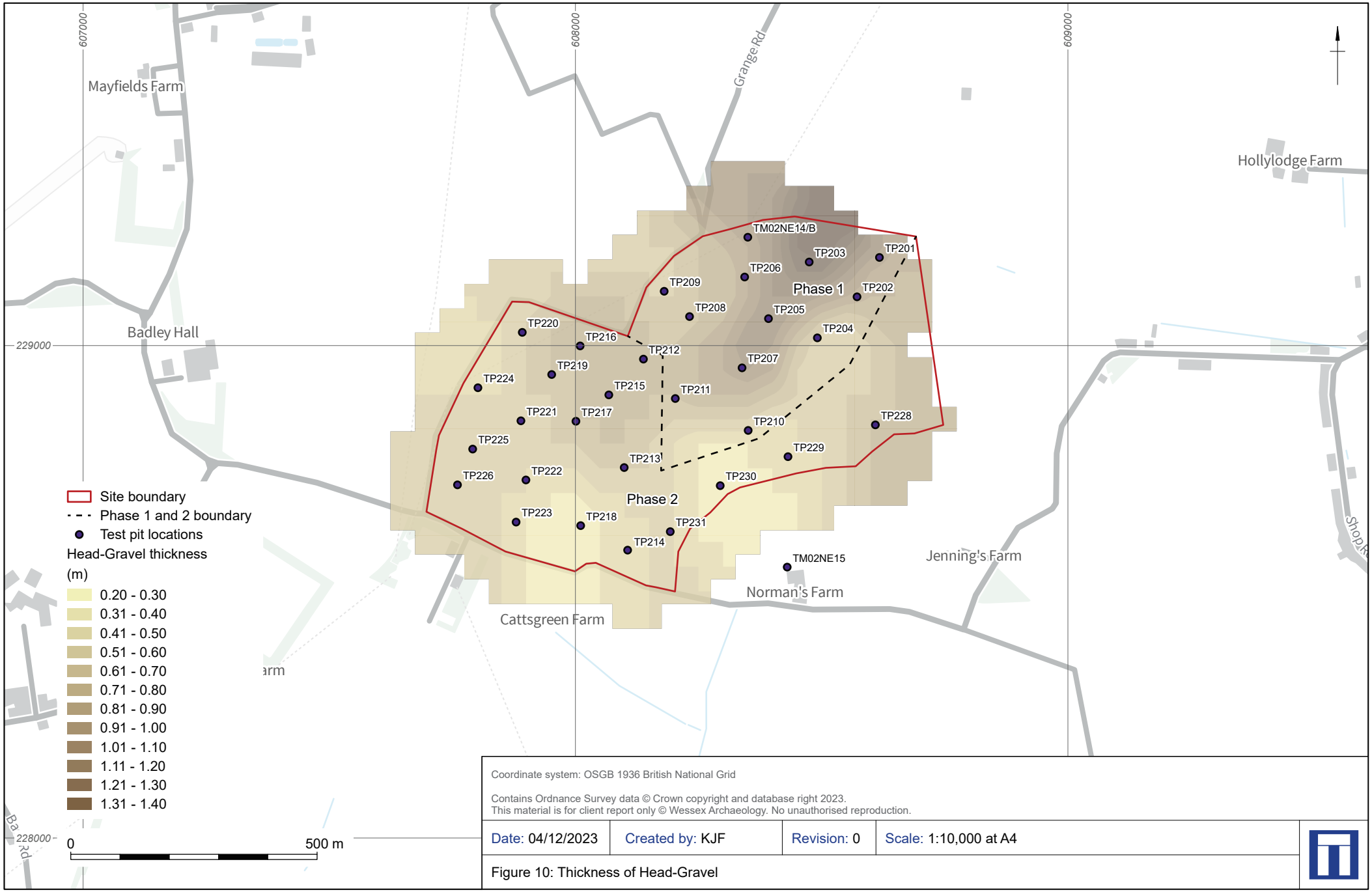

Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:10,000 at A4

Figure 10: Thickness of Head-Gravel

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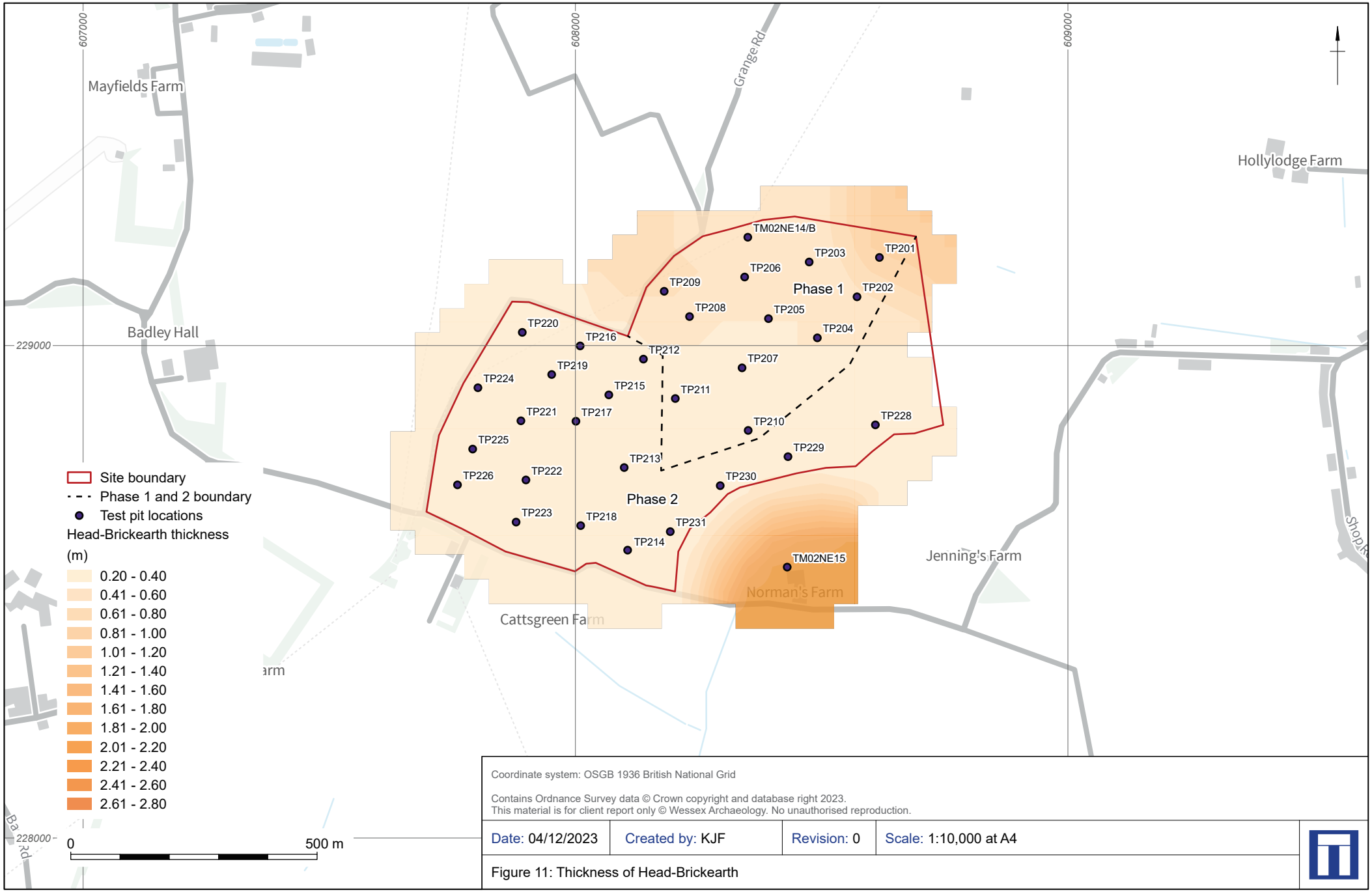

Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:10,000 at A4

Figure 11: Thickness of Head-Brickearth

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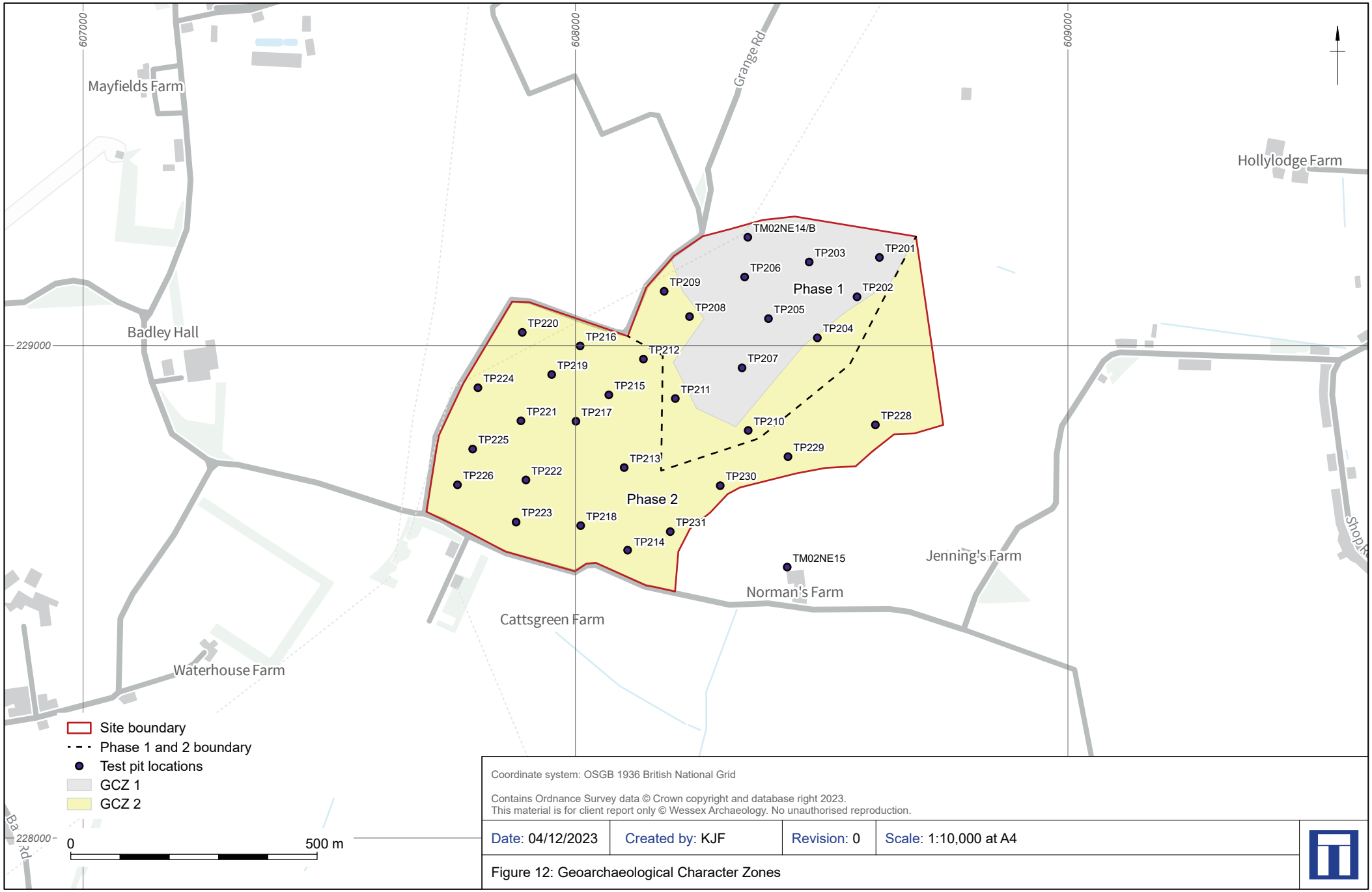

Coordinate system: OSGB 1936 British National Grid

Date: 04/12/2023	Created by: KJF	Revision: 0	Scale: 1:10,000 at A4

Figure 12: Geoarchaeological Character Zones

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Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www. wessexarch.co.uk

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