A Multi-disciplinary Investigation Of The Sediments at The London Gateway Site, Essex: Geophysics, Palaeoenvironment And Dating

Final Deposit Model Update

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A MULTI-DISCIPLINARY INVESTIGATION OF THE SEDIMENTS AT THE LONDON GATEWAY SITE, ESSEX: GEOPHYSICS, PALAEOENVIRONMENT AND DATING

Final Deposit Model Update

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1. INTRODUCTION

1.1 Scope of this report

This report details the results of work undertaken during 2011 to finalise the London Gateway floodplain geoarchaeological deposit model. This is the final stage in a long-running geoarchaeological investigation that has been updated at intervals since the preliminary deposit model produced for the London Gateway Environmental Statement (LG ES, Bates 2003a, Cultural Heritage Technical reports, Appendix O, Oxford Archaeology). The 'deposit model' refers to the integrated results of a series of geoarchaeological investigations which are focused on understanding the development of the floodplain areas of the London Gateway site, through the late Pleistocene and Holocene (12,000 BP to the present). The project was developed in recognition that the floodplain at London Gateway poses logistical difficulties in terms of accessing sequences where the depth of the Holocene stratigraphic record exceeds 10m across much of the site. Conventional methods of evaluation, such as trenching, would only have been effective in assessing the most recent phases of activity at the site – It was recognised that prospection for prehistoric archaeology (if present) would not be possible using such approaches. It was intended that by characterising the various depositional environments, this model would be a tool for assessing the archaeological potential of development sites within the floodplain and would inform decisions regarding potential future construction impacts. The deposit model builds on previous models developed for the Thames Estuary and represents a step-change in our understanding of archaeological landscapes within the floodplain.

The need for the work arises from the London Gateway Archaeological Mitigation Framework (AMF), which formed part of the 'Statement of Common Ground' agreed between the developer (then P&O) and Thurrock Council in 2003. Compliance with the AMF is a condition attached to both the Harbour Empowerment Order for the Port and the Outline Planning Application for the Commercial Park. The requirements for modelling the Holocene deposit sequence at London Gateway are outlined in paras 4.3.4 to 4.3.11 of the AMF. The deposit modelling methods stipulated in the AMF have been updated since 2003 to take advantage of new technology, in particular in the use of extensive electrical resistivity survey to characterise the geological sequence.

As the detailed design process for the development has proceeded, it has become apparent that construction impacts within the floodplain will be very limited due to the strategy of building up the ground levels across the site, effectively preserving any archaeology that may be present *in situ*. The deposit model nevertheless remains an essential component of the mitigation strategy for floodplain areas of the site - In accordance with the AMF it is necessary to update and check for potential archaeological impacts each time a detailed construction design is submitted that involves significant groundworks. The deposit model contributes to this process of ongoing assessment by providing an estimate of the depth, age and characteristics of alluvial deposits throughout the floodplain parts the site, which can be compared against the level at which ground disturbance is anticipated in the construction design.

1.2 Regional background to the site

Today the site area lies at the boundary between the inner and outer parts of the Thames estuary (Figure 1). The modern river Thames lies within a basin known as the London Basin that is bounded to the north by the Chalk escarpment forming the Chiltern Hills and to the south by the Chalk of the North Downs. Younger Eocene sediments occur within a synclinal feature between the Chilterns and the North Downs (Sumbler 1996). This structure defines the distribution of the local basement geology of the site area which is dominated by the Lambeth Group and the London Clay Formation (Figure 2).

The modern topography and river positions are a result of major drainage pattern modifications during the Quaternary and in particular events during the last 500,000 years (Gibbard 1994). Prior to c.450,000 B.P. drainage channels extended across the study area to confluence with a north easterly flowing Thames in East Anglia (Bridgland 1988). Following blocking of the northern route by the Anglian ice (Gibbard 1977, 1985; Bridgland 1988) drainage of the Thames was diverted into the modern valley although a northerly trend to the drainage patterns could still be detected until the late Pleistocene. These events resulted in the deposition of sands and gravels and the creation of terraces (now only remnants in many places) through incision during periods of lowered sea-level (Bridgland 2000, 2006). Presently these sand and gravel bodies lie to the north west of the study area on the higher ground as well as beneath the site in certain areas (Figure 3). The most recent episodes of gravel aggradation in the lower Thames, responsible for the deposition of the valley bottom gravels (or Shepperton Member, *sensu* Gibbard 1985, 1999) form the template onto which much of the Holocene alluvial and estuarine sedimentation occurred (Bates 1998; Bates and Whittaker 2004). This template typically declines in elevation from west to east therefore older sand and gravel deposits, exposed to the west, are buried beneath the floodplain in an eastwards direction.

The Holocene estuary of the Thames, a tide dominated estuary (*sensu* Dalrymple *et al*. 1992) contains major sand bars within the outer estuary area (marine dominated zone) and tidal meanders in an inner mixed energy zone. Holocene sediments within the site area are part of a continuum forming a wedge thickening downstream from less than 2m at Tower Bridge to reach a maximum thickness of 35m east of the study area at Canvey Island (Marsland 1986). It should be noted that as a consequence of sea level rise and fall the different zones within the estuary are likely to migrate along the estuary at times.

Our current understanding of the sedimentary sequences of the area are derived from work undertaken by Gibbard (1994) and Devoy (1977, 1979, 1982) who have previously considered the main sediment sequences present within our study area. However, in contrast to the relatively well known sequences of Pleistocene age (Gibbard 1994) the nature of the Holocene sediments resting on bedrock or pre-Holocene sand and gravel deposits are poorly understood and have only, with few exceptions, been described superficially (Devoy 1977, 1979). The basis for subdivision of these deposits was established by Devoy during the early 1970s (1979, 1982) using borehole stratigraphies integrated with biostratigraphic studies to infer successive phases of marine transgressions (typified by clay-silt deposition) and regressions (typified by peat formation). Devoy's work has resulted in a view of sediment accumulation being controlled within the area by a combination of factors dominated by sea-level change and tectonic depression of southern England. Most

recently regional models for sequence development have been described by Long *et al*. (2000) and Bates and Whittaker (2004) which begin to address the range of factors responsible for sequence accumulation.

The sediments of the estuary have been grouped by Gibbard (1999) into the Tilbury Member and consist of intercalated peats and clay-silts in the inner estuary. These sediments intercalate with marine sands near the Isle of Grain and Yantlet Channel and Sea Reach south of Canvey Island.

In order to fully understand the distribution of likely archaeological sites in the lower estuary area and the reasons behind major changes in settlement patterns in the past it is necessary to understand the changing nature of the estuary. These changes have been summarised recently by Bates and Whittaker (2004) for the inner estuary but presently little is known of the nature and significance of the deeper areas close to the inland edge of the outer estuary.

1.2 Previous work in the site area

A preliminary deposit model for the site was initially developed for the London Gateway Environmental Statement (Bates 2003a, Cultural Heritage Technical Reports, Appendix O, Oxford Archaeology) using a combination of borehole survey data, informed by three 'range-finder' radiocarbon dates and palaeoenvironmental assessment.

The data contained in the original deposit model derived from both geoarchaeological investigation and historical geotechnical data (Dames and Moore 1995, 1997; EMU Environmental Ltd, 2001; Environmental Resources Management (ERM), 2000, 2001; Fugro and McClelland, 1990; LTG Environmental Services, 1992 and Thyssen Geotechnical, 2001) as well as data from the BGS archive at Keyworth.

An up-date of the borehole-based deposit model was completed in March 2008, comprising an additional 611 sample points, within and adjacent to the development, (Stafford, E, 2008, London Gateway: Updated deposit model interim report, Oxford Archaeology). The majority of this data derived from more recent geotechnical investigations (Environ 2004, Environmental Resources Management 2004, Fugro Engineering Services Ltd., 2004, 2005, Svitzer, 2003). Further BGS data was also added, along with some data from geotechnical investigations omitted from previous updates. The latter largely comprised shallow interventions that recorded the depth of made ground across the Port Development. The preliminary model produced for the ES had concentrated on the deeper boreholes that penetrated the Pleistocene gravels in order to map the early Holocene topographic template. It was, however, considered important in the 2008 update to provide as much detail as possible on the distribution of made ground across the site, to inform assessments of construction impact within the alluvial floodplain.

In 2008 a pilot study was completed for an investigation of the sediment sequence using electrical resistivity, followed in 2009 by a full scale survey covering the entire land-side development within the floodplain (Bates and Bates, 2009, London Gateway: A Geophysical Assessment Report on the Sub-surface Stratigraphy of the Shell Haven Site, Oxford Archaeology). Drilling and logging of an additional 29 geoarchaeological boreholes was completed later in 2009, these being designed to 'ground-truth' the geophysical survey results and provide samples for sediment

analysis and radiocarbon dating. The 2009 geophysical survey report concluded with a discussion of the further work which would be required to complete the model. A design update note was prepared in April 2011 which set out the scope of the palaeoenvironmental analysis and radiocarbon dating which is reported here (Bates and Nicholson 2011).

Combined together these studies have generated a large and complex body of data which can be used to characterise the Holocene sediment sequence. This final report integrates and updates the results from the latest studies with those from the earlier studies.

The previous work outlined the potential of the site to address a range of geoarchaeological and palaeoenvironmental questions. This work indicated that:

1. Fine grained sedimentary sequences at the site spanned at least 8,000 years.
2. Palaeoenvironmental material (pollen, foraminifera and ostracods) were well preserved at the site.
3. A number of environments of deposition were present.
4. Considerable difficulty existed in terms of defining the base of the alluvium in some places.
5. Investigation of the site at an appropriate scale would produce a detailed reconstruction of landscape evolution across much of the Holocene.

These observations were made by reference to the prime source of information in the lower estuary of the Thames by Devoy (1977, 1979) who examined sequences both up-estuary in the vicinity of Tilbury and downstream at the Isle of Grain. His work indicated that a series of five major peat units could be identified in places within the estuary. These peat horizons were noted to rise in an upstream direction. Few investigations exist that may be of relevance to this area although Bates and Barham (1995) considered some of the problems when developing regional stratigraphic frameworks in the Thames area and Haggart (1995) has re-interpreted the sequences initially described by Devoy (1977).

Geological mapping of the site area indicates that parts of the southwestern area of the site is underlain by Palaeocene Lambeth Group (Figure 2). These deposits consist of shelly sands with lignite or coarse gravel (Lambeth Group). The remainder of the site area consists of the London Clay Formation of the Thames Group (dark blue to brown clay with some sand and silt).

Pleistocene deposits outcrop to the west of the site area on higher ground between Stanford-le-Hope and Corringham where sediments defined as head and river terrace deposits are mapped (Figure 3). Bridgland (1988) correlates the lower lying deposits trending from southwest to northeast immediately above marsh level to part of the Mucking Member (Gibbard 1999) and higher level gravels around Stanford-le-Hope to the Corbets Tey Member. Archaeological material exists in association with the Corbets Tey Member at Purfleet and Globe Pit, Thurrock (Wymer 1999) and in the Mucking Member at West Thurrock (Bridgland 1994).

Information from the British Geological Survey mapping indicates that buried sand and gravel deposits are also present beneath the floodplain surface in the site area. These deposits are probably the downstream equivalent of the East Tilbury Marsh Member or Shepperton Member of the Lower and Middle Thames.

Holocene deposits have also been depicted from the area consisting of sub-horizontal peat units (possibly up to 4 discrete units) intercalated with clay-silts; these appear to resemble sequences described by Devoy in the lower Thames. Also noted is the presence of sand units probably deposited as upper flow regime sand flats (British Geological Survey, 1997).

2. AIMS AND OBJECTIVES

This study was commissioned and implemented in order to investigate the long term history and development of the site from the late Pleistocene onwards. Specifically the aims were to:

- Characterise key stratigraphic units and establish the vertical sequence (including any land surfaces) of the sedimentary stack within the study area
- Link the geophysical data to the observed lithology and produce a definitive sub-surface model
- Define environments of deposition to key lithologies using a range of associated sub-fossil materials (foraminifera, ostracods, plant macrofossils and diatoms)
- Calibrate the lithological model with a series of radiocarbon dates from key stratigraphic units

The objectives were to:

- Develop an understanding of topographic change and associated sea level fluctuations within the study area and link them to boarder patterns within the estuary through time
- Develop a local model for environmental change related to the evolution of the estuary's geometry
- Compile a series of palaeogeographic maps illustrating the physical evolution of the landscape in relation to sea level change

3. METHODS

Investigations undertaken in previous phases of this survey involved the use of boreholes, cone penetration testing and surface and subsurface geophysics coupled with palaeoenvironmental assessment (Bates 2003a; Stafford 2008, Bates and Bates 2009). The use of multiple methods and techniques to investigate areas of deeply stratified alluvium have been previously outlined (Union Railways (South) Ltd, 1999; Bates and Bates 2000: Bates *et al*. 2000) and have recently been employed as part of a strategy examining sub-surface stratigraphies in the vicinity of the Thames River Crossing of the Channel Tunnel Rail Link (Bates and Stafford forthcoming). The techniques used in the ground investigation were selected for their ability to complement each other, to provide data sets suitable for construction of a comprehensive ground model. In addition to the undertaking of fieldwork targeted on

specific geoarchaeological questions, historical data available in the ES baseline dataset has also been investigated to aid in the construction of a ground model.

3.1 Geophysics

The survey comprised a number of east/west transects across the site at nominal 100m spacings (Figure 4). In addition a number of transects were also undertaken in order to tie together adjacent transects. Infill lines were obtained at 50m spacing where rapid electrical resistivity changes were mapped during the field acquisition.

The electrical resistivity imaging system comprised a number of electrodes linked together via multi-core cables, a switch-box that facilitates access to any combinations of electrodes, a power source and a measuring unit (Figure 5). Resistivity data were recorded via complex combinations of current and potential electrode pairs to build up a pseudo cross-section of apparent resistivity beneath the survey line (Figure 6). The depth of investigation depends on the electrode separation and electrode configurations, with greater electrode separations yielding resistivity measurements to greater depths.

For the survey a similar array to the test survey was chosen that included a modified Wenner array. This protocol was supplemented at near surface by dipole-dipole type measurements and at depth by Wenner-Schlumberger measurements for greater detail. The specific array was customized for the Gateway site in order to best achieve the objectives based on the resistivity variations observed at the site.

For the survey four electrode cables were used instead of two with 80 channels (electrodes) in use at each measurement setup location. In 2008 it was also decided to deploy two ABEM Terrameter Resistivity Systems (80 channel) and Field Computers to expedite collection of the field data.

Electrodes were deployed along selected traverse lines with the electrodes inserted into the ground to a depth of approximately 15cm. A minimum electrode spacing of 5m was used which gave an effective computation electrode distance of 2.5m. Maximum electrode spacing was greater than 100m in order to obtain an exploration depth of up to 50m. The quality of the geophysical data is outlined in Appendix 1 and 2.

3.2 Boreholes

The ground investigation to recover sediment samples and characterise sedimentary properties of the deposits involved the use of a number of different geotechnical sampling devices. The principle considerations in selecting the tools for this project involved the need to recover sample material for sediment characterisation and the need to cover large areas of the site to recover proxy information on sub-surface sediment types.

A shell and auger drill rig (Figure 7) capable of taking undisturbed 1m piston samples (Figure 8) was employed to drill 21 boreholes (OA1-OA21) to sample the soft Holocene sediments and to continue drilling through the underlying gravels to attain bedrock. Sampling of the sediments using the sample tubes commenced close to the ground surface and continued to the base of the soft sediments where possible.

Bulk samples were taken from the underlying gravels and the holes were drilled at least 1m into bedrock. A full description of the borehole stratigraphy is given in Appendix 3. These 21 purposive boreholes augmented the 10 boreholes (ARC BH1-ARC BH10) recovered and described and assessed during a preliminary phase of work (Bates 2003a).

Recovered cores from the shell and auger drilling were transferred to the Fugro Engineering Services store in Wallingford where, in 2008, they were split open lengthwise, cleaned, examined, photographed and described by Oxford Archaeology geoarchaeologists. Standard geological terminology (Jones *et al*. 1999) commonly used to describe Pleistocene sediments was utilised. All relevant information was recorded on Oxford Archaeology monolith/core logging proforma sheets and full details are provided as Appendix 3. All depth measurements recorded on the logging sheets are taken from the top of the core plastic casing. Any voids in the top or bottom of the casing are recorded as 'void' (see Appendix 3). Voids occur often through loss of sediment from the bottom of the core or through compaction of the sediment. As a general rule voids of c. 0.2m are typically caused by compaction.

Subsequently, in 2011, selected cores were taken to Oxford Archaeology where they were re-opened reopened and subsampled for dating and palaeoenvironmental analyses.

3.3 Microfossil (foraminifera and ostracods) investigation

Processing was undertaken by first breaking the sample into small fragments by hand. This sediment was placed in a ceramic bowl and dried in an oven. It was then soaked in hot water for several hours or overnight, with a little sodium carbonate added to help remove the clay fraction. Washing was through a 75 micron sieve with hot water. The resultant residue was returned to the bowl and dried again in the oven. Many of the samples, especially from Borehole OA06, had a high organic content, and the process had to be repeated once or even twice to achieve a satisfactory breakdown. The residues were finally placed in labelled plastic bags for storage and subsequent examination. For analysis, each dry sample was put through a nest of sieves (>500, >250,>150 microns and pan) and a little of each residue at a time sprinkled on a picking tray. A representative fauna of foraminifera and ostracods was picked out from each fossiliferous sample and placed in 3" x 1" faunal slides for archive purposes. The "organic remains" were noted and recorded on a presence/absence basis, whilst the abundance of each species of foraminifera and ostracods (where present) was estimated semi-quantitatively by experience and by eye.

The results of the investigation (see Section 4.3.1) are all colour-coded to indicate the ecological preferences of the foraminifera and ostracods present. Blue-green indicates the specialist agglutinating foraminifera of mid-high saltmarsh; light grey indicates brackish calcareous foraminifera of low-mid saltmarsh and tidal flats. Lime-green shading indicates brackish ostracods of tidal flats and sheltered creeks. Outer estuarine/marine foraminiferal and ostracod components are both shaded blue. Freshwater ostracods, which form only a very minute component are in light-blue. These ecological groupings are outline in Table 1. More ecological information on the microfauna, species by species, is given in the Appendix 4 at the end of the report.

3.4 Waterlogged plant remains

Samples of organic “peaty” sediment were extracted from the key borehole sequences. In order to recover sufficient material for useful analysis, samples were taken through the entire depth of organic horizons after sampling for radiocarbon dating and other microfossils. Half a litre of sediment from each of the samples apart from OA06 11.38-11.43m where only 200mls of sediment was available, was broken up by hand, wet sieved to 250 microns and then hand floated (washover technique) to 250 microns. Flots and residues were scanned using a low-power stereo microscope. The seeds and items such as thorns and buds were identified and the decision was taken that they should be scored on a scale of 1-5 items. The authors considered that the time taken to extract and count the seeds gave little additional information. Identification was aided by Katz *et al* (1965), Cappers *et al* (2006) and Stace (2010) and by comparison with modern reference collection held at OA North (some modern seeds were supplied by the Hohenheim Botanic Gardens, Stuttgart). The components of the matrix were noted and scored on the same scale of 1-5 where: 1=present (up to 5 items) and 5=abundant (more than 100 items). Plant nomenclature follows Stace (2010).

Each individual plant species has been described as a member of a single plant community although many taxa are often to be found growing in more than one type. These categories are similar to those defined by Huntley and Hillam (2000, 356-7). The ecological groupings are as follows:

1. Weeds of arable, cultivated and waste ground and ruderal plants: the former are annual plants found growing in arable fields or cultivated and waste ground. Ruderals are found growing on waste or fallow ground. The plants are usually perennials or biennials and inhibit the growth of annuals.

2. Grassland plants are to be found growing in open grassland or meadows.

3. Woodland/scrub plants comprising trees and shrubs,and the ground flora common in woodland clearances and hedgerows.

4. Wet ground and aquatic plants are to be found growing on wet marshy ground, on river, ditch and pond banks and in water meadows. This group in the samples from the London Gateway Floodplain Boreholes also includes plants associated with salt marsh and brackish conditions.

5. Crop and native plants that can be used as food sources.

6. Plants belonging to broad ecological groupings, which are not characteristic of any one community but are found in several.

3.5 Diatoms

Diatom preparation, counting and analysis followed standard techniques (Battarbee *et al.* 2001). Diatom floras and taxonomic publications were consulted to assist with diatom identification; these include Hendey (1964), Werff and Huls (1957-1974), Hartley *et al.* (1996), Krammer and Lange-Bertalot (1986-1991) and Witkowski *et al.* (2000). Diatom species' salinity preferences use the classification data in Denys

(1992), Vos and de Wolf (1988, 1993) and the halobian groups of Hustedt (1953, 1957: 199), these salinity groups are summarised as follows:

1. Polyhalobian: >30 g l^{-1}
2. Mesohalobian: 0.2-30 g l^{-1}
3. Oligohalobian - Halophilous: optimum in slightly brackish water
4. Oligohalobian - Indifferent: optimum in freshwater but tolerant of slightly brackish water
5. Halophobous: exclusively freshwater
6. Unknown: taxa of unknown salinity preference.

Diatom data were plotted using the 'C2' program (Juggins 2003).

3.6 Artefacts and larger ecofacts

Two samples, from OA06 at 4.80-4.90m and 4.90-5.00m depth within the core were wet sieved to 0.5mm to extract artefacts and larger ecofacts, these being the only deposits within the sampled cores which appeared from the sample logs to contain anthropogenic material (excluding charcoal of uncertain derivation). The sampled deposit was a dark greenish grey and very dark grey slightly silty clay with inclusions identified during the logging as possibly ceramic.

3.7 Dating

The programme of radiocarbon dating was designed to provide a robust chronological framework for the deposit model, albeit given the inherent difficulties encountered when dating fluvial sediments (see Howard *et al.* 2009).

During subsampling of the selected borehole cores, 20mm thick slices were taken from selected key horizons specifically for dating purposes, sample size dictated by the need to obtain sufficient material for dating of bulk sediment (radiometric-sized samples) or microfossils. These included organic-rich peat horizons, but also alluvial horizons that did not contain organic material; in these cases ostracods and foraminifera were extracted as the only potentially datable material available. The selection of material for dating, together with the technique for dating peat/organic sediment followed advice from A. Bayliss (English Heritage). In the first instance, samples of organic material were carefully examined and where possible waterlogged material or horizontally bedded charcoal from short-lived taxa was extracted. Unfortunately, while waterlogged seeds were present in a number of samples, they were of tiny size and insufficiently frequent to provide enough material for AMS dating. Waterlogged stems were present in a number of sample, but these appeared likely to be rhizomes of *Phragmites*; since these can penetrate several metres through a deposit this material was unsuitable for dating. Likewise, roundwood fragments were excluded since they could not be identified as non-root material with certainty. Consequently, in a number of cases bulk peat/organic sediment samples (wet weight between 60g and 131g) were submitted. Although radiometric dating had been originally recommended, the turnaround time required

for this project precluded it and so samples were instead submitted for AMS dating of both the humic (acid insoluble/alkali soluble) and humin (alkali insoluble/acid soluble) fraction with the agreement of A. Bayliss. For the humin fraction, the entire sample was combusted and from the CO_2 a sub-sample was taken for AMS dating. Likewise, the humic fraction was extracted in solution from the entire sample, and the solution sub-sampled and the humic precipitated and measured by AMS. This methodology avoids the dangers inherent in dating only a very small part of a heterogeneous sample, which can result in an erroneous date due to the incorporation of residual or intrusive material (G. Cook pers. comm.). In all cases samples were prepared and dated at the Scottish Universities Environmental Research Centre (SUERC), East Kilbride.

Foraminifera and ostracods were extracted for dating following the methodology described above (section 3.3), with the selection based on microfossils likely to be *in-situ* (ie not reworked). While calcareous foraminifera were selected if possible, in two cases only agglutinating foraminifera *Trochammina inflata* were present, and these were submitted as the only microfossils available to date key horizons. It should be noted that these are not calcareous (as are the rest of the foraminifera and all the ostracods presented here) but have a shell assembled by the foraminifer from mineral grains (in this case silica) cemented together with organic cement with a thick inner and thinner outer organic lining. The use of aggultinating foraminifera for AMS radiocarbon dating is virtually untried, and unfortunately despite the submission of 300-450 large specimens these failed to provide sufficient CO_2 to enable a date to be obtained. Where ostracods were provided, carapaces were used where possible as this signifies an *in situ* fauna with little or no transport. In all cases the ecology was brackish, either mudflats or saltmarsh.

In total, five charcoal samples, one sample of waterlogged macrofossils, six bulk peat sediment samples (for humic and humin measurement) and thirteen samples of foraminifera and ostracods were submitted for AMS dating, although a number of these samples failed to produce sufficient CO_2 to date (Table 2) even after additional material had been submitted.

The uncalibrated radiocarbon dates are provided in Table 2, in radiocarbon years BP (Before Present - AD 1950) using the half-life of 5568 years. Isotopic fractionation was corrected for using the measured δ13C values quoted (to ± 0.3 per mil relative to VPDB). Only one of the foraminifera/ostracod samples provided sufficient CO_2 to allow measurement of the δ13C so a value of 0 has been assumed for the others within the radiocarbon age calculation and an error of 5 per mil added. Calibrated dates are given using the programme OxCal 3.10 (Bronk Ramsey 1995; 2001; 2005) using atmospheric data from Reimer *et al.* 2004, with the end points rounded outwards following the format recommended by Mook (1986); however the dates from foraminifera and ostracods are best considered in radiocarbon years BP (G. Cook pers. comm.).

4. RESULTS

4.1 Geophysics and borehole investigation

Ninety five percent of the site was covered with DC resistivity sections at 100m line spacing oriented in parallel lines running East-West across the site (Figure 4). Approximately 3km of the line survey was not acquired at this spacing due to infrastructure. The infrastructure problems include line breaks around the bitumen plant and where standing water (mainly ponds) were encountered.

Where excessive acquisition problems were encountered with poor placements of the electrode spikes on crossing roads, the railway and places where old concrete slabs were present at the ground surface re-orientation of the lines was achieved where possible. Where re-orientation was not possible infill survey lines were conducted at 50m spacing at critical locations.

Additional survey lines were acquired in North-South orientations over significant anomalies that were identified in the original East-West survey lines and also in order to facilitate the completion of the 3D sub-surface geo-archaeological model.

The 2008 data was supplemented by that obtained in 2007 for integration in the final 3D sub-surface geo-electrical model.

4.1.1 Data processing and integration

Data processing was accomplished using the following procedures:

- Data was downloaded from the ABEM Terrameter field instrument to PC using ABEM SAS4000 Utilities. Data from each field instrument was downloaded at the end of each individual survey line and the field protocols compared to the field notes to ensure no stations were mis-recorded.

- All data was converted from apparent resistivity data in ABEM format to generic resistivity data format for reading with any resistivity programmes.

- Addition of survey data to ABEM format to include XY positioning.

- Data was uploaded to interpretation software Res2DINV v.3.56 (GeoTomo Software).

- Editing of survey data for line re-orientations based on XY positioning and filtering for excessive noise, negative data and rapid apparent resistivity variations that would violate the apparent resistivity inversion protocols.

- Inversion of apparent resistivity sections, comparison of measured apparent resistivity pseudo-sections to calculated pseudo-sections (models) and creation of an inverse model resistivity section for each line (Figure 6). Iteration on the model for best fit and reduction in RMS error.

- Export of model section for interpretation using Rockworks 2006 (Golden Software) together with ArcGIS (ESRI), Fledermaus and DMagic (IVS

Software) and Sonarwiz (Chesapeake Software). Specifically each of the programmes is used in the following ways. Rockworks – integration of the geophysical line location data and core data, production of whole rock volume models, interpolation of geophysical and core data into surfaces and 3D volumes and interpretation; Fledermaus -3D viewing of the resistivity data together with core data for quality control; Sonarwiz – digitization of 2D geo-archaeologically significant horizons together with borehole control.

Data interpretation procedures followed the sequence detailed below.

- Inspection of apparent resistivity pseudo-sections (Figure 6) with extant borehole data from previous studies, interpretation of significant horizons (e.g. bedrock surface) based on the electrical data and borehole data that are located close to the geophysical survey lines.

- Digitization of geophysical horizons.

- Adjustment of geophysical horizons to OD.

- Extrapolation (gridding) into 3D surface along geophysical lines using a 25m window (Figure 9).

- Comparison of geophysical 3D surface with new boreholes – see note below on statistical evaluation.

- Adjustment of geophysical surface for best fit with respect to new boreholes for most geologically reasonable fit to the data, re-gridding of geophysics data and uploading for import to ArcGIS.

- Extrapolation into 3D surface across all site using a 50m window and all boreholes on site for both bedrock surface and gravel surface (Figures 10 and 11).

The results of the geophysical survey were an enhanced, and more robust, model for the surface of the bedrock (Figure 10) and the gravel surface/base of Holocene alluvium (Figure 11). Additionally it is possible to suggest differences in the nature of the Holocene alluvial package between different parts of the site (Figure 12). For example subtle differences in conductivity values between the western and eastern parts of the site have been noted where the boundary between these zones appears to lie approximately along the line of the curving ridge identified in the gravel surface topography (Figure 11).

4.1.2 Sedimentary sequences

Sedimentary sequences from the site consist of a number of discrete sediment types that have been identified through the various historical, geotechnical and geoarchaeological data sources that are available to the project. However, there have been a number of difficulties in interpreting some of this data with particular reference to:

1. Identifying bedrock in some instances where bedrock may be similar to the Holocene stratigraphy.

2. Identifying the presence of thin sequences of Pleistocene gravels where they may be similar to units within the bedrock.

These difficulties have arisen for a number of reasons: that include the data quality (of the historic records) that reflect the competence of the drillers, the geotechnical brief, sampling design and time availability. Furthermore parameters recorded in geotechnical investigations are set by the brief and these may differ from those required by archaeologists attempting to understand the stratigraphic development of the site. Additionally the primary engineering borehole logs do not attempt any chronological interpretation of the sub-surface geology until bedrock is reached (if recognised).

Overlying the bedrock a number of discrete types of sediment have been identified:

1. Structureless grey clay-silts (Figure 13A).
2. Finely laminated clay-silts and sands (Figure 13B and C).
3. Organic silts and peats (Figure 14A and B)
4. Sands and gravels (Figure 14C).

Sands and gravels were encountered in a number of locations although their presence across the site is not uniform and typically sand and gravel is missing in the western part of the site. The surface elevation of the gravels (Figure 15) appears to be relatively uniform at between -10m and -15m O.D. across the site (perhaps trending towards lower elevations in the east). By contrast the basal contact between the gravels and the underlying bedrock shows a clear step in gradients between the western and eastern parts of the site. Towards the west the basal contact lies between -17m and -15m O.D. while to the east the contact lies below the -25m contour. This suggests that at least two distinct gravel aggradations are present at the site.

Within the Holocene alluvial stack the three main groups of sediments exhibit consistent patterns with the presence of an intermittent basal organic horizon (complex in places) (Figures 16-18) beneath either structureless clay-silts or laminated sands and silts. Typically these laminated deposits appear to be distributed towards the east of the site and are present in boreholes ARC BH7, OA11 and OA17. The structureless grey clay-silts are present towards the west of the site, as demonstrated in OA06 and OA12.

Organic horizons and peat units are commonly found between the elevations of -4m to -6m O.D. in parts of the site (Figures 16 – 19).

4.2 Chronology

The dating results with lab. reference numbers for the borehole samples are presented in Table 2 and the age estimates from the various media used provide a robust framework for the interpretation of the sequences. Where calibrated dates are given, they are cited at 2σ unless otherwise stated. The dates given below and on the Figures for the peat and organic sediments are, where possible, the weighted average result for the humic and humin fractions using R_Combine in Oxcal. 3.10.

The dates presented in Table 2 augment the three “range-finder” radiometric dates obtained from peat deposits in boreholes ARC BH2, ARC BH3 and ARC BH7 (Bates 2003a). The earliest of these three dates was a radiometric date of 7916±137 B.P. (Wk-11955: 7200-6450 cal. BC at 95.4%) from a thin band of compressed peat at 12.40m from the top of borehole ARC7, which provided the first clear indication that the lower part of the sequence in this area dated back to the early Holocene. Subsequently, as part of this phase of work, a much earlier date of 8985±35 B.P. (8290-7980 cal. BC) has been obtained from the humic fraction taken from organic sediment from 13.35-13.37m depth in borehole OA15 (humin fraction failed to date). Peat from 10.53-10.55m in borehole OA20 dated to 8526±23 B.P. (combined humic and humin date: T=3.4 at 1df))); 7590-7535 cal. B.C. Organic silt from 13.54-13.56m in borehole OA21 dated to 8227±23 B.P (combined humic and humin date: T= 0.0 at 1df)); 7350-7140 cal. B.C. In borehole OA09, only the humic fraction of the organic silt sample from 9.72-9.74m in the core could be dated, producing a date of 8930±35 B.P (8250-7960 cal. B.C). These dates all fit well with the period of landscape stability between 8,000 and 10,000 BP described by Bates and Whittaker (2004) and discussed further in section 5, below.

The next stage of peat formation is dated from samples taken at 11.43-11.45m in borehole OA06, which gave a combined date of 7007±23 B.P or 5990-5830 cal. B.C (T=0.0 at 1df) and charcoal from 11.37-11.39m in the same core which dated to 6640±35 B.P. (5630-5510 cal. B.C). Calcareous foraminifera collected from 7.86-7.88m in the same borehole gave a slightly earlier date of 6685± 50B.P, but with a very small CO_2 yield this date may be in doubt. Although it is possible that the dated charcoal was intrusive, the inclusion of lenses of charcoal within the peat indicates that this is unlikely to be the case. Charcoal was also extracted from peaty deposits at 10.15-10.17m in borehole OA20, giving a date of 6505± 35 B.P (5540-5370 cal. BC).

A third stage of stability, represented by peat formation, is present at 7.22-7.24m in borehole OA06, which gave a combined humic/humin date of 5613±21 B.P (4500-4360 cal. B.C; T=0.1 at 1df). Charcoal within compressed peat at 7.73-7.75 in borehole OA20 gave a date of 5755± 35 B.P (4710-4500 cal. B.C).

Peat sampled in boreholes ARC BH2 and ARC BH3 produced dates of 5104±53 B.P. (Wk-11953: 3990-3770 cal. BC at 94.1%) and 4787±57 B.P (Wk-11954: 3670-3370 cal. BC) respectively, but these dates were not replicated for any of the peats sampled as part of the current update. A later date of 4095±35 B.P (2870-2490 cal. B.C) came from a monocotyledon leaf fragment from a peat horizon in borehole OA06 (at -4.75-4.77m O.D.), although it should be noted that Howard *et al*. (2009) found that waterlogged plant remains from organic deposits in fluvial environments tended to produce a later date than the sediments from which they derived.

Unfortunately dating horizons further up the borehole sequences proved problematic, as the deposits did not contain clearly-*in-situ* organic material and attempts to date foraminifera failed due to insufficient sample size, even after additional material was submitted and over 600 individual foraminifera supplied.

4.3 Palaeoenvironments

Palaeoenvironmental reconstruction is primarily based on the evidence from the foraminifera and ostracods, supplemented with information from diatoms and waterlogged plant remains as appropriate.

4.3.1 Microfossils (foraminifera and ostracods)

Borehole OA06 (Table 3)

Twenty-one samples were examined from a 7.25m sequence (-2.57m down to -9.82m O.D.; 4.57-11.82m below ground level). The “organic remains” are recorded in the uppermost column in Table 3. All the samples contains plant debris and many seeds; some samples were very organic/peaty, these in particular covering the interval -4.64 down to -5.88m O.D. (6.64-7.88m below ground level). Eighteen samples contained brackish foraminifera and sixteen, brackish ostracods. Eleven samples contained large (>75μ diameter) diatoms. Nine samples contained insect remains. Six had molluscs (but often only juvenile spat). Four samples contained outer estuarine/marine foraminifera, but only one contained ostracods belonging to the same ecological category. Finally, two samples contained freshwater ostracods (but only in ones and twos) and one sample, had a few fish/amphibian bones.

The lowermost three samples covering the interval -9.52 down to -9.82m O.D. (11.52-11.82m below ground level) were all barren save for plant remains. This level is unlikely to be brackish as even in the most reducing of environments where decalcification would be expected, agglutinating foraminifera (which possess a shell of mineral grains cemented onto an organic template), would be expected to be preserved and in spite of a diligent search none was found. The onset of undisputable brackish conditions, and hence tidal access, occurs at -8.89/8.91m O.D., where a restricted fauna of foraminifera and ostracods indicative of tidal mudflats and creeks occur (Table 3).

From the onset of tidal conditions at -8.89/-8.91m O.D. up-sequence to -5.86/-5.88m O.D. (10.89/10.91 to 7.86/7.88m below ground level) the ecology is characterised as “brackish creeks and tidal flats with latterly, some development of fringing saltmarsh”. The foraminifera are dominated by large numbers of *Haynesina germanica, Elphidium williamsoni, E. waddense* and a brackish *Ammonia*. Interestingly, there are also large populations of diatoms that often signifies that there is a healthy foraminiferal population living on the mudflats, as the two have a symbiotic relationship (the foraminifera acting as a “greenhouse” for the diatoms, and hence living foraminifera are usually green or greenish-brown from the photosythesising diatoms). The ostracods are characterised by large numbers of *Cyprideis torosa* and several brackish species of *Leptocythere,* the whole indicative of mudflats with protected creeks. Relative sea-level was undoubtedly rising but the site must have been rather marginal as marine foraminifera and ostracods, which are often brought into more open estuaries by storm surges during sea-level rise, are here low in number and diversity, and only occur in this part of the sequence in the interval between -6.85 and -7.40m O.D. Agglutinating foraminifera of fringing mid-high saltmarsh begin to appear in small numbers at around -6.85 to -7.40m O.D.; these reach very large numbers, typified by *Trochammina inflata* and *Jadammina macrescens,* and very little else, between -5.38 to -5.66m O.D. (7.38-7.66m below ground level). Clearly saltmarsh had become firmly established and relative sea-level rise had ceased.

Around -4.66m O.D. and certainly above -4.60m O.D. (6.60m below ground level) there would appear to be another small pulse of rising relative sea-level. First, the mid-high saltmarsh indicators disappear completely to regenerate only slowly.

Foraminifera and ostracods characteristic of mudflats and creeks quickly become established again, often very large numbers and between -4.46 and -4.60m O.D. a few outer estuarine/marine foraminifera are found. This part of the sequence, up to -2.57m O.D. (4.57m below ground level), appears to be “saltmarsh, tidal flats and brackish creeks”, and only minor changes to the local ecology must have occurred. Perhaps surprisingly in such a marginal environment, there are virtually no freshwater ostracods.

Borehole OA11 (Table 4)

Located in the NE of the site (Figures 2 and 3) it is the easternmost borehole examined in the present survey. 31 samples were analysed for foraminifera and ostracods from this deep borehole, covering the interval 2.62/2.64m down to 16.12/16.14m below ground level (-0.59/0.61m to -14.09/14.11m O.D.). The results are shown in detail in Table 4.

The sample from 16.12m, the lowest examined, is a sandy gravel and is totally barren. This may indicate the underlying Pleistocene gravels have been reached.

Between 3.51/3.53m and 15.15/15.17m below ground level (-1.48/1.50m and -15.12/15.14m O.D.) a very diverse and rich fauna of both foraminifera and ostracods exists. This interval is summarised ecologically as open estuarine mudflats with protected creeks and saltmarsh. There appears to be a strong marine influence with associated relative rising sea-level, only waning latterly. Reworking, especially of the freshwater component, is common and some of the reworked fauna are probably Devensian in age. It is clear that the brackish mudflat, creek and saltmarsh component is *in situ*. The brackish foraminifera and ostracods are invariably abundant/superabundant. The ostracods, especially the *Leptocythere* spp. are found as carapaces which suggest little or no transport. Many of the foraminifera, moreover, indicate they are living in a very “healthy” environment too, with several species (e.g. the saltmarsh species *Trochammina inflata*) occurring as many very large individuals. The same samples contain in addition, a very large number of outer estuarine and marine species. The site therefore seems to have been directly open to marine influence for most of the time the sea-level was actively rising. The “exotic” marine ostracods recorded, albeit present usually only in ones and twos, must also be indicative of something and may be, in part, reworked from perhaps a last interglacial (MIS 5e) deposit nearby, incorporated by erosion as the sea-level rose. They are also a few outer-shelf species which can only have been introduced by storm surges.

The freshwater (or more accurately termed “non-marine”) component of the same interval is also interesting and diverse. Most of the species occur extensively in estuaries and coastal pools (Meisch, 2000), some of the species (e.g. *Heterocypris salina*) actually preferring brackish water. It is likely that they derive from mudflats, creeks and saltmarsh that also contained freshwater seepages and small streams which contributed to pools. Charophytes were living in a few of the samples which indicates these pools were indeed permanent and the water clean. There are also several species which, although part of today's British fauna, are considered as cold/cool indicators because of their fossil occurrence, often in the Devensian (Bates *et al.* 2009). The occurrence of *Cytherissa lacustris*, with its preference for cold deep water may indicate a time when the Thames channel was incised and deep, perhaps in the early Holocene or latest Pleistocene. Several other species (*Leucocythere batesi, Limnocythere falcata* and *Ilyocypris salebrosa*) are definitely reworked. The

former two being commonly found in Devensian cold-climate deposits, *I. salebrosa* being only known, so far, from MIS 9 sediments of the Thames/Medway/Rhine (see the Appendix at the end of this report and Whittaker and Horne, 2009, for further details). Below 13.69/13.71m below ground level (-11.06/11.08m O.D.) the freshwater component in the microfauna becomes quite rare and much less diverse.

The two uppermost samples in the borehole (2.62-3.03m below ground level) contain only agglutinating foraminifera of mid-high saltmarsh. By this time sea-level rise must have finally ceased and saltmarsh had accreted.

Borehole OA12 (Table 5)

This borehole is sited less than 500m to the east of OA11 but is represented by a somewhat reduced sequence. Sixteen samples from the interval 2.57/2.59m – 12.89/12.91m below ground level (-0.77/0.79m to -11.09/11.11m O.D.), a 10.34m sequence, were examined. The results of the microfaunal analysis are shown in Table 5.

The lowest sample examined here is from 12.89/12.91m. It contains a small quantity of plant debris and rhizoliths (formed around plant stems and rootlets). In the absence of any microfauna and in light of a similar signature in the lower part of OA20 (see below), it is assumed that this is indicative of the environs of a freshwater river, prone to drying out. Between 12.89 and 12.68m below ground level (-10.88 and -11.09m O.D.) tidal access arrives. The subsequent microfaunas above 12.68 right up to 9.60m below ground level (-10.88 to -7.80m O.D.) are identical to those seen for the most part in nearby OA11 containing brackish foraminifera and ostracods in superabundancy together with a sizeable (in terms of diversity) marine/outer estuarine component, and initially at least, a diverse freshwater ostracod fauna. In Table 5 this is characterised as open estuarine mudflats with protected creeks and fringing saltmarsh. The onset and cessation of marine influence is apparently abrupt.

Following this sudden cessation of the marine/outer estuarine faunas between 9.36 and 9.60m below ground level (-7.56 to -7.80m O.D.) an environment of much more restricted mudflats and fringing saltmarsh remains. After 8.59/8.61m below ground level (-6.79/-6.81m O.D.), even the remaining ostracods of tidal mudflats and creeks disappear and apart from one subsequent sample, the faunas (now only foraminifera) indicate brackish mudflats, and finally, above 4.602/4.62m below ground level (-2.80/-2.82m O.D.) the accretion of mid-high saltmarsh. Here the sediments of the upper core also appear rather weathered with much limonite.

Boreholes OA14 and 15 (Table 6)

Because of sampling difficulties the results of the analysis of boreholes OA14 and OA15 are considered together (for their respective locations see Figure 2).

In OA14 the lowermost two samples indicate a fluviatile/vegetated freshwater environment. Subsequently between 13.93 and 13.77m below ground level (-11.73 and 11.57m O.D.) the first tidal access occurs. Initially it seems to have established a brackish creek, whereupon wider mudflats, fringing saltmarsh with some marine influence rapidly develop (Table 6).

From 2.02/2.04m down to 10.53/10.55m below ground level (-0.26/0-0.28m to -8.77/8.79m O.D.) the faunas represent brackish mudflats with fringing saltmarsh. There are some outer estuarine/marine components but even though the silty residues (<150µ) above 7.78m (-6.02m O.D.) indicate rapid fine-sediment accumulation, the species diversity is not as marked as the boreholes, most notably OA11, situated to the east and lack any "exotic" species. Moreover, there appears to be two standstills between periods of sea-level rise. The former are indicated by peats. There is also a freshwater ostracod component, particularly from the interval 7.76/7.78m up to 5.36/5.38m below ground level (-6.00/-6.02m to -3.60/3.62m O.D.), all of which can tolerate low salinities in estuaries and coastal pools. There are no obvious reworked species, as occur in the more easterly situated boreholes (e.g. OA17c and OA20).

The top three samples lose the outer estuarine/marine component entirely and appear to represent mid saltmarsh and mudflats (Table 6), the sea-level rise being all but complete.

Borehole OA17c (Table 7)

This borehole is located in the SE of the London Gateway site. It is about 800m almost due south of OA11, and in terms of modern geography is the most open of the boreholes to the marine influence of the outer Thames Estuary. A series of samples were examined from 15.88/15.90m below ground level (-14.00/-14.02m O.D.). up to 5.66/5.68m below ground level (-3.78/3.80m O.D.). All have very similar microfaunas that are characterised as open estuarine mudflats, protected creeks and saltmarsh. There appears to be a strong marine influence that appears to develop rapidly, with some reworking especially of the freshwater component.

The nature of the onset of tidal access must have been very rapid as the gravels lie only a few centimetres below the initial fossiliferous sample. Initially at 15.88/15.90m the samples are not as rich as those seen subsequently and they lack much of the marine/outer estuarine component (and totally lacks any freshwater ostracods), yet the open estuarine/marine signature is quickly fully apparent by 15.83/15.85m below ground level (-13.95/-13.97m O.D.) and this continues almost without abatement until 5.66/5.68m below ground level (-3.78/3.80m O.D.), the highest sample examined. The "exotics" as well as the freshwater ostracods are virtually identical to, in particular, borehole OA11 with the same cold/cool indicators in the case of the latter. There was even another single reworked specimen of *Ilyocypris salebrosa,* unknown outside MIS9 of the Thames/Medway. The implications of these two components, and whether they are all or partially reworked, and from where they may be reworked, would warrant much further attention. They must be giving some clue, however, to the provenance of the sediment of the outer Thames estuary in the Early Holocene, at a time when the sea-level rise was rapid and the coastal palaeogeography of the south-east England and the southern North Sea was changing, sometimes catastrophically.

Borehole OA20 (Table 8)

This lies to the NE of the London Gateway site. Thirty nine samples were examined for microfauna from this borehole, covering the interval 2.01/2.03m down to 16.11/16.13m below ground level (+0.86/+0.84m to -13.24/-13.26m O.D.), some 14.12m of sediment. The results are shown in Table 8.

The onset of tidal conditions is marked on Table 8 at 10.07/10.09m below ground level (or -7.20/-7.22m O.D.). This contains a brackish fauna of foraminifera. The next sample examined below, at 10.60/10.62m below ground level (-7.73/-7.75m O.D.), however, is completely barren except for a some plant remains, as were all subsequent samples down to 16.11/16.13m below ground level, the lowest sample available. Many of these (Table 8) also had many rhizoliths formed round plant stems and rootlets. Candy (*in* Ashton *et al.,* 2005: 16) maintains they reflect (when associated with a freshwater environment)…."the drying out of the environment and the formation of fully terrestrial conditions either as a result of the initiation of a drier climate….or because of sediment infilling/lateral migrations of the channel system. Rhizoliths, along with other calcrete types, are typically used to indicate the existence of a dry climate, either a semi-arid climate or a humid climate with pronounced dry months". …."As rhizoliths may form over relatively short periods of time, i.e. the lifetime of the root, these features may not represent a long-lived period of land surface stability and soil development but could reflect a relatively short-lived land surface". It is unfortunate that the onset of tidal conditions cannot be tied down further as there was a void in the core between 10.09 and 10.60m below ground level .

The environment of borehole OA20 above 10.09m (below ground level) can be characterised as follows (Table 8). Subsequent sediments up to 7.82m below ground level (-4.95m O.D.) are …."Initially brackish mudflats at onset of tidal access, then mid-high saltmarsh quickly encroaches". There are no ostracods in this part of the core. Between 3.58 and 7.19m below ground level (-0.71 to -4.32m O.D.) the sediments contain a rich, low diversity fauna of brackish foraminifera and ostracods indicative of mudflats and creeks. There are huge numbers of large diatoms, which usually indicates a healthy foraminiferal fauna in particular, as the two are much associated as food for the foraminifera and as a "greenhouse" for the photosynthesis of symbiotic diatoms. The four uppermost samples, covering the interval from 2.01 down to 3.08m below ground level (+0.86 down to -0.21m O.D.), contain agglutinating foraminifera of mid-high saltmarsh and this must mark the final cessation of sea-level rise.

Not a single marine or outer estuarine foraminifer or ostracod, or a freshwater ostracod for that matter, was found in any of the samples from OA20. This must indicate the site of borehole was always somewhat removed and totally marginal and protected from the main marine influences prevalent to the east and southeast.

Borehole ARC BH7 (Table 9)

Previously (Bates 2003a) assessment of the microfaunas from ARC BH3 and BH7 were reported in 2003 (Whittaker, in Bates 2003a) and are shown here from ARC BH7 in Table 9. The graphical presentation of the foraminiferal and ostracod distributions has now been standardised to conform to layout of the results of Borehole OA06 and species names have been revised where necessary.

Borehole 7 represents a long sedimentary sequence of 13.51m (Table 9). Although the lowest sample (13.90-13.91m) is barren and probably fluviatile and freshwater, the next, at 12.40-12.41m has proven mid-high saltmarsh, as evidenced by the very many agglutinating foraminifera (especially *Trochamina inflata*, a herbivore and detrivore, see Appendix 4) which characterise this niche. By 10.81m saltmarsh had certainly disappeared and mudflats and creeks had become established. A period of

sea-level rise, if not before, is clearly evidenced by 9.41m through to 4.90m, by the occurrence of quite large numbers of outer estuarine and marine foraminifera and ostracods. The location of BH7 must have been prone to the effects of tidal surges that would have brought in this component. By 4.90m and certainly by 3.41m this pulse was over and saltmarsh began to accrete again, this continuing with little change until 0.40m, the top of the section examined.

Freshwater ostracods occur in only very small numbers in BH7 (within the interval 4.90-9.41m) and are completely absent in BH3. Those present in the former, although not identified to species level , are all forms that live in coastal pools.

Summary ecological reconstructions for the individual boreholes are given in Figure 21.

4.3.2 Waterlogged plant remains

The five samples selected for analysis were from very humified wood peat. In samples from borehole OA20 cf *Phragmites australis* (common reed) rhizomes were present; these often form distinctive layers in peat deposits. Rhizomes are the underground stems of the plant, which when preserved become flattened and have the appearance of leaves. Amorphous plant remains, together with the wood fragments, formed the bulk of the samples with a few seeds, grass and sedge remains, occasional woody buds, moss and insect fragments.

Borehole OA06 (Table 10)

The three samples, at depths of 6.77-6.90m, 6.90-7.00m and 11.38-11.43m from the upper and lower peat layers, were analysed from OA06. The upper band has been described in the borehole log as firm moderately moist organic sediment with inclusions of coarse brackish organic detritus and occasional narrow bands of sand. The lower band is also described as firm organic rich sediment with occasional very narrow bands of sand.

Seeds of saltmarsh goosefoot (*Chenopodium* cf *chenopodiodes* (L.) Aellen) were identified at a depth of 11.38-11.43m in the lower organic band. as the name suggests this plant is found growing on salt marshes today. A few seeds of fennel pondweed (*Potamogeton* cf *pectinatus* L*)* were also recorded at this depth and today fennel pondweed grows by freshwater ponds, canals and streams but also sometimes occurs in brackish conditions. The only other seeds identified at this level were occasional seeds of fat-hen (*Chenopodium album* L.) and sedges with lenticular seeds (*Carex* sp).

Very few seeds were identified at 6.90-7.00m in the upper organic layer except greater pond sedge (*Carex* cf *riparia* Curtis) and aquatic fine-leaved water-dropwort (*Oenanthe cf aquatica* (L.) Poir). Above this at 6.77-6.90m a greater number of different taxa were recorded although the number of seeds from each type was low. Common nettle (*Urtica dioica* L), alder *Alnus glutinosa* (L.) Gaertn), birch (*Betula* sp) and bramble (*Rubus* sect 2 Glandulosus Willm and Grab.) were all represented. The presence of common nettle might tentatively suggests some disturbed ground and the alder, birch and bramble may have been growing in a fen carr. Seeds from common sedge (*Carex* cf *nigra* (L) Richards), fine-leaved water-dropwort (*Oenanthe*

cf aquatica (L.) Poir) and sedge (*Carex* sp.) were identified in this sample. Greater pond sedge grows in wet meadows and swamps by ponds and streams, fine-leaved water-dropwort in seasonal ditches or ponds (often drying up in summer) and common sedge grows in a wide range of wet basic or acidic places especially on marshes and in flushes.

Borehole OA20 (Table 10)

The two samples analysed from OA20 at depths of 7.45-7.60m and 7.60-7.73m came from an organic layer described as firm spongy, crumbly silty peat with wood inclusions, the latter becoming less abundant in the lower sample. This layer was 0.40m thick. There were very few seeds from dryland plants recorded in this peat except for occasional seeds of fat-hen and blackthorn (*Prunus spinosa*). The rhizomes of cf *Phragmites australis* (common reed) were identified in both samples. There were some seeds of lesser spearwort (*Ranunculus flammula*), which grows in all types of wet places, and gipsywort (*Lycopus europaeus*), which today is found growing in fens, wet fields and river and lake banks. Neither species is associated with marine or brackish conditions, although common reed grows in a range of wet places it is also found on the edges of salt marsh or estuarine situations, so tentatively this could be evidence of brackish conditions.

Although the dataset from the analysis of the waterlogged plant remains is very restricted it does suggest changing environmental conditions with salt marsh locally present at a depth of 11.38-11.43m at this location. Later the plant remains in OA20 suggest freshwater conditions, although as mentioned above common reed can grow on the margins of salt marsh and in estuarine conditions. The plant remains in the upper organic layer of OA06 are clearly freshwater. The dates (see Table 2) from the two boreholes suggest that the organic layer from OA20 chronologically lies between the upper and lower organic layers in OA06.

The large numbers of fragments of wood in the samples from both the boreholes may suggest some locally growing woodland and at 6.77-6.90m in OA06 this may indicate the formation of fen car. Because of the cores were taken through alluvial and marine deposits the wood may have been redeposited from further upstream. In summary, although the dataset is small it has suggested changes in the environment from marine/brackish to freshwater conditions in the sediment sequences.

4.3.3 Diatoms

Borehole OA06 (Figures 22 and 23)

Eleven samples were prepared for diatom analysis from between 11.82m to 4.57m depth in the OA6 borehole sequence. Diatoms are absent from the slides prepared and examined from 6.89m depth, and in the samples at 11.43m, 11.52m and 11.80m depth. The samples at 6.89m and 11.43m depth are peats; it is often found that diatom silica dissolution in peat results in the loss of diatom assemblages.

The seven diatomaceous samples were analysed for diatoms and the results of diatom counting are presented in a diatom species percentage diagram (Figure 22) and in a summary diagram showing the percentages of the diatom halobian groups (Figure 23).

The three basal samples in the OA06 sequence are dominated by polyhalobous (41-43% of the total diatoms), polyhalobous to mesohalobous (8% of the total diatoms) and mesohalobous (26-37% of the total diatoms) diatom halobian groups. Oligohalobous indifferent taxa comprise 9-16% of the total diatoms. The dominance of the former marine and estuarine halobian groups is consistent with the evidence from foraminifera (report of J. Whittaker) which indicates in this section of the borehole: " brackish creeks and tidal flats with, latterly, some development of fringing saltmarsh". Here the diatom assemblages are dominated by a mixture of marine and brackish water taxa; the allochthonous marine diatoms include taxa such as *Cymatosira belgica*, *Paralia sulcata* and *Rhaphoneis* spp. Estuarine taxa include the planktonic species *Cyclotella striata* along with benthic diatoms such as *Nitzschia granulata, Nitzschia navicularis, Nitzschia punctata* and *Diploneis didyma*. At 8.85 m depth in the sequence the oligohalobous indifferent diatom *Fragilaria pinnata* reaches a maximum. However, this species is notable for having a broad salinity tolerance and its expansion is usually indicative of disturbed or rapidly changing habitats. The mesohalobous, attached species, *Achnanthes delicatula*, which also increases to a maximum at 8.85 m, may reflect the expansion of saltmarsh macrophytes suitable for epiphytic diatom growth.

In the three levels analysed between 7.88m to 6.58m depth in OA06 there is an increase to a maximum percentage of mesohalobous diatoms at 7.38m depth (74% of the total diatoms) followed by a maximum of polyhalobous taxa at 6.58 m depth (63% of the total diatoms). Halophilous and oligohalobous indifferent taxa form less than 5% of the assemblages in these three samples. The polyhalobous taxa in these samples are dominated by *Paralia sulcata, Cymatosira belgica* and *Rhaphoneis* spp. It is notable that the benthic mesohalobous diatoms *Nitzschia granulata* and *Nitzschia navicularis* are most abundant at 7.38m and 7.86m depth. These benthic taxa are epipelic (mud-surface) diatoms and their abundance probably reflects the development of estuarine mudflats.

In the top sample at 4.57m depth there is a recovery in the total percentage of oligohalobous indifferent taxa (29% of the total diatoms) which are again represented mainly by salinity tolerant *Fragilaria* spp. such as *Fragilaria pinnata* and *Fragilaria brevistriata*, but also with the presence of freshwater epiphytes such as *Cocconeis placentula*. The percentage of mesohalobous diatoms decreases to 15% of the total diatoms, with very low numbers of epipelic taxa such as *Nitzschia navicularis* and *Nitzschia granulata*. The most common mesohalobous species at 4.57 m depth is the estuarine planktonic species *Cyclotella striata*. Polyhalobous diatoms remain dominant but decrease to 42% of the total diatom assemblage. This marine component is again comprised mainly of allochthonous planktonic diatoms such as *Cymatosira belgica, Campylosira cymbelliformis, Paralia sulcata, Rhaphoneis minutissima, Rhaphoneis surirella* and the polyhalobous to mesohalobous species *Actinoptychus undulatus*. In this top part of the OA6 sequence Whittaker reports that the foraminifera indicate "saltmarsh, tidal flats and brackish creeks" following a phase of rising sea level. The diatom assemblage which has salt-tolerant and allochthonous freshwater taxa and shows a decline in epipelic, mesohalobous species is consistent with the inferred development of brackish creeks and saltmarsh. The environment indicated from diatom analysis is tidal, and the diatom evidence is not consistent with a freshwater habitat at the site of sediment deposition.

The diatom assemblages in the basal section of borehole OA06 are dominated by marine and brackish water, estuarine taxa. The diatom halobian groups and habitat

preferences (allochthonous marine, brackish planktonic and benthic epipelic taxa) are consistent with tidal creek and mudflat habitats with the latter growth (8.85m depth) of epiphytic mesohalobous and broad salinity tolerance oligohalobous indifferent taxa which may reflect habitats provided by saltmarsh macrophytes. In the overlying section of the sequence there appears to have been the development of an estuarine mudflat diatom community (maximum at 7.38 m depth). This is followed at the top of the sequence by a diatom assemblage including salt-tolerant freshwater taxa and a decline in epipelic, mesohalobous species. This is consistent with the habitats of brackish creeks and saltmarsh.

Borehole OA11 (Figure 24 and 25)

Ten samples were prepared for diatom analysis from between 14.92m and 3.01m depth in the OA11 borehole sequence. Diatom assemblages are present in all ten of these samples and the slides have been analysed for diatoms. The results of diatom counting are presented in a diatom species percentage diagram (Figure 24) and in a summary diagram showing the percentages of the diatom halobian groups (Figure 25).

In the lower nine samples 14.92m depth to 3.89m depth of the OA11 sequence polyhalobous diatoms are dominant and comprise 68-81% of the total diatom assemblage; declining to 41% in the top sample (3.01m depth). These polyhalobous species are allochthonous marine diatoms and include a number of mainly planktonic species: *Cymatosira belgica, Paralia sulcata, Rhaphoneis minutissima, Rhaphoneis amphiceros, Rhaphoneis surirella, Thalassionema nitzschiodes, Campylosira cymbelliformis* and *Odentella aurita*. Benthic polyhalobous taxa such as *Nitzschia panduriformis* and *Trachyneis aspera* are also present but are less abundant than the planktonic and semi-planktonic marine species. Polyhalobous to mesohalobous species include the planktonic diatom *Actinoptychus undulatus* and the attached species *Cocconeis scutellum*.

The total percentage of mesohalobous diatoms in the five samples from 14.92m depth to 11.94m depth in OA11 increases from 10% at the base to a maximum of 23% at 11.94m depth. Relatively high percentages of mesohalobous diatoms (18%) are maintained in both of the two succeeding samples at 9.01m and 7.02m depth; declining respectively to 12% and 11% of the total at 5.05m and 3.89m depth. The diatom taxa composing the mesohalobous group in the nine samples between 14.92 m and 3.89 m depth are a mixture of planktonic (*Cyclotella striata*), benthic (*Diploneis aestuarii, Diploneis didyma, Nitzschia punctata, Nitzschia granulata, Nitzschia navicularis, Gyrosigma balticum*) and attached (*Achnanthes delicatula*) species. Halophilous and oligohalobous indifferent diatoms form a relatively small component of the diatoms assemblages throughout the OA11 sequence; reaching a maximum of combined maximum of 6% at 3.89m. Taxa with broad salinity tolerance such as *Navicula cincta, Fragilaria pinnata* and *Fragilaria construens* var*. venter* are the most common diatoms in these two halobian groups.

At the top of the borehole OA11 sequence, at 3.01m depth, the percentage of oligohalobous indifferent taxa remains low (3%) and halophilous species are absent. However, the cumulative total of polyhalobous diatoms declines to a minimum of 41% (*Cymatosira belgica* declines from a maximum of 35% in the underlying sample to a minimum of 4%) whilst the polyhalobous to mesohalobous, and mesohalobous halobian groups increase to maxima of 8% and 43% respectively. Within the

dominant mesohalobous group at 3.01m depth benthic, epipelic taxa are the dominant habitat group (e.g. *Caloneis westii, Diploneis didyma, Nitzschia punctata, Nitzschia granulata*; and particularly *Nitzschia navicularis,* which comprises 25% of the diatom assemblage in the top sample).

The foraminifera and ostracod assemblages of the interval between 3.51/3.53m and 15.15/15.17m depth have been interpreted as representing open estuarine mudflats with protected creeks and saltmarsh (see above). The fauna show strong marine influence with rising sea-level, only waning latterly (also evidence of reworked, probably Devensian the freshwater material). The diatom assemblages are consistent with this reconstructed sedimentary environment. However, there is no clear evidence for reworked earlier diatom material and the presence of oligohalobous indifferent diatom taxa is limited to a low percentage of opportunist taxa with broad salinity tolerance. As discussed above, the change in the top part of the diatom sequence, where the assemblages shift from the dominance of planktonic marine diatoms to a greater number of benthic mesohalobous, estuarine taxa, indicates a change in the source diatom communities. There is an increase in the contribution of mud-surface diatoms to the sediment record. This change in the diatom assemblage which is found in the top sample coincides with the evidence from agglutinating foraminifera, indicating the development of mid-high saltmarsh. However, the diatom assemblage indicates an environment which is strongly saline and tidal, and there is no development of a diatom community with species having restricted freshwater growth optima that would indicate a freshwater sedimentary environment.

The diatom assemblages of OA11 are dominated by polyhalobous plankton with an increasing (to 11.94 m depth) and then consistent input of mesohalobous taxa (to 3.89 m depth) from various habitats. The top sample is an exception where there is a significant increase in the proportion of mesohalobous, and polyhalobous to mesohalobous halobian groups. Epipelic, mud-surface mesohalobous species are dominant within the top assemblage (3.01 m depth) and occur at the same time as foraminiferan data that suggest a middle to high saltmarsh environment.

4.4 Artefacts and larger ecofacts

Samples from 4.80-4.90 m and 4.90-5.0m in borehole OA06 both produced small fragments of burnt clay or briquetage together with fragments of shell, crab carapace and animal bone, including a water vole *Arvicola terrestris* tooth in the sample from 4.90-5.0m and a small (vole-/mouse-sized) phalanx from 4.80-4.90 m. Taken together these remains indicate that this silty clay deposit contained some human-derived material, probably washed in, while the water vole is likely to have been resident in the lower reaches of a freshwater river or a reed-fringed brackish lagoon.

5. AN INTEGRATED LANDSCAPE HISTORY FOR THE SITE

The assembled evidence from the site provides us with a complex set of information that when taken together provides a robust model for site development. This information can be used to examine the evidence for spatial diversity within sequence development and the nature of lateral variability in landscape elements. The topographic projection for the bedrock surface (Figures 9, 10 and 15) indicates that two discrete gravel bodies are likely to exist beneath the Holocene alluvium at the site. The evidence for this consists of a lower bedrock surface at c.-25m O.D. and a higher one around -15m O.D. (Figure 15). On the basis of the long profiles provided by Gibbard (1994, see Figures 37 and 48) it appears probable that the higher of these surfaces is overlain by sediments associated with the East Tilbury Marshes Gravel while the lower surface is associated with sediments associated with the Shepperton Gravel. These are Middle and Late Devensian in age respectively.

The origin of the topographic features associated with the gravel surface topography (Figures 9 and 11) is difficult to determine. For example the long arcing feature between boreholes OA06 and OA12. This surface, whatever its origins, and that of the bedrock where no Pleistocene sediments have accumulated (Figure 26), represents the early Holocene topographic template (*sensu* Bates and Whittaker 2004). The shape of this surface has dictated the patterns of sedimentation during and after the onset of sedimentation in the Holocene. This feature is shown for example to divide the geophysical data into two different zones (Figure 12) and it is commonly the case that the highly laminated sediments illustrated in Figure 14B/C are all associated with boreholes taken to the south or east of this arcing feature.

In order to understand the data the modelled gravel surface topography (Figure 11) has been taken in conjunction with the modelled age estimates for Holocene sedimentation onset (*sensu* Bates and Whittaker 2004; see background curve in Figure 20) to produce a series of maps showing palaeogeographic change in the area between 8.5 and 6 ka B.P. The succession of topographic change following inundation in the Holocene is shown for successive 2 m intervals (Figure 27). Comparison of these models with the radiocarbon dates provided by this study and the associated palaeoenvironmental data from the microfossils (Tables 3-9) suggest that while in some cases the model is supported in other cases there are discrepancies between the model and the evidence. For example in Figure 20 some of the key dates for onset of sedimentation at the site are predicted (red dotes based on the model of Bates and Whittaker 2004) and the actual ages plotted in green. In some cases there appears to be good agreement between the real and the predicted in other cases there is considerable discrepancy.

Organic sedimentation under freshwater conditions (Fr in Figure 20) is noted in a number of boreholes and the age estimates for these events ranges from 8985+/-35 BP in OA14/15, through 8526+/-23 B.P in OA20 to 7007+/-23 B.P in OA06. The accumulation of this organic material is consistent with similar patterns throughout the lower Thames (Devoy, 1977, 1979, 1982; Bates and Whittaker, 2004; Bates and Stafford *in prep*.) and represents the infilling of hollows in the topographic template with material in some instances resulting from the backing up and ponding of water resulting from gradual onset of marine conditions further down the catchment. No significant palaeoenvironmental remains have been recovered from these deposits although some evidence from the limited plant macrofossils suggests brackish conditions encroaching in OA06 at this time.

The onset of brackish or marine conditions has also been documented and can be compared with the dates provided by modelling and topographic projection in the study area (Figure 26). It is interesting to note that in some cases (e.g. OA12) where the onset of brackish sedimentation has been dated to around 8085+/-55 BP the model would suggest the onset of sedimentation should have been delayed until after 7.2 ka BP. In other places (e.g. in OA11 and OA20) accumulation of sediments appear to have been delayed (in OA11 sedimentation appears to be first documented around 6080+/-50 BP while the model indicates that brackish conditions should have been encountered around 7.8 ka BP; in OA20 brackish conditions are first encountered around 6505+/-35 B.P. as opposed to 7.8 ka B.P. indicated by the model). The reasons for the differences between the model and the reality may be a function of the detailed modelling parameters, difficulties in modelling the scales of reconstruction (i.e. it is possible that the topographic template modelled through the geophysics is too coarse to reflect the reality of a single borehole such as OA12). In other situations in is possible that erosion may have removed evidence for the earliest phases of deposition on the topographic template or alternatively that the area was not subject to deposition around this time.

Following the onset of sedimentation on the topographic template a complex history of shifting environments of deposition have been identified from the fossil data and the sediments (Figures 21, 28 and 29). The local environments of deposition have been summarised from the combined microfossil data (foraminifera, ostracods and diatoms) and the results are summarised in Figure 28. The spatial distribution of these environments based on the boreholes is shown in Figure 29. In Figure 29 the spatial distribution of different local environments is shown (each square represents an individual borehole) across the site. This is shown spatially in Figure 30 as an attempted palaeogeographic reconstruction.

The five sliced landscapes (Figures 29 and 30) indicate the following:

1. 8-9ka B.P. The landscape is dominated by dry ground topography with freshwater deposition occurring in a localised basin, perhaps beginning to be influenced by brackish water towards 8k. Some pockets of sedimentation may be occurring in large ponds or small lake basins in this landscape. At this time woodlands developed and archaeological finds are likely to comprise occasional artefacts and ecofacts (some reworked) associated with sporadic human activity close to the channel and basin margins (see Bates and Whittaker 2004).

2. 7-8ka B.P. Dry ground still exists as a series of interconnected ridges in the landscape that is now dominated by tidal mudflats, creeks and salt marshes encroaching through the remnant valley forms of the topographic template. Some marine influence is noted in places. Probable high energy conditions associated with strong tidal regimes is likely along the eastern boundary of the site. Again any human activity is likely to have been sporadic and confined to the higher ground. Pollen evidence from borehole ARC7 discussed in Bates 2003a indicates the presence of woodland locally, comprising principally oak but also alder, hazel, lime and elm. The presence of charcoal in borehole OA06 suggests clearance, although whether by humans or lightening strike can not be confirmed.

3. 6-7ka B.P. Dry ground remains throughout the site as a series of island type features separated by now extensive tidal mudflats and creeks. Charcoal within boreholes OA06 and OA20 suggests some landscape clearance, possibly by humans.

4. 5-6ka B.P. Only a few isolated remnants of the former dry ground now exist as isolated islands in the marshes. Wetland conditions are dominated by creeks, mudflats and salt marshes. Locally marine influences are also important. Peat in OA06 yielded plant remains suggestive of fen carr and disturbed ground. Human exploitation of the marshes is likely but may leave little in the way of archaeological evidence.

5. 4-5ka B.P. All former dry ground has disappeared from the main site area resulting in a low relief landscape of marshes, creeks and mudflats with high energy conditions dominating to the east with strong marine influences. The presence of reworked fossils in these deposits demonstrates the increased erosive power associated with these sequences. Any evidence for human activity is likely to be confined to the north and western part of the study area.

6. CONCLUSIONS

This investigation has demonstrated that an integrated approach to the investigation of a deeply buried site, in which conventional archaeological approaches to investigation are inappropriate, can succeed and provide useful information. The work has demonstrated that:

1. Use of boreholes alone rarely provides sufficient information to adequately model subsurface topographies without the application of other techniques to infill gaps between borehole locations (Figure 31).

2. Where sufficient numbers of boreholes exist an integrated geophysical and borehole survey can produce a detailed ground model.

3. Significant levels of compatibility can be demonstrated between the boreholes and the geophysics. For example it was noted (Figure 12) that the Holocene alluvium exhibited lower conductivities beyond the arcing ridge separating the two halves of the site and that it was only in those areas of lower conductivities that the laminated sands were noted. This is supported by the plot of the distribution of all boreholes in which sand is a significant component of the sediment (Figure 32).

4. The model of Bates and Whittaker (2004) is not always a reliable guide to the timing of the onset of sedimentation on the early Holocene topographic template. Significant temporal lags have been noted between predicted and actual timing of onset of sedimentation that probably reflect periods of non-deposition or erosion rather than errors in the actual timing of flooding of the surface.

5. Considerable spatial variability in local environments of deposition within the marshes has been demonstrated. These spatial variations will have significant impacts on the nature of resource distribution in the past and

hence are of considerable important in considering archaeological potential and human use of these landscapes in the past.

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APPENDIX 1. GEOPHYSICS: QUALITY ASSURANCE

Quality assurance of the ABEM Terrameter instruments was achieved by calibration prior to field deployment and re-calibration at the end of the project. Calibration of the instrument is achieved using a resistivity test box with known resistances.

In the field the electrodes were located along the survey lines at fixed distances based on the position of the electrical connections on individual cables. Electrical connections are fixed at 5m. Each cable was positioned using the field grid surveyed over the site by Oxford Archaeology. Where deviations from the line were necessary the electrode locations were surveyed using GPS.

APPENDIX 2. GEOPHYSICS: NOISE

In electrical resistivity surveying noise is generally experienced of two forms; electrical noise and ground disturbance noise.

Electrical noise is derived from electrical sources other than the resistivity instruments such as grounded power lines, electrical fences, earthed electrical generators. The noise is recognised in the final data by exceptionally large variations in resistivity in the very near surface and can be easily recognised as such and removed during data processing. The London Gateway site is relatively free of these noise sources as the plant is largely inactive.

Ground Disturbance noise is experienced where the near surface has been altered from its natural condition, i.e. is made ground. This was the case over much of the site since it is an old industrial plant. Ground disturbance consisted of areas of man-made fill, old concrete slab, roadways and rubble mounds. The majority of these features did not unduly affect the resistivity measurements as electrodes could be deployed through the features however the large rubble mounds necessitated the occasional divergence of the survey lines in order to deploy the electrodes. Where this was the case the new electrode locations were measured and the survey line resumed after passing by the disturbance. Degradation of the near surface is manifest within the data as rapid and large fluctuations in apparent resistivity. However, the affect of the near surface made ground was not significant below the first 2-4m depth as the resistivity method chosen for this project (where the target horizons are up to 20m deep) with an electrode spacing of 5m is not suited to surveying from 0-3m. The minor influence of this noise on the part of the sections below approximately 4m can also be noted in comparisons of the data acquired along longer resistivity lines that extend beyond the limits of the refinery site, in particular onto the farm land in the Northwest.

APPENDIX 3. BOREHOLE LOGS FOR BOREHOLES OA1-21.

Borehole OA01

INT	OA01		
E	570791.45		
N	181600.81		
GL mOD	2.24		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.50	Silty sand	Dark brown gravelly topsoil. Gravel is fine subangular **MADE GROUND** (driller description).
			At 0.20 (B2): Mixed deposit of yellowish brown (2.5Y 5/2) silty clay with orange and light bluish grey mottles, and black sandy clay with 50% slag inclusions, pebble sized.
0.50	1.50	Gravelly silty clay	Brown/mottled and grey/mottled orange brown clay with gravel and cobble sized fragments of brick and clinker and occasional pockets of ash **MADE GROUND** (drillers description).
			At 0.50 (B4): Dark greyish black (N2.5/2.5), loose crumbly, gravelly silty sand. Gravel is poorly sorted subangular pebbles and bricks (10%).
			At 0.90 (B6): Mixed brown (2.5Y 4/1) and light bluish grey (5B 6/1) silty clay with orange mottles, soft and plastic, sticky, with blackish humic gritty silty sand, small pebbles and brick fragments.
1.50	3.00	Silty clay	Firm brownish grey clay with rootlets. At 1.50m smashed jar (drillers description).
			At 1.50 (B10): Greyish brown (10Y4/1) moderately soft, plastic, sticky, moist, massive, silty clay, 1% gritty coarse sand.
			At 2.00-3.00 (B11): Greyish brown (10YR 4/1), massive, plastic, soft sticky silty clay.
			Below this depth piston samples
3.00	3.40	VOID	**VOID**
3.40	5.13	Silty clay	At 3.40-3.58 (P13): Dark greyish brown (10Y4/1), light brown mottles, very soft, plastic, silt clay, massive. Fine blackish flecks 3.40 to 3.50, distinct basal boundary.
			At 3.58-3.99 (P13): Dark grey (2.5Y4/1) soft, plastic, small sand lenses common (30%) occasional small blackish organic detritus and white shell fragments.
4.00	4.70	VOID	VOID
4.70	4.98		At 4.70-4.98 (P15): Dark greenish grey soft, sticky silty clay, massive with sandy patches (5-10%). Intact shell 1% present.
5.00	5.27	VOID	VOID
5.27	5.39		At 5.27-5.39 (P17): Dark greyish brown 2.5Y4/1 mottled massive very soft, plastic silty clay few small fine sand lenses (10%). Clear basal boundary.
5.39	6.57	Clayey silt	At 5.39-5.98(P17): Mid bluish grey N 4/- soft plastic sticky clayey silt, fine sand lenses (30mm thick) at regular intervals (20 to 50mm), rare fine fragments of shell above 6.30, many fine to medium shell fragments 6.30- 6.40m.
6.00	6.27	VOID	VOID
6.27	6.40		At 6.27-6.40 (P19): Mid bluish grey N 4/- soft plastic sticky clayey silt, fine sand lenses (30mm thick) at regular intervals (20 to 50mm), rare fine fragments of shell above 6.30, many fine to medium shell fragments 6.30- 6.40m. Clear basal boundary.
6.40	6.57		At 6.40-6.57 (P19): Mid bluish grey (10B4/1) soft, plastic, sticky, clay siltoccasional shell up to D. 25mm, small brown organic fragments (eroded peat?) 5 to 10%. Abrupt basal boundary.

INT	OA01		
E	570791.45		
N	181600.81		
GL mOD	2.24		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
6.57	6.89	Peat	At 6.57-6.89 (P19): Very dark reddish brown 5YR2.5/1, dark reddish brown 5Y3/2 between 6.68 to 6.83m, dark greyish brown 5Y3/1 below 6.83 with very fine light yellowish brown sometimes broken bands and lenses, firm, massive, large pieces of wood up to 80mm L. Abrupt basal boundary. Peat
6.89	8.56	Silty clay	At 6.89-6.98 (P19): Light bluish grey (10G5/1) soft, very plastic, very sticky, slightly silty clay, organic detritus (15%), small yellowish brown particle and many blackish flecks.
7.00	7.27	VOID	VOID
			At 7.27-7.96 (P21): Dark greenish grey (5GY4/1) occasional bluish grey mottles or stratified bands of diffuse bluish grey, very fine black flecks (15%) at 7.27 to 7.78m, very soft, moist, plastic, sticky, massive, two thin (2mm) sand layers at 7.40 and 7.42m.Frequent small blackish brown organic patches at 7.30 to 7.36 and 7.55 to 7.67 (10%), Lighter, more bluish below 7.78 with many small fine sand lenses (20%).
8.00	8.38	VOID	VOID
			At 8.38-8.56 (P22): Greyish brown 5GY 5/1 soft silty clay with small fine sand inclusions above 8.38-8.44. Occasional very fine blackish flecks. Diffuse lower boundary.
8.56	9.75	Clayey silt	At 8.56-9.00 (P22): Dark bluish grey (5B 4/1) soft silt, slightly clayey. Very fine sand inclusions, below 8.30m BGL gradually increasing towards base. Very fine blackish flecks common (15%). Occasional small blackish organic inclusions (3%) below 8.90m.
9.00	9.46	VOID	VOID
			At 9.46-9.55 (P24): Grey with light blue (5B 5/1) diffuse mottles. Soft slightly sandy, slightly clayey silt. Fine lenses of fine sand. Structureless. Small blackish (organic) inclusions (3%). Diffuse lower boundary.
			At 9.55-9.75 (P24): Bluish grey (5B 4/1) with occasional small light bluish grey mottles (2%). Firm clayey silt, with small lenses of fine sand. Occasional small blackish organic (1%), inclusions. Abrupt lower boundary.
9.29	10.00	Silty clay	At 9.75-10.00 (P24): Dark grey (10G 4/1) with fine light bluish grey mottles. Firm silty clay and dark Grey lenses of sandy silt (50%). Sand is very fine. Softer, moister and less sandy towards base.
10.00	10.24	VOID	VOID
10.24	10.34	Sandy clayey silt	At 10.24-10.34 (P26): Greyish brown (2.5Y 4/1) firm clayey sandy silt. Sand is fine, mica present. Structureless. Occasional very fine organic flecks. Abrupt lower boundary.
10.34	10.49	Sandy clayey silt	At 10.34-10.49 (P26): Bluish grey (N 4/) with small distinct greyish brown mottles. Soft sandy (fine sand) clayey silt. Structureless. Sharp lower boundary.
10.49	10.84	Silty clay	At 10.49-10.84 (P26): Light bluish grey (10GY 4/1) soft silty clay, organic detritus at top above 10.34mBGL, occasional detritic inclusions below. Clear lower boundary.
10.84	10.88	Sandy silt	At 10.84-10.96 (P26): Dark grey slightly clayey sandy silty with 30% organic fragments included. Clear lower boundary.
10.88	10.96	Peat	At 10.88-10.96 (P26): Dark brown (5YR 2.5/1) firm, moderately dry (compacted) peat, with frequent fine (1mm) light yellow broken bands (wood/sand?). Abrupt lower boundary.
10.96	11.00	Clayey sand	At 10.72-10.85 (P26): Light greenish grey (2.5Y 4/1) firm fine clayey sand. Mica and fine white shell fragments present.
11.00	11.70	VOID	VOID
11.70	12.00	Silty clay	At 11.00-11.30 (P28): Greenish brown (10Y 4/1) mixed with dark grey (5B 4/1) 50% soft slightly sandy silty clay. Sand is medium to coarse. Few flecks of blackish organic matter and marine shell included.

INT	OA01		
E	570791.45		
N	181600.81		
GL mOD	2.24		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
			Below this depth bulk spot samples
11.50		Gravel	At 11.50 (B31): Dark brownish grey (10Y 4/1) gravel with near liquid sandy clay (10%).Small to large mainly angular, some rounded to well rounded (20%) pebbles of flint.
12.00		Gravel	At 12.00 (B33): Gravel, moderately sorted, small to large, rounded to subangular pebbles of flint. .
13.00		Gravel	At 13.00 (B35): Gravel, moderately sorted, small amount of dark greyish brown (2.5Y 3/2) sandy clay (2-5%). Mainly small angular to subangular pebbles (65%) some medium to large, rounded to subangular pebbles of flint.
14.00		Gravelly sand	At 14.00 (B37): Gravelly sand (40/55), yellowish brown (2.5Y 5/3), poorly sorted. Medium to fine sand. Small to large, subangular to rounded flint pebbles (45%).
15.00		Sandy gravel	At 15.00 (B39): Sandy gravel (50/50). Yellow (2.5Y 6/4) loose, very moist, coarse to medium sand. Small to large rounded to angular pebbles of flint. Poorly sorted.
16.00		Sandy gravel	At 16.00 (41): Sandy gravel. Brown (10YR 4/6) loose, moist, medium to fine sand. Small to large mostly subangular pebbles of flint. Poorly sorted.
17.00		Sandy gravel	At 17.00 (B43): Yellowish brown (2.5Y 5/4) sandy gravel. Moderately wet fine to coarse sand (40%). Small to large pebbles (50%) angular to rounded and small angular cobbles (10%) of flint. Poorly sorted.
18.00		Gravelly sand	At 18.00 (B45): Yellowish brown (10YR 5/6) gravelly sand, very moist. Fine to medium sand (60%). Small angular pebbles (30%) and medium to large subrounded pebbles (10%). Occasional medium size rounded pebbles (2-5%). Poorly sorted.
18.30		Clayey sand	At 18.30 (B47): Yellow (5Y 5/8) wet, moderately firm very fine, slightly clayey sand, massive. Mica present. No coarse inclusions. Very well sorted.
19.30		Clayey sand	At 19.30 (B50): Yellow (5Y 5/3) wet, very fine, slightly clayey sand, massive. Mica present. No coarse inclusions. Very well sorted.

Borehole OA02

INT	OA02		
E	571095.38		
N	181604.23		
GL mOD	2.24		
TD	25.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.10	Silty clay	**Topsoil** (drillers description)
			At 0.10 (B2): Dark reddish brown (7.5YR 3/2), Stiff fine roots present. Few (5-10%) small white mineral inclusions (weathered limestone?). No other coarse inclusions.
0.10	0.90	Gravelly sandy clay	Firm red brown occasionally mottled orange brown slightly gravelly sandy clay. Gravel is subangular to subrounded fine and medium of flint, chalk and brick. Frequent rootlets (drillers description). **MADE GROUND**
			At 0.90 (B4): Mid brown (10YR 4/2) firm silty clay, mixed with lenses of loose dark reddish brown (7.5YR 3/2), organic rich silt (from topsoil).

INT	OA02		
E	571095.38		
N	181604.23		
GL mOD	2.24		
TD	25.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.90	1.20	Sandy clay	Firm brown mottled orange blue grey sandy clay, sand is fine and medium. Occasional pockets of orange fine sand and silt. Occasional rootlets (drillers description).
			Below this depth piston samples
1.20	1.91	VOID	VOID
1.91	5.00	Silty clay	At 1.91-2.2 (P5): Light bluish greenish grey (10Y 5/1) with yellowish brown mottling (10YR 5/8) and fine to medium concretions of mineral iron (Fe) 2% included. Soft, moist, silty clay, rare organic inclusions, small blackish flecks (1%).
2.20	2.38	Void	VOID
			At 2.38- 3.00 (P7): Dark brownish grey (5Y 4/1) with diffuse bands of slightly darker sediment. Soft, moist, silty clay, occasional lenses of fine sand, black fibrous vertically aligned organic inclusions (2%).
3.00	3.26	VOID	VOID
			At 3.26-3.70 (P10): Dark greyish brown (2.5Y 4/1) with bands of slightly darker sediment (mid greyish brown 2.5Y 4/1 to 2.5Y 5/1) with very fine blackish flecks (1%). Soft, massive ,moist, silty clay, occasional detritic organic inclusions. Diffuse basal boundary.
			At 3.70-4.00 (P10): Mid greenish grey (5GY 4/1 to 5GY 5/1), soft, moist, silty clay, weakly stratified by few thin broken wavy fine sand layers (1 to 2mm), few fine sand inclusions.
4.00	4.30	VOID	VOID
			At 4.30-5.00 (P12):Mid brownish grey (2.5Y 4/1) soft, massive, silty clay, weakly stratified by thin bands of fine sand and zones of fine sand inclusions black fibrous vertically aligned organic inclusions (2%).
5.00	5.29	VOID	VOID
5.29	6.57	Laminated silty clay	At 5.29-6.00(P14): Dark greenish grey (5GY 4/1 to 5GY 5/1) with bands of light greenish grey (2.5GY 5/1) and dark grey to (N4/) soft, slightly wet silty clay, stratified by broken or continuous laminations of fine sand (0.25 to 3mm), rare fine blackish flecks (1%).
6.00	6.21	VOID	VOID
			At 6.21-6.45 (P16):Light grey (N 4/ to N 5/) soft silty clay laminated with very fine dark grey fine silty clay and fine sand intervals (1 to 4mm). Abrupt basal boundary.
			At 6.45-6.47 (P16): Greyish brown (5GY 4/1) soft silty clay with many yellowish brown 5Y 5/3 sand inclusions and small very dark brown organic clasts included. Abrupt boundaries.
			At 6.47-6.57(P16): Dark and mid grey (N 3/ and N 4/), changes quickly to light grey after exposure to air, separated by thin dark bed at 6.33. Soft massive silty clays, structureless. Clear basal boundary.
6.57	8.00	Laminated silty clay and organics	At 6.57-6.58 (P16): Very dark blackish brown (10YR 2.5/1), soft to spongy organic layer, laminated with soft light grey silty clay. Clear boundary.
			At 6.58-7.00 (P16): Very dark grey (N2.5/ and mid grey N3/) soft, silty clay, weakly stratified, diffuse and abrupt changes of colour, occasional very fine sand beds, shell fragments at 6.61 in fine sand bed.
7.00	7.14	VOID	VOID

INT	OA02		
E	571095.38		
N	181604.23		
GL mOD	2.24		
TD	25.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 7.14-8.00 (P18): Very dark greenish grey (5BG 3/1) and dark greenish grey 5GY 4/1 clearly distinguish bands, moist, soft, silty clay, stratified, frequent lamination with fine sand, two 20mm beds of greenish grey silty clay with 3% marine shell fragment, blackish flecks of organic material common 2%.
8.00	8.23	VOID	VOID
8.23	8.47	Silty clay	At 8.23-8.47 (P20): Mid greenish grey (5GY 4/1), soft, structurless silty clay, dark brown to blackish, very fine to small organic inclusions. One dark and one light grey band (10mm each) above clear basal boundary.
8.47	8.75	Organic silt	At 8.47-8.75 (P20): Dark brown (5Y 2.5/1) change to very dark blackish brown (darker than 5Y 2.5/1). Soft, massive, organic rich silt, few fine sand inclusions (10%). Inclusions: light bluish clay clasts 2% and organic detritus (wood?). Diffuse basal boundary. Possible soil horizon.
8.75	10.38	Sandy silty clay	At 8.75-9.00 (P20): Mid yellowish brown (2.5Y 4/1, 75%) and dark brownish grey (2.5Y 3/1, 25%) with very dark blackish brown (darker than 5Y 2.5/1) mottling from top to base. Soft to moderately firm, structureless, sand silty clay, Inclusions: organic detritus 2%. Diffuse basal boundary. Alluvium / Possible soil formation ?
9.00	9.21	VOID	VOID
			At 9.21- 10.00 (P23): Olive grey (5Y 5/2) moist soft clayey silt with small amount of fine sand. Fine blackish organic remains (3%), sometimes vertical (roots) and very few coarse inclusions above 9.65mBGL. Below 9.65m increasing small amounts (up to 3%) of sand grains and small pebbles and yellowish white hard fine sediment clasts (5%) and rare fine blackish organic remains (1%).
10.00	10.24	VOID	VOID
			At 10.24-10.38 (P26): Mid yellowish brown (5Y 4/2), structureless, moderately firm sandy silty clay, few (2%) blackish mottles (30mm D.). Diffuse basal boundary.
10.38	11.00	Sandy clay	At 10.38-11.00 (P26): Light greyish brown (2.5Y 4/2 to 5/2), fine yellowish green mottles common (5 - 10%), few (2%) fine blackish mottles, structureless, firm sandy silty clay. Few (2%) fine sand inclusions more frequent (10%) towards base, medium size (30mm) yellowish white hard fine grained sediment clasts (10%) below 10.70m, occasional shell fragments
			Below this depth bulk spot samples
11.00		Clayey gravel	At 11.00-11.40 (B31): Clayey gravel (30/70), brown (2.5Y 6/4). Gravel is small to large, subangular to rounded pebbles of flint.
12.00		Gravelly sand	At 12.00-12.45 (B33): Gravelly sand (30/70), light yellowish brown (2.5Y 6/3) gravelly sand. Mainly fine sand, gravel is small to large, subangular to rounded pebbles of flint. Also stratified layers of light greenish grey (10Y 5/1) slightly silty clay.
13.00		Gravelly sand	At 13.00-13.45 (B35): Gravelly sand (40/60), yellowish brown (2.5Y 6/4) Sand is, fine to coarse. Gravel is small to large, angular to subangular pebbles of flint.
15.00		Gravelly sand	At 15.00-15.45 (B39): Gravelly sand (40//60), yellowish brown (2.5Y 6/4). Sand is fine to medium sand. Gravel is mainly small pebbles, subangular to rounded of flint and quartz.
17.00		Sandy gravel	At 17.00-17.45 (B43)L Sandy gravel (30/70), yellowish brown (2.5Y 5/4). Sand is fine to coarse, gravel is small to large, angular to subrounded pebble of flint.

INT	OA02		
E	571095.38		
N	181604.23		
GL mOD	2.24		
TD	25.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
18.00		Gravelly sand	At 18.00-18.45 (B46)L Gravelly sand (40/60), light yellowish brown (2.5Y 5/1). Sand is fine to coarse. Gravel is mainly small to medium, angular to rounded pebbles of flint.
19.00		Sandy gravel	At 19.00-19.45 (B48): Sandy gravel (30/70), yellowish brown (2.5Y 6/4). Sand is mainly coarse. Gravel is small to large, subangular to rounded pebbles of flint. Occasional pockets of greenish grey (5GY 6/1) sandy silt (fine sand).
19.50		Gravelly silty clay	At 19.50 (B50): Gravelly silty clay (20/80), firm. Dark grey (5Y 3/1 to 4/1) with mid grey (2.5Y5/1) mottles (30%). Gravel is medium, angular to rounded pebbles of flint. Occasional small pebbles and inclusions of black, brittle fine sediment, humic smell (compacted decayed peat?).
21.00		Gravelly clay	At 21.00-21.45 (B54): Gravelly (silty) clay (40/60), dark greyish brown (2.5Y 4/1). Moderately soft, contains few angular coarse sand grains. Gravel is small to large, angular to subrounded pebbles of flint..
21.60		Sand	At 21.60 (B56): Fine sand, greyish brown (2.5Y 4/1) moderately firm. Few angular coarse sand grains (3%).
23.00		Sandy clayey gravel	At 23.00-23.45 (B59): Sandy clayey gravel (20/80), greyish brown (2.5Y 4/1 to 5/1) . Gravel is small angular pebblesand medium to large rounded to well rounded pebbles.

Borehole OA03

INT	OA03		
E	571449.61		
N	181620.10		
GL mOD	1.94		
TD	26.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.20	Sand and gravel	Brown black clayey sand with gravel and cobble sized fragments of brick and clinker, roots and concentrated pockets of ash **MADE GROUND** (drillers description).
			At 0.20 (B2): Blackish sandy clay with 50% pebble size slag mixed with yellowish brown (2.5Y 5/2) firm silty clay with orange and light bluish grey mottles.
0.20	1.20	Gravel and sandy clay	Brown slightly sandy clay with gravel and cobble sized fragments of brick, pockets of ash and roots **MADE GROUND** (drillers description).
			At 0.80 (B4): Reddish brown (7.5YR 4/2), dark grey and orange patches. Firm to stiff, sandy silty clay. Small angular pebbles (5%), Slag present. Humic smell.
			At 1.20 (B6): Brown (2.5Y 4/2) greyish brown mottle, stony, firm, plastic, slightly sticky clayey silts small to large angular pebbles, iron slag included.
1.20	2.00	Silty clay	Firm brown mottled grey brown silty clay with rootlets (drillers description).
			At 1.50 (B8): Yellowish brown (2.5Y 4/2) greyish brown mottles 5Y 4/1 Soft to firm sticky, plastic, silty clay, fine clasts of firm clay, occasional small blackish plant detritus.
			Below this depth piston samples

INT	OA03		
E	571449.61		
N	181620.10		
GL mOD	1.94		
TD	26.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
2.00	2.19	VOID	VOID (compaction)
2.19	5.23	Silty clay	At 2.19-2.33 (P10): Brown (10YR 4/2) soft, moist, sticky silty clay. Few very dark brown or reddish brown organic detritic inclusions (5%), Clear irregular basal boundary.
			At 2.33-3.00 (P10): Dark greyish brown (2.5Y 4/1) soft, sticky plastic massive, structureless silty clay, moist, silty clay, few very dark brown and blackish organic detritic inclusions: (5%).
3.00	3.26	VOID	VOID (compaction)
			At 3.26-3.45 (P12): Brown (10YR 5/1) soft, plastic massive, structureless silty clay. Very dark brown and black organic slightly fibrous detritus included. Diffuse irregular lower boundary.
			At 3.45-4.00 (P12): Dark greyish brown (2.5Y 4/1) soft, plastic silty clay. Fine to coarse, up to 70mm L., vertically aligned, very dark brown organic inclusions (5-10%).
4.00	4.24	VOID	VOID (compaction)
			At 4.24-5.00 (P14): Dark greyish brown (5Y 4/1), gradual colour change to grey (2.5Y 4/1) below 4.25m. Soft, plastic massive, structureless silty clay. Fine blackish organic detritus increasing down profile from 3-5%.
5.00	5.22	VOID	VOID
			At 5.22-5.33 (P16): Brown (10YR 5/1) soft, plastic massive, strucureless, silty clay. Fine blackish detritic inclusions (2%). Clear, irregular boundary.
			At 5.33-5.45 (P16): Greyish brown (2.5Y 4/1) soft, plastic, silty clay with fine sand inclusions (flasers) and fine small organic detritus (5-10%). Sharp basal boundary.
5.23	5.63	Clayey silt	At 5.45-5.85 (P16): Greyish brown (2.5Y 4/1) with small diffuse very dark grey (N4/) mottles, soft, plastic, silty clay with clasts of clayey silt (15%). Fine blackish organic inclusions (2-3%). Inclusions of fine sand and occasional intact marine shell below 5.70m. Sharp basal boundary.
5.85	5.95	Silty sand	At 5.85-5.95 (P16): Greyish brown (5Y 4/1) silty fine sand, with mica. Sharp basal boundary.
5.95	6.38	Sandy silt	At 5.95-6.00 (P16): Dark grey (10YR 4/1) slightly clayey sandy silt.
6.00	6.24	VOID	VOID
			At 6.24-6.38 (P18): Dark greyish brown (2.5Y 4/2) with very dark grey mottles, massive structureless fine sandy silt. Mica present.
6.38	7.00	Laminated Silt	At 6.38-7.00 (P18): Very dark grey (2.5Y 4/1 to 2.5Y 3/1), silt, laminated with fine sand (mica present) in 1 to 5mm intervals. Occasional fine blackish detritic flecks (2%).
7.00	7.24	VOID	VOID
7.24	7.43	Sandy clayey silt	At 7.24-7.43 (P20): Very dark greenish grey, soft, plastic, sandy clayey silt (fine sand). Gradual change to weakly laminated sandy silt towards the base. Clear basal boundary.
7.43	8.73	Laminated sand	At 7.43-8.00 (P20):Dark greenish grey (10Y 4/1) sand laminated with brownish (10YR 4/1) greenish or bluish grey or grey (N/4) clay. 20mm thin organic rich layer (weak peat?) at 7.31 to 7.33, occasional 2mm thin organic rich beds between 7.33 and 7.62m. Occasional shell fragments.
8.00	8.22	VOID	VOID
			At 8.22-8.73 (P22): Mid Greenish grey (10Y 4/1), sand with occasional mica, finely laminated with greyish brown to dark greyish brown (N 3/) silty clay. Distinct laminations alternating with irregular or broken bedding. Structureless clayey silt from 8.24 to 8.30. Inclusions: dark reddish brown organic material from 8.41 to 8. 50mBL, occasional shell fragments, white shell fragments (2%) in sandy layer at 8.72 to 8.73.

INT	OA03		
E	571449.61		
N	181620.10		
GL mOD	1.94		
TD	26.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
8.73	11.83	Laminated silty clay	At 8.73-9.00 (P22): Very dark grey (N 3/) clayey silt with fine lenses (30%) of greenish grey (10Y 4/1) fine sand, Weak lamination visible at base
9.00	9.20	VOID	VOID
			At 9.20-9.42 (P24): Dark greyish brown, soft plastic silty clay laminated with mid greenish grey (10Y 4/1) fine sand containing mica, finely laminated. occasional black very fine organic flecks. Clear basal boundary.
			At 9.42-9.52 (P24): Dark grey to very dark grey (N3/ to N4/) soft, slightly silty, clay. Laminated with fine sand layers and two very dark grey 10mm layers at 9.45 and 9.48. Clear basal boundary.
			At 9.52-9.61 (P24): Greenish grey (5GY 4/1) soft plastic silty clay. Laminations, 3mm thick of fine sand. Clear basal boundary.
			At 9.61-9.83 (P24). Dark grey (N3/) soft, silty clay with 2mm fine sand layers at 9.48 to 9.6 and very dark grey 1-2mm (N 4/) organic rich layers at 9.48 and 9.53. Very dark grey mottles from 9.74 to base. Clear basal boundary.
			At 9.83-9.95 (P24): Greenish grey (5GY 4/1) silty clay with bands of thin laminated fine sand. Clear basal boundary.
			At 9.95-10.00 (P24): Very dark grey (5GY 3/1) soft sticky silty clay, 10 mm bluish grey (10BG 4/1) clay at 9.75, three 3mm thick fine sand layers present. Clear basal boundary.
10.00	10.18	VOID	VOID
			At 10.18-10.47 (P26): Dark greyish brown (5GY 4/1) laminated sand (40%) with 2 to 5mm thin layers of dark greyish brown silty clay. Inclusions: occasional hell, occasional small organic fragments. Clear boundary.
			At 10.47-10.75 (P26): Dark greyish brown (5GY 4/1) silty clay with occasional 1mm thin fine sand layers and zones of weak sand lamination (<1mm). 20mm thick fine sand layers at 10.49 and 10.55, organic fragments from 10.66 to 10.68. Clear boundary.
			At 10.75-10.80 (P26): Very dark blackish grey (N 3/) silty clay, occasional reddish brown organic fragments, thin greyish brown fine sand layers at top and base. Abrupt boundary. Organic rich sediment/peat.
			At 10.80-11.00 (P26): Dark greenish grey (5GY 4/1) clay, occasional very fine sand layers and zones of weak sandy lamination (1mm). Marine shell included.
11.00	11.20	VOID	VOID
			At 11.20-11.33 (P28): Dark grey (N3/ to 4/) greenish grey towards base, soft, plastic, clayey silt, structureless. fine blackish dark flecks at top. Clear basal boundary.
			At 11.33-11.66 (P28): Greenish grey (5GY 4/1) with bands of dark grey (N3/), bluish grey toward base. Few very fine black flecks. Soft, very plastic silty clay with fine sand lenses (5-10%), few 1mm thin sand layers at top. Inclusions: occasional organic fragments. Clear basal boundary.
			At 11.66--11.74 (P28): Very dark blackish bluish grey (10B 2.5/1) soft, sticky, plastic clayey silt, structureless, occasional small fine sand lenses and broken sand layers. Clear boundary.
			At 11.74-11.83 (P28): Dark grey (5BG 3/1) silty clay, small fine sand lenses and thin broken sand layers common.
11.83	12.00	Silty clay	At 11.83-12.00 (P28): Mid bluish grey (5B 4/1) to dark grey (5B 4/2) with distinct brownish grey mottles. Very fine to small organic flecks in top part.
			Below this depth bulk spot samples

INT	OA03		
E	571449.61		
N	181620.10		
GL mOD	1.94		
TD	26.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
12.40		Gravelly clayey sand	At 12.40 (B32): Gravelly clayey sand, dark grey (N4/), firm, moist, plastic, slightly sticky. Gravel (10%) is small to medium sub-angular pebbles of flint.
12.70		Gravel	At 12.70 (B34): Gravel, slightly clayey. Greyish brown (5Y 4/1), wet near liquid, clayey silt (10%). Gravel (90%) is small to large, angular to rounded pebbles of flint.
13.00		Gravel	At 13.00 (B36): Gravel, dark brownish grey (2.5Y 4/1), loose, small to large subangular to rounded pebbles of flint.
14.00		Sandy gravel	At 14.00 (B38): Sandy gravel (30/70), greyish brown (2.5Y 4/2). Sand is coarse to medium. Gravel is angular to rounded small to large pebbles of flint.
15.00		Sandy gravel	At 15.00 (B40): Sandy gravel (40/60), yellowish brown (2.5Y 5/3), sand is coarse to fine, gravel is small angular to rounded pebbles (40%), medium to large sub-angular to rounded pebbles (20%) of flint.
16.00		Gravelly sand	At 16.00 (B42): Gravelly sand (40/60), yellowish brown (2.5Y 5/3), sand is medium to fine, gravel is small angular to well rounded pebbles (20%), and medium to large sub-angular to rounded pebbles (20%) of flint.
17.00		Sandy gravel	At 17.00 (B44): Sandy gravel (40/60), yellowish brown (2.5Y 5/3). Sand is coarse to fine, gravel is small to large angular to rounded pebbles (50%) and sub-rounded cobbles (5%) of flint.
18.00		Sandy gravel	at 18.00 (B46): Sandy gravel (35/65), yellowish brown (2.5Y 5/4), sand is fine to coarse, gravel is small to large angular to rounded pebbles (60%) and sub-angular cobbles (5%) of flint.
19.00		Gravelly sand	At 19.00 (B48): Gravelly sand (40/60), yellowish brown (2.5Y 5/4) sand is fine to coarse, gravel is small to medium sub-angular to rounded pebbles of flint.
20.30		Sandy gravel	At 20.30 (B53): Sandy gravel, brownish yellow (2.5Y 6/4), sand is fine to medium, slightly clayey. Gravel is small to large sub-angular to rounded pebbles of flint.

Borehole OA04

INT	OA04		
E	572578.89		
N	181904.74		
GL mOD	2.41		
TD	32.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.80	Sandy clay	Firm brown sandy clay with frequent rootlets and rare gravel. Sand is fine to coarse. Gravel is subrounded fine of flint **TOPSOIL** (drillers description)
			At 0.20 (B2): Dark brown (10YR 3/2) firm friable clayey silt, plentiful small roots, stony (15%), small angular pebbles, small (2mm D.) blackish concretions (manganese). Distinct humic smell.
0.80	1.60	Gravelly sandy clay	Firm brown mottled grey brown sandy clay with fragments of subangular fine and medium gravel sized brick and clinker. Sand is fine to coarse, occasional rootlets **MADE GROUND** (drillers description).
			At 0.80: (B3): Dark brown (2.5Y 3/2) firm to stiff clayey silt, roots present, small stones (10%), CBM inclusions.

INT	OA04		
E	572578.89		
N	181904.74		
GL mOD	2.41		
TD	32.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 1.20 (B6): Dark brownish grey (5Y 4/1). Soft, plastic very sticky silty clay, occasional small mollusc shell fragments (1%) faint rotten smell.
			At 1.60 (B8): Dark brown (2.5Y 3/3) clayey silt. Inclusions: small roots, small stones, CBM, clinker (slag).
1.60	2.00	Silty clay	Soft grey, locally brown, slightly sandy silty clay with occasional lenses of black silty organic matter. Sand is fine and medium (drillers description).
			Below this depth piston samples
2.00	2.18	VOID	VOID
2.18	5.00	Silty clay	At 2.18-2.98 (P9): Greyish brown (10Y 4/1), with light bluish grey (5B6/1) mottles, (more common above 2.4m), soft, silty clay. Occasional small sand lenses 2.33 to 2.70m, small blackish flecks of organic material (5%), more plentiful above 2.58m (10%).
3.00	3.28	VOID	VOID
			At 3.28-3.37 (P11): Yellowish brown (2.5Y 4/2), soft plastic silty clay. Occasional very fine orangey brown Fe flecks. Sharp lower boundary.
			At 3.37-3.81 (P11): Greyish brown (2.5Y 4/1), soft, massive, silty clay. Gradual increase in sand content towards base. Occasional broken dark brown to blackish organic rich bands (1mm), dark brown flecks of organic detritus. Diffuse lower boundary.
			At 3.81-3.96 (P11): Mid greenish grey (10Y 4/1), soft, silty clay. Occasional thin broken dark brown bands at 20mm intervals. No coarse inclusions. Sharp lower boundary.
			At 3.96-4.00 (P11): Mid greenish grey (10Y 4/1), soft, slightly sandy silt, very rich in organic inclusions (40%).
			At 4.00-5.00 (B15): Mid greyish brown (5Y 4/1) moderately firm, plastic, very sticky silty clay, small blackish inclusions (5%), Yellowish brown patches, light yellow to blackish patches (ashes?). Possible small CBM fragments, small angular stones 5% (contaminated bulk sample? piston core failed at this level)
5.00	5.28	VOID	VOID
5.00	6.00	Laminaated clayey silt	At 5.28-6.00: Dark greyish brown (5Y 4/1) silty sand. Coarse laminations of soft, plastic, clayey silt with occasional small fine sand lenses and sequences of fine (1mm), often broken sand laminations. Inclusions: occasional shell fragments in sand, fine brown organic fragments 4.09 to 4.17 (2%), occasional very fine blackish flecks (1%).
6.00	6.20	VOID	VOID
6.20	6.86	Bedded sandy silty clay	At 6.20-6.43 (P19):Dark greenish grey (Gley 1 4/1), soft structureless sandy clay, no coarse inclusions. Clear lower boundary.
			At 6.43-6.58 (P19): Dark greenish grey (Gley 1 4/1), soft structureless silty clay lens. Clear lower boundary.
			At 6.58-6.65 (P19): Dark greenish grey soft structureless sandy clay. Clear lower boundary.
			At 6.65-6.69 (P19): Dark greenish grey (Gley 1 4/1), soft structureless silty clay lens. Clear lower boundary.
			At 6.69-6.86 (P19):Dark greenish grey soft structureless silty clay with no inclusions. Occasional fine sand inclusions. Clear lower boundary.
6.86	6.96	Peat	At 6.86-6.96 (P19): Black (10YR 2/1), friable, well humified peat. Disturbed upper surface (possible erosional contact). Lower boundary diffuse.
6.96	10.00	Silty clay	At 6.96-7.00: (P19): Dark greenish grey (Gley 1 4/1) soft silty clay.
7.00	7.25	VOID	VOID
			At 7.25-8.00 (P21): Dark greenish grey (Gley 1 3/1) soft structureless silty clay. Homogenous with no coarse inclusions. Frequent black mottling.

INT	OA04		
E	572578.89		
N	181904.74		
GL mOD	2.41		
TD	32.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
8.00	8.54	VOID	VOID
			At 8.54-9.00 (P23): Dark greenish grey (2.5Y 4/1) soft structureless silty clay with no coarse inclusions. Occasional black mottles 5-10%.
9.00	9.15	VOID	VOID
			At 9.15-10.00 (P25): Dark greenish grey (Gley 1 4/1) soft structureless silty clay. Homogenous with no inclusions, rare black mottling.
10.00	10.20	VOID	VOID
10.20	11.00	Laminated silty clay	At 10.20-11.00 (P27): Dark greenish grey (Gley 1 4/1) soft silty clay with fine sand laminations (10mm thickness). Occasional organic inclusions, although no identifiable plant material.
11.00	11.23	VOID	VOID
11.23	12.00	Laminated sandy clay	At 11.23-12.00 (P29): Very dark grey (2.5Y3/1) soft sandy clay with fine sand lenses (10 - 20mm thickness). Well stratified sequence. The sandy lenses are slightly darker in colour. No coarse component. Sharp boundaries in plane becoming more diffuses. Alluvium.
12.00	`12.31	Laminated sand and silt	At 12.00-12.31 (P31): Dark greenish grey (5GY 4/1) moist firm laminated fine sands and soft sticky sandy clayey silts at <1mm to 2mm intervals. Mica present. Few thin organic rich layers and occasional small organic fragments.
12.31	13.00	Clayey sand	At 12.31-12.50 (P31): Dark greenish grey (5GY 4/1) weakly stratified, fine clayey sand, mica frequent, occasional small organic fragments.
			Below this depth bulk spot samples
13.00		Sand	At 13.00-14.00 (B34): Fine sand, slightly clayey, brownish grey (10Y 4/1).
14.00		Sand	At 14.00 (B35): Fine sand, slightly clayey, brownish grey (10Y 4/1).
15.00		Sandy silty clay	At 15.00 (B38): Sandy silty clay, greyish brown (5Y 4/1). Soft. Small to medium angular pebbles (10-15%) of flint.
15.40		Sandy silty clay	At 15.40 (B40): Sandy silty clay, mid yellowish brown (2.5Y 52 to 4/2). Soft. Small angular to sub-angular pebbles (20%).
16.00		Sandy gravel	At 16.00 (B42): Sandy gravel (40/60), yellowish brown (2.5Y 5/4), sand is fine to medium slightly silty (40%). Gravel is small to large angular to rounded pebbles and occasional cobbles of flint.
17.00		Gravelly sand	At 17.00 (B46): Gravelly sand (40/60). Yellowish brown (2.5Y 5/4). Sand is coarse to fine. Gravel is angular to rounded small to large pebbles of flint.
18.00		Gravelly sand	At 18.00 (B48): Gravelly sand (30/70). Yellowish brown (2.5Y 5/4), sand is coarse to fine. Gravel is angular to rounded small to large pebbles of flint
19.00		Gravelly sand	At 19.00 (B50): Gravelly sand. Yellowish brown (2.5Y 5/3). Sand is coarse to fine angular to rounded small to large pebbles of flint.
20.00		Gravelly sand	At 20.00 (B52): Gravelly sand. Yellowish brown (2.5Y 5/4). Sand is fine to coarse. Gravel is angular to rounded small to large pebbles and small cobbles of flint.
21.00		Gravelly sand	At 21.00 (B54): Gravelly sand. Yellowish brown (2.5Y 5/4) . Sand is fine to coarse. Gravel is angular to rounded small to large pebbles and small cobbles of flint.
22.00		Gravelly sand	At 22.00 (B55): Gravelly sand. Yellowish brown (2.5Y 5/6). Sand is fine to coarse. Gravel is angular to rounded small to large pebbles and small cobbles of flint.
23.00		Gravelly sand	At 23.00 (B58): Gravelly sand. Yellowish brown (2.5Y 5/3). Sand is fine to coarse. Gravel is angular to rounded small to large pebbles (35%) of flint.
23.60		Gravel	At 23.60-23.90 (B59): Gravel, mainly bluish black occasionally yellowish brown flint. Medium pebbles to medium cobbles, angular to sub-rounded.
24.00		Sandy gravel	At 24.00 (B61): Sandy gravel. Greyish brown (2.5Y 5/2). Sand is fione to coarse. Gravel is small angular to rounded pebbles (15%) medium to large sub-rounded to rounded pebbles (35%), subangular cobbles (10%) of flint.

INT	OA04		
E	572578.89		
N	181904.74		
GL mOD	2.41		
TD	32.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
25.00		Gravelly sand	At 25.00 (B63): Gravelly sand. Yellowish brown (2.5Y 5/3) Sand is mainly coarse, some medium to fine gritty sand. Gravel is angular to rounded small to large pebbles of flint.
26.00		Gravel	At 26.00 (B65): Gravel, mostly flint, bluish black and yellowish brown flint. Angular to rounded small to large pebbles and small cobbles.
26.70		Sand	At 26.70 (B67): Dark grey (N4/) with dark greenish grey mottles (10Y 4/1). Moist, moderately firm slightly clayey fine sand, some medium and coarse grains (5%).

Borehole OA05

INT	OA05		
E	571075.47		
N	181605.99		
GL mOD	1.98		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	1.20	Gravelly clay	Brown clay with gravel and cobble sized fragments of brick, roots and occasional pockets of ash **MADE GROUND** (drillers description).
			At 0.2 (B2): Dark brown (10YR 3/2) firm silty clay, plentiful fine roots, angular pebbles (10%), CBM (1%), plant detritus.
			At 1.20 (B4): Brown (2.5Y 4/2) moderately soft, silty clay, clasts of yellowish brown silty clay, occasional medium size rounded pebbles. Small shell fragments (1%), CBM (1%), and slag present. Plentiful roots remains, humic smell.
1.20	2.00	Silty clay	Firm grey mottled brownish grey silty clay with abundant rootlets and occasional infilled burrows (drillers description).
			At 1.60 (B6):Brownish grey (5Y 4/1) soft silty clay. Pockets of yellowish brown (10YR 6/6) silty clay. Small angular pebbles (5-10%). Rare small blackish organic flecks.
			Below this depth piston samples
2.00	2.25	VOID	VOID
2.25	6.00	Silty clay	At 2.25-3.00 (P7):Dark greenish grey (2.5Y 4/1), soft, structureless, silty clay, no coarse inclusions occasional blackish mottling (15%).
3.00	3.50	VOID	VOID
			At 3.50-3.70 (P9): Dark greenish grey (2.5Y 4/1), soft, structurelesss, silty clay, no coarse inclusions. Very sterile and homogenous.
			At 3.70-4.00 (P9): Very dark grey (2.5Y 3/1), soft, loose, clayey silt with sand inclusions. Sand is fine to medium- No coarse inclusions. Very sharp boundary. No coarse inclusions. Very sterile and homogenous.
4.00	4.28	VOID	VOID
			At 4.28-5.00(P11): Very dark grey (10YR 4/1), soft, structurelesss, silty clay. No coarse inclusions, homogenous with only rare black mottling (5%).
5.00	5.53	VOID	VOID
			At 5.53-6.00 (P13): Dark grey (2.5Y 4/1), soft, structurelesss, silty clay with no coarse inclusions. Absence of any mottling.

INT	OA05		
E	571075.47		
N	181605.99		
GL mOD	1.98		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
6.00	7.00	Organic silt	At 6.00-7.00 (B16): Black, organic rich silt. Firm, slightly brittle, breaks with clean surfaces, blocky, polyhedral structure. Very moist. Peat. Contact to light bluish grey (10GY 5/1) soft silty clay. (**Piston sample failed at 6.00-7.00m**)
7.00	7.22	VOID	VOID
7.22	11.00	Silty clay	At 7.22-8.00 (P18): Grey (2.5Y 5/1), soft, structureless, silty clay, no coarse inclusions. Frequent blackish mottling (15%), root decay.
8.00	8.16	VOID	VOID
			At 8.16-8.78 (P20): Greenish grey, soft, silty clay, structureless, with frequent blackish mottling. Sharp basal boundary.
			At 8.78-9.00 (P20): Dark grey (2.5Y 4/1), soft, silty clay with sand inclusions and no coarse component. Structureless with a sharp upper boundary.
9.00	9.34	VOID	VOID
			At 9.34-10.00 (P22): Dark grey (2.5Y 4/1), soft, structurelesss, silty clay no coarse inclusions. Very sterile and homogenous deposit.
10.00	10.36	VOID	VOID
			At 10.36-11.00 (P24): Dark grey (2.5Y 4/1), soft, structurelesss, silty clay with no coarse inclusions. Rare blackish mottles (5%).
11.00	11.84	VOID	VOID
11.00	11.40	Sandy silt	At 11.84-12.00 (P26): Greenish grey (10Y 4/1), moist, sandy silt. Sand very fine, variable content - parts of the sediment are very clayey and sticky, no real structure to unit. Organic inclusions (5%), mica present. Occasional fine (<1mm) white inclusions - probably fragments of marine shell.
			Below this depth bulk spot samples
11.40		Silty gravel	At 11.40 (B29): Silty gravel. Dark brownish grey (10Y 4/1). Near liquid slightly sandy clayey silt (10%). Mainly small to medium, few large, angular to rounded pebble of flint.
12.00		Silty gravel	At 12.00 (B31): Silty gravel. Dark brownish grey (2.5Y 4/1). Sandy clayey silt (10%). Small to large, angular to subrounded pebbles and small cobbles.
13.00		Sandy gravel	At 13.00 (B33): Sandy gravel. Dark brownish grey (5Y 4/1). Sand is fine to coarse (15%). Gravel is small to large, angular to rounded pebbles and small cobbles.
14.00		Gravelly sand	At 14.00 (B35): Gravelly snad. (Light) brown (2.5Y 6/2). Sand is fine to coarse (60%). Gravel is small to large, angular to rounded pebbles (40%) of flint.
15.00		Gravelly sand	At 15.00 (B37): Light brown (2.5Y 5/2) gravelly sand. Sand is fine to coarse (70%). Gravel is small to large, subangular to rounded pebbles (30%) of flint.
16.00		Sandy gravel	At 16.00 (B39): Sandy gravel. Dark brownish grey (5Y 4/1). Sand is fine to medium (35%). Gravel is mainly small angular to rounded pebbles (40%) and few medium to large, subangular to well rounded pebbles (25%).
17.00		Sandy gravel	At 17.00 (B41): Sandy gravel. Light yellowish brown (2.5Y 6/3). Sand is medium to coarse (20%). Gravel is small to large, subangular to rounded pebbles (80%) of flint.
18.40		Sand	At 18.40 (B45): Fine sand, slightly clayey. Very dark brownish grey (10Y 3/1) Occasional platy coarse sand grains or very small pebbles (2mm).

Borehole OA06

INT	OA06		
E	571198.70		
N	181606.76		
GL mOD	2.00		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.20	Gravelly clay and sand	Brown slightly gravelly clayey sand with gravel and cobble sized fragments of brick and clinker and concentrated pockets of ash **MADE GROUND** (drillers deescription).
			At 0.2 (B2): Brown (10YR 4/2) sandy silty clay, stony (25%) plenty of demolition rubble (slag, CBM, glass).
0.20	1.20	Silty clay	Grey brown silty clay with brick, ash and roots **MADE GROUND** (drillers description).
			At 0.90 (B4): Brown (10YR 4/2) firm, silty clay, slightly sandy (gritty) with small pebbles (5%). CBM (2%) and slag included. Humic smell.
			At 1.20 (B6): Brown (2.5Y 4/2) sandy silty clay, stony (30%) demolition rubble and slag included.
1.20	1.40	Silty clay	Firm grey brown silty clay with rootlets (drillers description).
			At 1.40 (B8): Brown (10YR 5/2) soft, silty clay, occasional small subangular pebbles (1%) an detritic plant remains.
1.40	3.00	Silty clay	Firm grey mottled grey brown silty clay with rootlets and occasional infilled burrows (drillers description).
			At 2.00-3.00 (B11): Brown (10YR 4/2) to dark grey (2.5Y 4/1) moderately soft sandy silty clay, mixed structure, moist. Stony (15%), including subangular weather red sandstone cobbles.
			Below this depth piston samples
3.00	3.25	Silty Clay	At 3.00-3.25 (P13): Dark grey N 2.5/ soft, moist silty clay, very fine inclusions of thin fine sand, structureless. Few mid grey mottles. Occasional shell fragments included.
3.25	3.70	Silty clay	At 3.25-3.70 (P13): Dark greenish grey 5GY 3/2, possibly mottled, soft, structureless silty clay, few fine inclusions of fine sand . Few small blackish detritic plant and occasional shell fragments included. increasing from top to base (3-5%),
3.70	3.85	Clay silt	At 3.70-3.85 (B15): Dark bluish grey (5B 3/2) very soft, very wet, near liquid clayey silt. Humic smell. No inclusions visible.
3.85	4.00	VOID	VOID. Not retrieved due to Piston Construction
4.00	4.24	VOID	VOID
4.24	4.75	Silty clay	At 4.24-4.75 (P16): Silty clay. Greyish brown (2.5Y 4/1) grading to greenish grey (5B 5/1) towards the base. Very dark greyish brown and grey mottling (50%). Very soft, occasional inclusions of fine sand and broken laminations below 4.49m.
4.75	5.00	Silty clay	At 4.75-5.00 (P16): Dark greenish grey and very dark grey N 2.5/ mixed soft slightly silty clay with greenish grey 5GY 5/1 fine sand inclusions and two beds of laminated sand. Inclusions: occasional shell fragments and small red fine grained stone or pottery?
5.00	5.23	VOID	VOID
5.23	5.60	Clay silt	At 5.23-5.60 (P18): Bluish grey (5GY 3/1) becoming light bluish grey (5B 4/1) 70mm above base. Soft clayey silt alternating with zones of slightly sandy silt. Clear lower boundary.
5.60	5.90	Silty clay	At 5.60-5.90 (P18): Very dark bluish grey (N2.5/) with 30mm bluish grey lenses. Soft, moist, silty clay. Occasional fine sand inclusions and weak grey mottling. Few small fragments of organic matter and blackish flecks.
5.90	5.97	Clay silt	At 5.90-5.97 (P18): Very dark greenish grey (5GY 2.5/1), very soft, structureless, clayey silt.
5.97	6.00	WAX	WAX
6.00	6.24	VOID	VOID

INT	OA06		
E	571198.70		
N	181606.76		
GL mOD	2.00		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
6.24	6.64	Silty clay	At 6.24-6.64 (P20): Very dark grey (N4/1) linear light brown mottles, getting lighter and more bluish (5B 5/1) towards base. Soft silty clay with fine lenses of fine sand (25%) at intervals. Inclusions: dry brittle brown sediment clast, white shell fragments. Sharp lower boundary.
6.64	6.71	Clayey silt	At 6.64-6.71 (P20): Dark greyish brown (2.5Y 4/1) increasingly darker towards base, soft slightly clayey silt. Small brown organic fragments (4%) included. Broken lamination with thin beds of silt and organic rich sediment containing small clasts of peat (2mm). Clear lower boundary.
6.71	6.98	Peat	At 6.71-6.98 (P20): Firm, moderately moist, organic rich sediment, divided in three sub-units: top 90mm very dark reddish brown (5YR 2.5/1) mid 100mm very dark greyish brown (7.5YR 2.5/1) basal 80mm blackish brown (10YR 2.5/1). Inclusions coarse brackish organic detritus, occasional very thin brown sand bands.
6.98	7.20	VOID	VOID
			At 7.20-7.25 (P22): Firm, spongy organic rich sediment, very dark brown (10YR 2/1). Inclusions of small organic fragments (wood?). Sharp basal boundary
7.25	7.98	Bedded silt and clay	At 7.25-7.98 (P22): Light bluish grey (10BG 5/1) plentiful fine blackish flecks (15-20%). Soft clayey silt, gradual change to silty clay near base. Small to medium size brown and yellow organic fragments (wood) included. Weak broken fine lamination with thin organic rich layers in top 200mm.
7.98	8.21	VOID	VOID
8.21	8.53	Silty clay	At 8.21-8.53 (P24): Light greenish grey (Gley 1 5/1), soft, silty clay / clay structureless, with frequent black mottles (15%). No coarse inclusions. . Diffuse basal boundary.
			At 8.53-9.00 (P24): Lighter greenish grey (Gley 1 5/1)), soft, clayey silt, structureless, with rare / absent black mottles (5%). No coarse inclusions.
9.00	9.25	VOID	VOID
9.25	9.80	Clay silt	At 9.25-9.80 (P27): Dark greyish brown N 4/ soft, slightly clayey silt, structureless. Very fine greyish brown flecks (10%). Diffuse basal boundary.
9.80	10.00	Silty clay	At 9.80-10.00m (P27): Dark grey (2.5Y 4/1 to 5/1) soft, silty clay, structureless. Small diffuse brownish grey mottles (20%), Very fine dark grey flecks.
10.00	10.33	VOID	VOID
10.33	10.59	Clay silt	At 10.33-10.59 (P28): Dark grey (10B 4/1) with weak diffuse bluish grey mottling near base. Soft, clayey silt. Very fine blackish inclusions (1%). Clear basal boundary. Alluvium.
10.59	10.99	Silty clay	At 10.59-10.99 (P28): Dark bluish grey (5GY 4/1) soft silty clay. Zones of very thin dark lamination with occasional small reddish brown organic fragments. Shell present.
11.00	11.30	VOID	VOID
11.30	11.33	Silty clay	At 11.00-11.03 (P30): Grey (5B 5/1) soft silty clay, clear basal boundary.
11.33	11.44	Peat	At 11.33-11.44 (P30): Firm organic rich sediment very dark reddish brown (5YR 2.5/1). Four subunits. Occasional very thin broken sand bands.
11.44	11.61	Organic silt	At 11.44-11.56 (P30): Very dark blackish grey (10YR 2.5/1) soft to moderately firm silt, structureless, few small fragments of reddish brown wood (5%). Slightly diffuse boundary.
11.61	11.86	Sandy clay	At 11.90-11.86 (P30): Light bluish grey (5GY 4/1) to dark grey mottles increasing with depth (20% to 50%) firm sandy clay, slightly silty. Small brown and blackish organic inclusions (2%). Clear lower boundary.
11.86	11.98	Sandy clay	At 11.86-11.98 (P30): Light yellowish grey (10Y 6/1) firm sandy clay structureless. Inclusions: occasional small brown organic fragments (1%), and small fragments of sea shell.
			Below this depth bulk spot samples

INT	OA06		
E	571198.70		
N	181606.76		
GL mOD	2.00		
TD	24.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
11.70		Clayey sand	At 11.70 (B31): Sandy gravel (30/70). Light brown (2.5Y 5/2)/. Clayey medium to fine sand (30%). Small to large angular to sub-rounded pebbles (70%) of flint.
12.00		Sandy gravel	At 12.00 (B33): Sandy gravel. Dark greyish brown (2.5Y 4/2). Sand is coarse to fine, clayey. Gravel is subangular to rounded small to large pebbles of flint.
13.00		Sandy gravel	At 13.00 (B35): Sandy gravel (30/70). Light yellowish brown (2.5Y 5/2), sand is medium to fine (30%). Gravel is small to medium, angular to subrounded pebbles of flint
14.00		Sandy gravel	At 14.00 (B37): Sandy gravel (30/70). Light brown (2.5Y 5/2), sand is coarse to fine. Gravel is angular to rounded pebbles and small cobbles.
15.00		Sandy gravel	At 15.00 (B39): Sandy gravel. Light brown (2.5Y 5/2), sand is coarse to fine, gravel is angular to rounded pebbles of flint.
16.00		Sandy gravel	At 16.00 (B41): Sandy gravel (30/70). Light brown (2.5Y 5/2), sand is medium to fine, gravel is angular to rounded pebbles of flint.
17.00		Sandy gravel	At 17.00 (B43): Sandy gravel (30/70). Light brown (2.5Y 5/2), sand is coarse to fine, gravel is small to medium pebbles, sub-angular to rounded of flint.
18.00		Sandy gravel	At 18.00 (B45): Sandy gravel (30/70). Greyish brown (2.5Y 4/2), sand is medium to fine, clayey. Gravel is angular to subangular pebbles and small cobbles of flint
18.70		Gravelly sand	At 18.70 (B47): Gravelly sand (10/90). Yellowish brown (2.5Y 4/2), sand is fine to medium. Gravel is occasional small pebbles (10%).

Borehole OA07

INT	OA07		
E	571134.95		
N	182396.99		
GL mOD	2.2		
TD	19.6		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.10	(no description)	Grass (description from geotechnical log).
0.10	1.00	Sandy clay	Firm brown locally orange mottled sandy clay. Sand is firm and medium. Abundant rootlets (drillers description).
			At 0.10 (B2): Very dark brown (7.5YR 3/1 to 3/2) stiff silty clay with fine reddish brown (Fe)) mottles (5%). Small polyhedral peds and fine rootlets.
		Silty clay	At 1.00 (B4): Dark brownish grey (2.5YR 3/1 to 4/1) firm silty clay with light grey (2.5Y 5/1) mottles (10%) and plentiful distinct fine reddish brown (Fe) mottles and (Fe) concretions (25%). Inclusions of small dark brown stiff brittle organic clasts (2%) and very fine pale yellow (sulphuric?) bands (1%).
			Below this depth piston samples
1.20	1.85	VOID	VOID
1.85	6.00	Silt clay	At 1.85-2.00 (P5): Dark greyish brown (10YR 4/2), with orange (Fe) mottles. Moist, moderately stiff slightly clayey silt. Thin roots present (1%). Breaks into clean flakes. Humic smell.
		VOID	At 2.00-2.34 VOID

INT	OA07		
E	571134.95		
N	182396.99		
GL mOD	2.2		
TD	19.6		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 2.34-2.47 (P7): Olive (5Y 5/3) moist, slightly firm, fairly plastic, very slightly sticky silty clay. Hint of orange from Fe. Occasional unstratified fine sand inclusions. Unstratified organic flecks, <1mm diameter, <1%. Area of underlying unit has crept up to contaminate this unit.
			At 2.47-3.00 (P7): Greenish grey (10Y 5/1), plastic, soft, massive clay with small quantity of silt. Organic inclusions 3%, consistent throughout unit, some deposited vertically (roots?) Rare mica. Upper boundary sharp but curves upwards - probably caused by drilling. No Fe mottling.
			At 3.00-4.00 (B11): Brownish grey (2.5Y 4/1) very soft, slightly silty clay, structureless. (Piston sample failed at 3.00-4.00)
		VOID	At 4.00-4.27 VOID
			At 4.27-5.00 (P13): Dark greyish brown (2.5Y 4/1) soft, moist, plastic, clayey silt. Fine lenses of fine sand (15%), shell (>1%), weak humic smell.
		VOID	At 5.00-5.25 VOID
			At 5.25-5.75 (P15): Dark greenish grey (5GY 4/1) moist, moderately soft, plastic silty clay. Fine sand lenses, decreasing in mid-section of core as clay proportion increases. Occasional marine shell fragments and some complete pieces. Organic material >1%. Mica present. Massive, little structure.
		VOID	At 6.00-6.22 VOID
6.22	6.61	Peat	At 6.22-6.61 (P17): Very dark brown (7.5YR 2.5/2) to black. Top very dark and spongy, increasingly firm/compacted with depth. Strong earthy smell. Abundant horizontal lenses of yellowish brown (10YR 6/6 to 4/6) fibrous, decaying plant material, increasingly thin (>1mm) and closely spaced with depth. Sharp lower boundary.
6.61	6.70	Silty clay	At 6.61-6.70 (P17): Greenish grey (10YR 5/1) moist, slightly firm, plastic silty clay. Horizontal lenses of organic material.
6.70	7.00	Organic clayey silt	At 6.68-6.79 (P17): Very dark grey indicating high organic content, becoming mottled with a lighter greenish grey (5GY 5/1) towards base. Moist soft moderately plastic clayey silt. Crumbly/fibrous plant detritus (2%) throughout; particularly in lenses in dark upper 2cm of unit - possible palaeosoil. Occasional fine sand lenses, mica present. Humic smell.
7.00	7.26	VOID	VOID
7.26	7.30	Sandy silt	At 7.26-7.30(P20): Mid grey (5GY 5/1) with small vertical blackish patches. Firm, slightly plastic sandy silt. Very fine sand, weak very thin >0.5mm laminations, small vertical blackish organic inclusions. Clear basal boundary.
7.30	7.87	Clayey silt	At 7.30-7.87: Light yellowish brown (2.5Y 5/2) soft to firm, moist, plastic, slightly sandy slightly clayey silt. Small fine sand lenses 7.60-7.87m. Very dark greyish brown fibrous detritic plant remains, vertical. Whitish vertical planar mineral matter, slightly sandy. small angular flint pebbles (1%). Clear basal boundary.
7.87	8.00	Silty clay	At 7.87-8.00 (P20): Mid brownish grey (5Y 4/2 firm), plastic, moist sandy, slightly silty clay. Massive, structureless. Occasional very light brown fine sand lenses. Rare blackish organic patches.
8.00	8.38	VOID	VOID
8.38	8.42	Silty clay	At 8.38-8.42 (P23): Upper 2cm very dark grey (N4/) very moist, very soft, plastic silty clay - possibly contamination. Lower 2cm light yellowish brown (2.5Y 4/2) soft very plastic silty clay. Sharp boundary between two layers. Clear basal boundary
8.42	8.59	Clayey sand	At 8.42-8.59 (P23): Dark yellowish brown (2.5Y 4/1) firm, plastic, moist clayey medium to fine sand. Occasional small diffuse dark grey small mottles 1%, few small angular pebbles 2%. Clear basal boundary.

INT	OA07		
E	571134.95		
N	182396.99		
GL mOD	2.2		
TD	19.6		
Depth (m)		**Keyword**	**Description**
From	**To**		
8.59	8.89	Clayey silt	At 8.59-8.89 (P23): Medium yellowish brown (5Y 4/1) clayey silt. Above 8.37 stratified with sand bands, broken lamination; below 8.37 very fine lenses of fine sand. Occasional subangular small pebbles 1%. Clear basal boundary.
8.89	9.00	Clayey sand	At 8.89-9.00 (P23): Dark yellowish brown (2.5Y 3/2) firm plastic clayey medium to fine sand. Dark grey diffuse mottles 5%. Occasional coarse sand grains.
			Bulk spot samples below this depth
9.00		Gravelly silt clay	At 9.00-10.00 (B27): Dark brown (2.5Y 4/2 to 5/2) gravelly silty clay. Moderately soft, moist, slightly sandy clay (70%). Small to medium, angular to rounded pebbles (30%).
9.50		Sandy gravel	At 9.50 (B30): Sandy gravel (30/70). Yellowish brown (2.5Y 5/3 to 5/4). Wet, clayey, medium to coarse sand. Gravel is small to large, subangular to rounded pebbles.
10.00		Gravelly sandy clay	At 10.00-10.45 (B32): Gravelly sandy clay. Yellowish brown (2.5Y 4/2). Moderately stiff, sandy silty clay (70%). Mainly small, subangular to rounded pebbles (30%) of flint.
11.00		Gravelly silty clay	At 11.00-11.45 (B34): Gravelly silty clay. Light yellowish brown (10Y 6/4) firm silty clay. Small subangular to subrounded pebbles (10%).
11.60		Sandy gravel	At 11.60 (B36): Sandy gravel (30/70). Yellowish brown (2.5Y 6/4). Wet, near liquid clayey, mainly fine sand. Small to large, angular to subrounded pebble of flint.
13.00		Gravelly sand	At 13.00-13.45 (B40): Gravelly sand (35/65). Yellowish brown (2.5Y 6/6). Mainly medium sand. Small to large pebbles, subangular to rounded.
14.00		Gravelly sand	At 14.00-14.45 (B42): Gravelly sand (25/75). Brownish yellow (10YR 6/6). Mainly fine to medium sand and occasional coarse sand grains. Small to large pebbles, angular to rounded.
14.10		Gravelly sandy clay	At 14.10 (B44): Brown 10YR 4/2 and also brownish yellow 10YR 6/8 gravelly sandy clay. Very stiff silty clay (65%), with fine to medium sand (20%) and small to medium subangular to rounded pebbles (15%). Undated
14.60		Gravelly silty clay	At 14.60 (B46): Gravelly silty clay (15/85). Brown (10YR 4/2) with very fine distinct reddish brown mottles (10%). Small amount of fine to coarse sand (5%) included. Small subangular to subrounded pebbles.

Borehole OA08

INT	OA08		
E	571682.91		
N	182398.8		
GL mOD	2.35		
TD m	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.20	No description	Made ground (Driller's description)
0.20	1.20	Sandy gravelly clay	Firm brown sandy gravelly clay. Gravel is subangular to angular fine to coarse of brick fragments, concrete, flint and occasional clinker **MADE GROUND** (drillers description).

INT	OA08		
E	571682.91		
N	182398.8		
GL mOD	2.35		
TD m	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
1.20	1.40	Gravelly clay	Soft grey brown mottled blue grey slightly silty sandy clay. Gravel is angular to subangular mainly fine and medium of flint, brick, clinker **MADE GROUND** (drillers description).
			Below this depth piston samples
1.40	1.75	VOID	VOID
1.75	7.66	Silty clay	At 1.75-2.25 (P7): Mid yellowish brown (2.5Y 4/1 - 4/2) soft silty clay. Very dark brown/black small inclusions 5-15%, occasional long black roots 1.43-49m. Diffuse dark grey mottles 1.50-70m. Structureless. Clear basal boundary.
			At 2.25-2.40 (P7): Dark greyish brown (5Y 3/1 - 4/1) soft silty clay. Fine blackish organic inclusions 10-15%, fine sediment clasts 10%. Structureless
		VOID	At 2.40-2.70 VOID
			At 2.70-3.40 (P10): Mid greenish grey (5GY 5/1) soft, silty clay. Occasional olive yellow mottles (2.5Y 6/8), especially in upper half. Upper 7cm more grey, possible higher organic input. Black/yellowish fibrous plant fragments, often vertically deposited, 4%. Structureless.
		VOID	At 3.40-3.60 VOID
			At 3.60-3.76 (P12): Light greyish brown (2.5Y 4/4 - 5/1) soft silty clay. Fine sand inclusions 5%, organic blackish detritus 2%. Structureless.
			At 3.76-4.05(P12): Mid greyish brown (2.5Y 4/1) soft silty clay. Very fine, very dark grey/black mottles 5%, fine sand inclusions 5%. Diffuse boundaries.
			At 4.05-4.40 (P12): Dark greyish brown (2.5Y 3/1 - 4/1) soft silty clay. Small fine sand inclusions 25%, very dark brown organic clasts. Diffuse upper boundary
		VOID	At 4.40-4.57 VOID
			At 4.57-5.40 (P14): Dark greenish grey (5GY 4/1) very moist, very sticky, soft, slightly silty clay. Weakly stratified lenses of fine sand occurring in zones; upper 10cm of core fine sand non-stratified but becoming a main component of the sediment. Shell inclusions including large fragments. Organic inclusions very rare.
		VOID	At 5.40-5.64 VOID
			At 5.64-6.40 (P16): Dark greyish brown (5G 3/1) soft structureless silty clay. Occasional fine sand inclusions, two pieces of intact shell at 5.46m.
		VOID	At 6.40-6.61 VOID
			At 6.61-7.40 (P18): Dark brownish grey (N4/1 - 3/1) soft massive structureless silty clay. Small distinct mid-yellowish brown mottles 6.40-64 and 6.98-7.04m. Zones of sand inclusions, occasional shell fragments 2%.
		VOID	At 7.40-7.62 VOID
			At 7.62-7.66 (P20): Greenish grey (10GY 5/1 - 4/1) very soft, sticky, moist silty clay. High quantity of peat intruding into unit from preceding unit.
7.66	7.91	Peat	At 7.66-7.91 (P20): Soft, friable, silty textured, slightly moist peat. Colour variable in stratified bands from dark reddish brown (7.5YR 3/2) to slightly yellowish, dark brown to black. Lenses of yellowish decayed plant material. 7.54 lens of spongy, crumbly less compacted woody material.
7.91	10.58	Silty clay	At 7.91-8.20 (P20): Greenish grey (10GY 5/1) moist, moderately soft, plastic silty clay. Fibrous black/orangey brown plant fragments, possibly eroded peat, deposited irregularly, 10%. Grey mottles 2%. Sharp upper boundary.
			At 8.20-8.40 (P20):Dark greenish grey (10Y 4/1) moist, soft silty clay. Organic inclusions mostly deposited horizontally 8%.
		VOID	At 8.40-8.58 VOID

INT	OA08		
E	571682.91		
N	182398.8		
GL mOD	2.35		
TD m	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 8.58-9.40 (P22): Greenish grey (10GY 5/1) moist, slightly firm silty clay, band of grey mottling 9.14-17m. Fibrous very dark brown/brownish yellow horizontally deposited plant material 15%, throughout unit.
		VOID	At 9.40-9.62 VOID
			At 9.62-10.09 (P224): Mid bluish grey (2.5Y 4/1 - 5/1) structureless soft silty clay. Fine to coarse black/dark brown organic detritus including wood 10-20%, becoming less frequent with depth (towards 10%)
			At 10.09-10.30 (P24): Mid greenish grey (5GY 4/1) soft massive silty clay. Occasional broken very thin brown laminations; blackish small horizontal organic detritus patches; occasional small yellowish brown (wood?) fragments.
			At 10.30-10.40 (P24): Mid grey (N 3/1 - 4/1) wet, very soft silty clay. (Core extrusion failed, sample has been collected up in a bag as a bulk sample).
		VOID	At 10.40-10.58 VOID
10.58	10.91	Organic silt	At 10.58-10.91 (P26): Very dark greyish brown (5Y 2.5/1), soft, plastic, nonsticky moderately moist silt. Organic rich. Occasional fine inclusions of fine sand grains 5%. Diffuse basal boundary with light bluish grey 5G 5/1 mottling 20%. Patch of organic detritus 10.91m. (Alluvium)
10.91	12.84	Sandy silt	At 10.91-11.40 (P26): Light bluish grey (5G 5/1) plastic sandy silt, slightly clayey, moderately firm to soft. Small blackish mottles 20% between 10.92-11.20m. Occasional patches of organic detritus. (Alluvium)
		VOID	At 11.40-11.57 VOID
			At 11.57-12.3 (P28): Greenish grey 10GY 6/1 - 5/1 moist to wet, moderately soft, sandy silt. Water content decreasing/ clay content increasing with depth. Occasional diffuse organic black mottles 2%. Structureless (Alluvium)
			At 12.3-12.4 (P28): Bluish grey (5BG 5/1) moist, slightly firm, sandy silty clay. Occasional very fine lenses of fine sand. Inclusions of marine shell fragments >1%, black organic flecks >1%. Diffuse upper boundary. Weakly stratified. (Alluvium?)
		VOID	At 12.40-12.59 VOID
			At 12.59-12.84 (P30): Greenish/bluish grey (5G 6/1) moist, moderately soft fine sandy clay silt. Rare organic inclusions >1%. Structureless (Alluvium?)
12.84	13.32	Clayey silt	At 12.84-13.32 (P30): Greyish brown (2.5Y 5/2) moist, soft to slightly firm clayey silt, with fine to medium sand increasing with depth.Occasional inclusions of coarse sand/small pebbles 1%. Marine shell fragment at 12.65m. Organic inclusion >1%. Clear upper and lower boundaries. Band of clayey fine to medium sand 13.07-13.13m. (Alluvium?)
13.32	15.40	Sandy silt	At 13.32-13.40 (P30): Brownish grey/greyish brown (2.5Y 6/2 - 5/2) moist, soft sandy silty clay. Occasional coarse sand inclusion 1%. Rare organic inclusions >1%.
		VOID	At 13.40-13.72 VOID
			At 13.72-14.40 (P32): Greyish brown (2.Y 5/2) moist, soft sandy silt. Sand fine to medium, increasing together with clay content to a distinct band of sandy clay in lower 7cm of unit. Black organic flecks 1%. Coarse sand 1%.
		VOID	At 14.40-14.67 VOID
			At 14.67-15.40 (P35): Mid greyish brown (2.5Y 5/2), moist, soft, plastic sandy clayey silt, with proportion of clay increasing with depth. Occasional diffuse black organic mottles 1-2%. Coarse sand inclusions 1%. Occasional weakly stratified lenses of fine sand.
			Below this depth bulk spot samples

INT	OA08		
E	571682.91		
N	182398.8		
GL mOD	2.35		
TD m	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
15.40		Gravelly silty clay	At 15.40 (B38): Brown (2.5Y 5/2) gravelly silty clay. Very soft, wet. 10% gravel of angular large pebbles.
15.80		Clayey gravel;	At 15.80 (B40): Brown 2.5Y 5/2 clayey gravel. Wet, near liquid, slightly sandy clay (10%). Sand is fine. Small to large, mainly medium pebbles, subangular to rounded. Pleistocene.
16.00		Clayey gravel;	At 16.00 (B42): Olive grey (5Y 5/2) clayey gravel (10/90). Small to medium pebbles, angular to rounded.
17.00		Sandy gravel	At 17.00 (B44): Olive grey (5Y 5/2) sandy gravel (20/80). Sand is slightly clayey, wet. Small to large pebbles, subangular to rounded.
18.00		Gravelly sand	At 18.00 (B46): Yellowish brown (2.5Y 5/4) gravelly sand (10/90). Very moist and loose. Sand is fine to medium. Gravel is of flint, small to medium pebbles, angular to rounded.
19.00		Sandy gravel	At 19.00 (B48): Yellowish brown (2.5Y 5/4) sandy gravel (40/60). Very moist and loose. Sand is medium. Gravel is of flint, quartz and igneous rock, small to large pebbles, angular to rounded.
20.00		Sandy gravel	At 20.00 (B50): Yellowish brown (2.5Y 6/6) sandy gravel (40/60). Loose, moist fine to coarse sand. Gravel is of flint, mainly small to large pebbles, subangular to subrounded.
21.00		Gravelly sand	At 21.00 (B52): Yellowish brown (2.5Y 6/4) gravelly sand. Loose, moist fine to coarse sand. Mainly small to medium and few large pebbles, subangular to rounded of flint and few quartz.
22.00		Gravelly sand	At 22.00 (B53a): Yellowish brown (2.5Y 5/3) gravelly sand (40/60). Loose, moist, fine to medium sand. Mainly small to medium and few large pebbles, subangular to rounded of flint and few igneous rock fragments.
23.00		Gravelly sand	At 23.00 (B55): Yellowish brown (2.5Y 6/4) gravelly sand (40/60). Loose, fine to coarse sand. Mainly small to medium and few large pebbles, subangular to rounded, of flint.
24.00		Gravelly sand	At 24.00 (B57) Light yellowish brown (2.5Y 6/4), gravelly sand (30/70), sand is fine to coarse, gravel is flint, small to medium pebbles with rare cobbles, subrounded to subangular, loose.
26.00		Gravelly sand	At 26.00 (B61) Yellowish brown (2.5Y 6/6), gravelly sand (30/70), sand is fine to coarse, gravel is flint, small to large pebbles with rare cobbles, subrounded to subangular, loose.
27.00		Gravelly sand	At 27.00 (B65) Yellowish brown (2.5Y 6/6), gravelly sand (40/60), sand is fine to medium, gravel is flint, small to large pebbles with rare cobbles, rounded to subangular, loose.

Borehole OA09

INT	OA09		
E	571177.76		
N	182100.23		
GL mOD	2.05		
TD	27.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.80	Sandy clay	Firm brown sandy clay with frequent rootlets. Sand is fine to coarse **MADE GROUND** (drillers description)

INT	OA09		
E	571177.76		
N	182100.23		
GL mOD	2.05		
TD	27.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 0.80 (B4): Brown (2.5Y 4/3) plastic, soft, very sticky silty clay. Diffuse greyish brown (2.5Y 5/1), slightly reddish brown (10YR 5/4) mottles. Occasional coarse sand, gritty, 2%.
0.80	1.20	Silty clay	Soft brown mottled grey and orange slightly sandy silty clay. Sand is fine and medium (drillers description).
			Below this depth piston samples
1.20	1.45	VOID	**VOID**
1.45	2.20	Silty clay	At 1.45-2.20 (P5): Brown (2.5Y 4/3) plastic, soft, very sticky silty clay. Diffuse greyish brown (2.5Y 5/1), slightly reddish brown (10YR 5/4) mottles. Occasional coarse sand, gritty, 2%.
2.20	2.37	VOID	VOID
2.37	2.78	Silty clay	At 2.37-2.78 (P7): Very dark greenish grey (Gley 1 3/1), soft structureless silty clay. Homogenous, no coarse inclusions.
2.78	3.20	Silty clay	At 2.61-3.03 (P7): Very dark greenish grey, Soft silty clay. Frequent sand lenses (10mm thickness), fine to medium sand , occasionally silty.
3.20	3.40	VOID	VOID
3.20	4.20	Silty clay	At 3.40-4.00 (P9): Dark greenish grey (Gley 1 4/1) soft silty clay with fine sandy lenses (10mm thickness)
4.20	4.38	VOID	VOID
4.38	5.20	Silty clay	At 4.20-5.02 (P11): Dark grey (2.5Y 4/1) soft silty clay. Structureless, no coarse inclusions. Occasional blackish/humic mottles - very faint with diffuse boundaries.
5.20	5.50	VOID	VOID
5.20	5.92	Clay	At 5.20-5.62 (P13): Dark greenish grey (Gley 1 4/1) soft structureless clay. Homogeneous, no coarse inclusions.
5.92	6.20	Sandy clay	At 5.62-5.90 (P13): Dark greenish grey (Gley 1 4/1), soft/loose structureless sandy clay. No coarse inclusions.
6.20	6.41	VOID	VOID
6.41	6.64	Silty clay	At 6.41-6.64 (P15): Very dark grey (2.5Y 3/1) soft silty clay with no coarse inclusions
6.64	6.66	Organic silty clay	At 6.64-6.66 (P15): Black (2.5Y 2.5/1) humic silty clay band. Very diffuse boundaries
6.66	6.72	Silty clay	At 6.66-6.72 (P15): Very dark grey (2.5Y 3/1) soft silty clay with no coarse inclusions
6.72	6.89	Organic silty clay	At 6.72-6.89 (P15):Black (2.5Y 2.5/1) humic silty clay band. Very diffuse boundaries
6.89	7.06	Silty clay	At 6.89-7.06 (P15): Very dark grey (2.5Y 3/1) soft silty clay with no coarse inclusions
7.06	7.20	Organic silty clay	At 7.06-7.20 (P15): Black (2.5Y 2.5/1) soft humic silty clay/clay with no coarse component. Clay rich. Distinct upper and lower boundaries
6.85	7.20	Silty clay	At 6.85-7.20 (P15): Very dark grey (2.5Y 3/1) soft silty clay with no coarse inclusions. Structureless
7.20	7.40	VOID	VOID
7.40	8.20	Silty clay	At 7.20-8.00 (P17): Greenish grey (Gley 1 5/1) soft silty clay. No coarse inclusions, occasional root remains and blackish mottling. Structureless, very homogeneous.
8,20	8.46	VOID	VOID
8.46	9.20	Silty clay	At 8.46-9.20 (P19): Very dark greenish grey (Gley 1 3/1) soft structureless silty clay. No coarse inclusions, occasional rootlets and rare charcoal
9.20	9.47	VOID	VOID
9.47	9.77	Organic silt	At 9.47-9.77 (P21): Black (2.5Y 2.5/1) soft/friable organic silt. Well humified.
9.77	10.20	Silty clay	At 9.50-10.20 (P21): Dark grey (2.5Y 4/1) soft structureless silty clay. Homogeneous, no coarse inclusions.

INT	OA09		
E	571177.76		
N	182100.23		
GL mOD	2.05		
TD	27.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
10.20	10.37	VOID	VOID
10.37	10.57	Silty clay	At 10.37-10.57 (P23): Dark greenish grey (Gley 1 4/1), soft structureless silty clay. No coarse inclusions. Lower boundary abrupt and irregular.
10.57	10.63	Sand	At 10.57-10.63 (P23): Very dark greenish grey (Gley 1 3/1), loose medium to coarse sand. Diffuse lower boundary.
10.63	11.20	Silty clay	At 10.46-11.03 (P23): Dark greyish brown (10YR 4/2) soft structureless silty clay. No coarse component, occasional blackish mottling.
11.20	12.08	VOID	VOID
12.08	12.17	Clayey sand	At 12.08-11.40 (P24): Slightly moist, slightly stiff clayey sand. 11.20-11.24 laminated with more clayey dark greenish grey (10YR 4/1) and soft, more sandy olive (5Y 5/3). 11.24-11.29 less well stratified, colour more homogeneous. Sand component very fine. Occasional orange (Fe) mottles. No organic inclusions. Diffuse lower boundary.
12.17	12.20	Sandy clayey gravel	At 12.17-12.20 (P24): Sandy clayey gravel, clast supported sediment. Small pebbles 50-60%, subrounded to subangular. Sand gritty, fine to medium, with coarse inclusions. Orange (Fe) mottles.
			Below this depth bulk spot samples
11.40		Sandy gravel	At 11.40 (B28): Mid brownish grey (5Y 4/1) sandy gravel. Very wet, liquid coarse to fine silty sand, 10%. Small angular to subangular pebble 70%. Medium to large angular to subangular pebble 15%. Subrounded large cobbles 5%. Predominantly flint.
12.00		Sandy gravel	At 12.00 (B30): Light yellowish brown (2.5Y 5/2) sandy gravel. Mainly coarse sand, some medium and fine sand, slightly clayey, gritty. Pebbles, subangular to subrounded, 70%.
13.00		Gravelly sand	At 13.00 (B32): Light yellowish brown (2.5Y 5/4) gravelly sand. Medium sand, some fine and coarse, very moist, 55%. Gravel subangular to well rounded pebbles. Flint present, occasional quartz.
14.00		Gravelly sand	At 14.00 (B34): Light yellowish brown (2.5Y 5/4) gravelly sand. Medium sand 50%. Gravel small pebbles angular to subangular 30%. Medium pebbles angular to rounded 15%. Large pebbles and small cobbles, subangular 5%. Mainly flint. Some igneous/metamorphic rock, occasional yellowish red, fine, hard sandstone.
15.00		Sandy gravel	At 15.00 (B36): Light yellowish brown (2.5Y 5/4) sandy gravel. Medium sand, some fine and coarse, 40%. Angular to rounded pebbles. Abundant flint. Occasional quartz.Very hard fine yellow sandstone.
16.00		Sandy gravel	At 16.00 (B38): Mid yellowish red (10YR 6/6) sandy gravel. Coarse to fine sand, gritty, 30%. Subangular to rounded pebbles, occasional angular pebbles. Flint.
17.00		Sandy gravel	At 17.00 (B40) Light yellowish brown (2.5Y 6/4) sandy gravel. Medium to fine sand, small amount of coarse sand, gritty, 30%. Small pebbles, angular to rounded, 40%. Medium to large angular to subangular pebble, 30%. Flint, occasional quartz 2%. Occasional yellow sandstone.
18.00		Sandy gravel	At 18.00 (B42): Yellowish brown (2.5Y 5/4) sandy gravel. Very moist, fine sand with some medium and coarse, 30%. Small to large subangular to rounded (mostly rounded) gravel. Flint 10%.
18.40		Clay	At 18.40 (D43): Very dark brownish grey (2.5Y 3/2) clay, slightly silty, slightly sandy. Firm, plastic, slightly sticky. Clasts of small angular pebbles present. Coarse to medium sand clasts, angular, forming lenses.
19.00		Clay	At 19.00 (B45): Dark brownish grey (5GY 3/1) firm, slightly plastic, slightly sandy, silty clay. Stoney 15% - white, thin fragile chips. Diffuse small lenses of very fine, light greyish sand.

INT	OA09		
E	571177.76		
N	182100.23		
GL mOD	2.05		
TD	27.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
20.00		Sandy silt	At 20.00 (B47): Very dark brownish grey (5Y 3/1) clayey sandy silt. Firm, plastic, nonsticky. Fine sand 5-10%. Massive. Small light grey fine sandy lenses. Inclusions of small platy fragmented white stones 5%. Fine flint present.
20.60		Sandy silty clay	At 20.60 (B48): Dark brownish grey (10YR 4/1) sandy silty clay. Moderately firm, moist, plastic, slightly sticky. Small diffuse lenses of fine, mid grey sand 5%. Small flint fragments. Stoney 2-5%, small angular pebbles.
21.00		Sandy silt	At 21.00 (B51): Black, firm to plastic, slightly sandy silt. Structure fine polyeders - blocks. Earthy smell. (Peat decayed, compacted)
21.80		Sand	At 21.80 (D52): Very dark brownish grey 10Y 3/1 moderately wet, very fine sand, slightly clayey. Moderately firm, slightly plastic. Occasional mica. Massive. Weak stratification (peels into irregular layers). Occasional small, subangular pebbles 2%.

Borehole OA10

INT	OA10		
E	572242.69		
N	182097.9		
GL mOD	2.75		
TD	34.35		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	1.20	Gravelly sand	Brown gravelly sand with medium cobbles. Sand fine to coarse. Gravel flint brick and concrete, fine to coarse, subangular and subrounded. Cobbles concrete and brick, subanglar. MADE GROUND (Drillers description).
			At 0.20 (B2) Clayey sand, yellowish brown (5Y 5/4) fine clayey sand, firm, occasional small angular pebbles 5% of flint and concrete.
			At 1.20 (B4) Gravelly sand (10/90) yellowish brown (5Y 5/2). Sand is fine and slightly clayey. Few small to large sub-angular to subrounded pebbles of limestone and flint.
1.20	2.00	Sandy clay	Brown firm sandy clay with grey mottles. Sand is fine, frequent rootlets (Drillers description).
			At 1.40 (B6) Slightly sandy silty clay, few small roots, brown (2.5Y 4/1). Diffuse greyish brown (2.5Y 3/1) (10%) and reddish brown Fe (2%) mottles.
2.00	3.00	Sandy clay	Soft brown grey sandy clay. Sand is fine (drillers description)
			At 2.00-3.00 (B8) Silty clay, mid greyish brown (2.5Y 5.2), soft structureless.
			Below this depth piston samples
3.00	3.25	VOID	VOID
3.25	3.43	Silty clay	At 3.25-3.43 (P10): Bluish grey (5BG 5/1) moist soft plastic very sticky clay, slightly silty. Weak diffuse brownish grey mottles 5GY 4/1 5%. Organic inclusions <1mm to 5mm, 10%. Distinct lower boundary.

INT	OA10		
E	572242.69		
N	182097.9		
GL mOD	2.75		
TD	34.35		
Depth (m)		**Keyword**	**Description**
From	**To**		
3.43	3.70	Clayey silt	At 3.43-3.70 (P10): Dark greyish brown (2.5Y 3/1) soft to firm, slightly plastic, slightly sticky clayey silt. Areas of bluish grey (5BG 5/1) especially 3.31-3.40m. Small reddish brown organic detritus fragments 1mm-5mm 20%. Some diffuse stratification of brown and bluish clay. Abrupt basal boundary.
3.45	4.00	Silty clay	At 3.70-4.00 (P10): Bluish grey (10BG 5/1) massive, plastic, soft sticky silty clay. Abundant fine black flecks 10-20% (variable), organic detritus common (10%) between 3.70-3.78m.
4.00	4.22	VOID	VOID
4.22	5.00	Silty clay	At 4.22-5.00 (P12): Dark greenish grey, soft structureless silty clay. No coarse inclusions, frequent blackish mottling (15%) - rootlets and Manganese
5.00	5.35	VOID	VOID
5.35	5.60	Silty clay	At 5.35-5.60 (P14):Dark grey (2.5Y 4/1) with slight reddish mottling, structureless silty clay. No coarse inclusions, frequent decayed rootlets. (alluvium)
5.60	6.00	Silty clay	At 5.60-6.00 (P14): Dark grey (2.5Y 4/1) soft structureless silty clay. No coarse inclusions and no evidence of rootlets, very homogeneous, clean and sterile (Alluvium)
6.00	6.31	VOID	VOID
6.31	6.85	Silty clay	At 6.31-6.85 (P16): Greenish grey (5GY 4/1) soft, plastic, sticky silty clay. Very weak light bluish grey mottling. Very fine (5%) and small to medium (1mm to 10mm) organic dark brown/blackish detritus; larger fragments common (10%) at 6.43-6.49 and 6.75-6.78m. Sulphuric smell (Alluvium)
6.85	6.98	Silty clay	At 6.85-6.98 (P16):Dark greyish brown, soft, plastic silty clay. Small diffuse greenish grey mottles, very dark grey small mottles at base 6.64-67m. Very fine sand with mica included 5-10%. Occasional organic inclusions 2%. Diffuse boundary.
6.98	7.18	VOID	VOID
7.18	7.25	Silty peat	At 7.18-7.25 (P18): Very dark reddish brown (7.5YR 2.5/1) spongy to firm, crumbly, silty peat. Light yellowish brown small inclusions (wood?) 5%. Clear basal boundary. Position of upper boundary estimated - lost at top of core(Peat)
7.25	7.75	Silty clay	At 7.25-7.75 (P18): Bluish grey (5GY 5/1) soft sticky plastic silty clay. Diffuse brownish grey mottling 2.5Y 5/1 especially at top. Abundant stratified reddish brown/yellowish brown organic detritus (wood?) 2mm thick. Clear to diffuse basal boundary (Alluvium)
7.75	8.00	Silty clay	At 7.75-8.00 (P18): Bluish grey to grey (N3/1 to 4/1) plastic, sticky, soft silty clay. Blackish small to medium organic detritus 1-5mm, 5%. (alluvium)
8.00	8.15	VOID	VOID
8.15	8.19	Silty clay	At 8.15-8.19 (P20): Light greenish grey (5GY 5/1 to 6/1) very sticky, soft plastic slightly silty clay. Very fine occasional coarse dark brown organic inclusions 5%

INT	OA10		
E	572242.69		
N	182097.9		
GL mOD	2.75		
TD	34.35		
Depth (m)		**Keyword**	**Description**
From	**To**		
8.19	8.84	Silty clay	At 8.19-8.84 (P20): Greenish grey (10Y 5/1) soft, plastic sticky silty clay.Very small fine sand lenses common (20%). Weak traces of broken very thin, fine sand laminations between 8.30 and 8.53m. Organic inclusions 1-5mm, dark brown organic detritus common (2-5%), more frequent 8.52-64m (10%) possible thin (2mm) organic layers at 8.24 and 8.75m. Sharp upper and lower boundaries (alluvium)
8.84	9.00	Silty sand	At 8.84-9.00 (P20):Dark greenish grey (10G 4/1) soft to firm silty sand . Sand very fine with occasional mica. Small sand lenses.(Alluvium)
9.00	9.22	VOID	VOID
9.22	9.50	Sandy silt	At 9.22-9.50 (P22): Dark greenish grey (5Y 4/1) moist, plastic, very soft to firm weakly stratified sandy, slightly clayey silt and silty sand at 20-30mm intervals. Sands very fine, changes very diffuse. Occasional dark grey mottles (5mm) and blackish flecks (<1%. Clear to slightly diffuse lower boundary (Alluvium)
9.28	10.00	Sand	At 9.50-10.00 (P22): Dark bluish grey (5GY 4/1) firm, stratified very fine sand, slightly silty with interspaced layers of sandy silty clay. Diffuse stratigraphy, weak lamination (fine sand) in clayey layers. Fine mica present in sands. Occasional reddish brown fine organic matter at 9.53-9.56m and 9.74-9.77m. Occasional small blackish flecks 9.85 to base (Alluvium)
10.00	10.17	VOID	VOID
10.17	11.00	Clayey sand	At 10.17-10.82 (P24): Bluish grey, soft to moderately firm, slightly sticky, slightly plastic clayey sand. Weak traces of alternating more sandy and more silty clayey sediment, weak traces of thin layer lamination at 10.84-10.93m. Occasional organic brown small flecks 10.73-93m (Alluvium)
11.00	11.22	VOID	VOID
11.22	12.00	Sandy silt	At 11.22-11.78 (P26): Dark greenish grey (10Y 4/1) very sandy silt (possibly silty sand) slightly clayey. Varying amounts of sand and clay resulting in a weak stratification, some structureless and some weak sandy lamination present. Occasional blackish/reddish brown small fragments or patches and occasional mica (1%).
12.00	12.19	VOID	VOID
12.19	12.56	Silty sand	At 12.19-12.56 (P28): Dark greenish grey (10Y 4/1 to 5GY 4/1) soft to firm very fine silty sand. Includes zones of clayey, sandy silt. Very fine reddish brown and blackish flecks (10%) mica (<1%). Small sandy lenses or weak fine lamination. Occasional patch of dark brown organic matter (<1%). distinct fine band of brown organic rich sand (1mm) at 12.55m. Clear lower boundary.
12.56	13.00	Silty sand	At 12.56-12.79 (P28): Dark bluish grey (N 4/1) getting darker and brownish towards base (N 3/1) soft to firm very fine silty sand. Small sand lenses or weak fine sand/clay stratification. Weak stratification with darker bands at 12.69-12.71m and 12.75-12.77m, more clayey bands at 12.67-12.69m 12.82-12.84m. Very fine dark brown/blackish flecks and mica present.
13.00	13.25	VOID	VOID

INT	OA10		
E	572242.69		
N	182097.9		
GL mOD	2.75		
TD	34.35		
Depth (m)		**Keyword**	**Description**
From	**To**		
13.25	13.52	Silty sand	At 13.25-13.52 (P30): Dark grey (N 4/1) with yellowish grey (5Y 5/3) broken lamination, firm very fine silty sand. Occasional lamination with yellowish fine sandy silt. Weak sulphuric smell. Very fine dark brown organic flecks (20%) in top 6cm, frequent shell fragments and coarse sand 13.46-13.52m. Abrupt lower boundary.
13.52	13.96	Silty clay	At 13.52-13.96 (P30): Bluish grey (10B 5/1) sticky silty clay. Fine brown, irregular lamination with layers of very fine brownish organic matter. Small to medium (<5mm) organic reddish brown inclusions (5%) common 13.58-13.77m (15%) rare below 13.77m (2%). Clear wavey mottled basal boundary (Alluvium)
13.96	14.00	Silty clay	At 13.96-14.00 (P30): Very dark brownish grey (10B 2.5/1) soft, very sticky silty clay. Small bluish grey mottles, abundant fine blackish inclusions (20%). (Alluvium)
14.00	14.33	VOID	VOID
14.33	14.50	Silt	At 14.33-14.50 (P32): Very dark blackish brown (5Y 2.5/1) firm, slightly plastic, structureless, massive silt. Diffuse colour change to base. Weak metallic smell (Fe). Very fine mica/silicate, no inclusions. Diffuse boundary at base (Alluvium)
14.50	15.00	Clayey sand	At 14.50-15.00 (P32): Greyish brown (5Y 4/1) firm, slightly plastic, very clayey sand. Sand content varies to sandy clay at 14.57-62m. Light yellowish brown 5Y 5/2 at 14.75-14.86m. Fine to small (2mm) organic blackish matter 10% between 14.50-14.75and 14.85 to base. Massive, structureless (Alluvium)
			Below this depth bulk spot samples
15.00		Silty clay	At 15.00 (B36): Silty clay, soft, structureless, greyish brown (2.5Y 5/2) with soft to firm inclusions of greenish grey silty clay (5G 4/1) 5%.
15.70		Gravelly sandy clay	At 15.70 (B38): Gravelly sandy clay, brown (5Y 4/2). Gravel is small to large, angular to rounded pebbles.
16.00		Gravel	At 16.00 (B40): Gravel, slightly clayey (10/90), greyish brown (5Y 4/1). Gravel is mainly small with a few medium to large pebbles, mainly angular with a few subangular to rounded.
17.00		Sandy gravel	At 17.00 (B42): Sandy gravel (10/90) greyish brown (2.5Y 4/1). Sand is fine to coarse. Gravel is mainly small with a few medium pebbles angular to rounded.
17.40		Sandy clay	At 17.40 (B44): Sandy clay, yellowish brown (2.5Y 5/3). Firm to stiff. Sand is fine with occasional small angular pebbles.
18.00		Gravelly sand	At 18.00 (B46): Gravelly sand (40/60), yellowish brown (2.5Y 5/3) sand is fine to medium, gravel is small to large, subangular to subrounded pebbles of flint.
19.00		Gravelly sand	At 19.00 (B48): Gravelly sand (40/60). Sand is fine to coarse. Gravel issmall to medium angular to rounded pebbles of flint with a few quartz.
20.00		Gravelly sand	At 20.00 (B50): Gravelly sand (40/60). Sand is fine to coarse. Gravel issmall to medium angular to rounded pebbles of flint with a few quartz.
21.00		Sandy gravel	At 21.00 (B52): Sandy gravel (30/70) brownish grey (5Y 4/2 to 5/2). Sand is fine to medium. Gravel is small to large pebbles subangular to rounded, of flint.
22.00		Sandy gravel	At 22.00 (B54): Sandy gravel (40/60) greyish brown (5Y 5/2 to 5/3). Sand is fine to medium. Gravel is mainly small with a few medium pebbles subangular to rounded.

INT	OA10		
E	572242.69		
N	182097.9		
GL mOD	2.75		
TD	34.35		
Depth (m)		**Keyword**	**Description**
From	**To**		
23.00		Sandy gravel	At 23.00 (B56): Sandy gravel (30/70) yellowish brown (2.5Y 6/2). Sand is fine. Gravel is mainly small with a few medium pebbles subangular to rounded.
24.00		Sandy gravel	At 24.00 (B68): Sandy gravel yellowish brown (2.5Y 6/2). Sand is fine to coarse. Gravel is mainly small with a few medium pebbles angular to rounded of flint and a few quartz.
25.00		Sandy gravel	At 25.00 (B60): Sandy gravel (30/60), greyish brown (2.5Y 5/2). Sand is fine to coarse. Gravel is small to large pebbles subrounded to rounded of flint, quartz and white sandstone.
26.00		Gravelly sand	At 26.00 (B62): Gravelly sand (40/60). Sand is fine to coarse. Gravel issmall to medium angular to rounded pebbles of flint with a few quartz.
27.00		Gravelly sand	At 27.00 (B64): Gravelly sand (40/60). Yellowish brown (2.5Y 6/3). Sand is fine to coarse. Gravel is small to large, angular to subrounded pebbles.
28.00		Gravelly sand	At 28.00 (B66): Gravelly sand (20/80). Yellowish brown (2.5Y 5/3). Sand is fine to medium. Gravel is small to large, subangular to rounded pebbles.
28.40		Clayey sand	At 28.40 (B68): Slightly clayey sand, dark greyish brown (2.5Y 3/1 to 5Y4/1), moderatley firm, sand is fine with a few coarse grains 3%.

Borehole OA11

INT	OA11		
E	572879.18		
N	182600.15		
GL mOD	2.03		
TD	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.80	Sandy gravelly clay	Brown, firm sandy gravelly clay with frequent rootlets. Sand fine to coarse. Gravel subangular to subrounded, fine to medium of flint. **MADE GROUND** (drillers description).
			At 0.20 (B2): Gravelly silty clay, slightly sandy, brown (10YR 4/2). 50% gravel, pebbles and cobbles of concrete and flint. Roots present.
0.80	1.60	Silty clay	Brown with orange mottles, firm slightly silty clay with occasional rootlets.**MADE GROUND** (drillers description).
			At 0.80 (B4): Silty clay, stiff to firm, grey (N5/) with small reddish brown mottles 10%. Some rootlets.
1.60	2.20	Silty clay	Soft brown grey slightly sandy silty clay with frequent pockets of partially decomposed organic plant material. Sand is fine (drillers description).
			At 1.60 (B8) Silty clay, yellowish brown (2.5Y 4/3). Structureless. Fine reddish brown mottles of Fe 5%.
			Below this depth piston samples
2.20	2.44	VOID	**VOID**

INT	OA11		
E	572879.18		
N	182600.15		
GL mOD	2.03		
TD	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
2.44	3.20	Silty clay	At 2.44-.3.20 (P9): Brown (2.5Y 5/1) very soft, plastic, silty clay. Increasing dark greyish brown (2.5Y 4/1) diffuse mottling from 2.45m to base. Very fine to small (1mm) reddish brown/blackish organic inclusions (5%), larger fragments at 2.44-2.50 (wood) and 3.14-3.16.
3.20	3.40	VOID	VOID
3.40	3.48	Laminated silty clay	At 3.40-3.48 (P12): Brown (10YR 4/1) silty clay. Fine blackish organic inclusions 2%. Fine laminations with fine sand layers. Diffuse lower boundary.
3.48	4.09	Laminated sand and clayey silt	At 3.48-4.09 (P12): Laminated unit: 2-4mm dark grey (2.5Y 4/1) firm, only slightly clayey, very fine sand; greyish brown (10YR 4/1) very soft, plastic 1mm clayey silt. Occasional very fine brown organic matter included in sand (2%). Blackish mottles at 3.40. Abrupt basal boundary.
4.09	4.20	Silty clay	At 4.09- 4.20 (P12): Dark greyish brown very soft, massive silty clay. Occasional fine or small blackish flecks 2-4%.
4.20	4.71	VOID	VOID
4.71	4.94	Laminated sand and clay	At 4.71-4.81 (P14): Dark yellowish brown (10Y 4/1 to 3/1) finely laminated unit. 1mm silty sand layers separated by very thin clay layers every 20mm. Lamination become less distinct towards base. Dark brown organic fragment 5mm diameter at 4.92. Diffuse basal boundary.
4.94	5.20	Silty clayey sand	(P14): Dark grey (5GY 3/1) soft, weakly stratified, silty clayey sand. Broken silty sand layers/lenses. Occasional shell fragments
5.20	5.44	VOID	VOID
5.44	6.20	Laminated sand and silty clay	At 5.44-6.20 (P16): Dark brownish grey (10YR 4/1) grading into dark grey (5Y 4/1 to 3/1) laminated unit. Laminations at 1mm intervals and smaller of very fine sand with silty clay layers.
6.20	6.43	VOID	VOID
6.43	7.05	Laminated sand and silty clay	At 6.43-7.05 (P18): Dark brownish grey (5GY 4/1) medium to fine sand frequently laminated with 1mm thick very soft silty clay bands or thin blackish sand layers. Blackish (N 2.5/1) diffuse 50mm mottles fro the top to 6.74. At 6.43-6.72 fine to medium sand, only slightly silty. At 6.72-7.05 medium sand laminated with thin clayey silty bands and organic laminations. Abrupt basal boundary.
7.05	7.20	Sandy silt	At 7.05-7.20 (P18): Dark brownish grey (5GY 4/1) soft sandy silt. Small sandy lenses, very fine rare mica.
7.20	7.45	VOID	VOID
7.45	8.20	Laminated sand and clay	At 7.45-8.20 (P20): Dark grey (5GY 5/1 to 4/1) laminated unit: Fine to medium sand o 1-20mm, and clay <1-2mm, and occasional laminae of very dark brown (5Y 2.5/1) organic rich layers. Small fragments <2mm frequent from 7.61-7.81 3mm thick peaty organic rich layers at 7.53 and 8.01; several weaker similar layers present.
8.20	8.42	VOID	VOID
8.42	9.20	Laminated sand and silty clay	At 8.42-9.20 (P22): Dark grey (5Y 3/1) fine sand, with laminations of 1-4mm greyish brown silty clay at irregular intervals and bands of organic rich very dark brown sandy silt. Dark yellowish brown lenses in top 15cm. Occasional fine shell fragments. Quartz grains on surface give the appearance of the sediment being lighter.
9.20	9.43	VOID	VOID
9.43	9.83	Laminated sand and clayey silt	At 9.43-9.83 (P24): Dark grey (5Y 4/1 to 3/1) fine or medium sand interspaced with moderately firm, very thin, mid grey soft clayey silt layers and broken layers (1mm) of dark brown organic rich sand. Shell present 5-10%; 9.59-9.68m. Diffuse basal boundary.

INT	OA11		
E	572879.18		
N	182600.15		
GL mOD	2.03		
TD	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
9.83	10.20	Laminated silty sand and silty clay	At 9.83-10.20 (P24) Dark grey (10Y 4/1 to 3/1) silty sand. Sand fine and laminated with thin silty clay bands. Zones with very dark brown organic layers (1-2mm). Small shell fragments present 9.83-10.06.
10.20	10.40	VOID	VOID
10.40	11.20	Laminated sand with silty clay	At 10.40-11.20 (P26): Dark grey (10Y 3/1) finely laminated (2-5mm) medium to fine sand. Shell fragments common (5%) from top to 11.90 and 12.12-12.15. Occasional dark brown organic rich sand bands. Some light yellow brown bands from the top to 11.52 may be due to contamination. Thin interspaced grey (5Y 4/1) silt clay bands, especially frequent 11.87-12.06m.
11.20	11.47	VOID	VOID
11.47	12.20	Laminated sand and silty clay	At 11.47-12.20 (P28): Dark grey (2.5Y 4/1) finely laminated sand with very light yellowish brown sand layers (5Y 6/3) at the top. Laminae 1mm thick or less, separated by silty clay or organic rich dark brown sand layers. Shell fragments 3% at 11.90-12.05m. 11.47-11.79m very light brown yellow sand lenses 1mm to 25mm interspaced with brown silty clay layers 1mm thick and grey silty clay and sand layers, creating mixed colour pattern. Very dark brown organic rich band 5mm at 11.81 and 12.19m BGL.
12.20	12.48	VOID	VOID
12.48	12.72	Laminated silty clay and sand	At 12.48-12.72 (P30): Dark greyish brown (5Y 4/1) very soft, very plastic, silty clay, stratified in 1mm layers, occasionally up to 20mm. Intercalated thin layers (<1mm) of blackish mottled, light brownish grey very fine sand. Abrupt lower boundary.
12.72	13.20	Laminated silty clay and sand	At 12.72-13.20 (P30): Grey (5GY 4/1) fine and medium sand, stratified in 1-5mm thick laminations. Thin separating layers of light grey (5GY 5/1) silty clay and thin dark reddish brown organic rich layers. Fine shell fragments common 12.85-12.95m.
13.20	13.54	VOID	VOID
13.54	13.90	Laminated silty clay and sand	At 13.54-13.90 (P32): Bluish grey (5GY 4/1) soft silty clay. Finely laminated (1-2mm) with very thin (<1mm) layers of dark grey fine sand with varying inclusions of dark brown organic detritus (5-30%). Occasional sand bands 2-5mm thick and small sand lenses with large organic detritus inclusions at 13.55 and 13.62. Diffuse basal boundary.
13.90	14.20	Laminated silty clay and sand	At 13.90-14.20 (P32): Dark greyish brown (2.5Y 4/1) firm to soft, plastic, slightly sticky clayey silt, stratified weak to very weak broken fine sand laminations (0.2-0.5mm). Distinct coarse lamination (1mm) 14.03-14.11m. Occasional fine brown organic detritus inclusions in sandy layers 14.07-14.11m.
14.20	14.39	VOID	VOID
14.39	14.85	Laminated silty clay and sand	At 14.39-14.85 (P34): Brownish grey (5Y 4/1 to 3/1) zonal bands (30-40mm) of dark greyish brown (5Y 3/1) and blackish blue (10B 2.5/1). Soft to firm sticky, plastic silty clay, zones of fine (1mm) lamination with thin fine sand layers <1mm of dark brown colour. Occasional sand bands 1-2mm, light very fine sand, rare very fine dark brown organic inclusions (1%), few small fine sand lenses. Diffuse lower boundary.
14.85	15.20	Silty clay	At 14.85-15.20 (P34): Very dark bluish/blackish grey (10BG 2.5/1) soft to firm moderately moist to dry silty clay, stratified, weak fine laminations at intervals with very thin, fine sand layers <0.5mm. Occasional sand layers 0.5-1mm mid brownish grey. Very fine blackish flecks in laminations. Occasional small mottles of mid greyish brown, usually attached to sand layers.

INT	OA11		
E	572879.18		
N	182600.15		
GL mOD	2.03		
TD	33.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
15.20	15.90	VOID	VOID
15.90	16.20	Silty sandy clay	At 15.90-16.20 (P36): Brown (7.5YR 5/3) soft, friable structureless silty clay/ sandy clay with frequent partially sorted subrounded to subangular gravel inclusions.
			Below this depth bulk spot samples
16.00		Clayey gravel	At 16.00 (B41): Clayey gravel (10/90), slightly sandy, yellowish brown (2.5Y 5/3). Gravel is small to large pebbles, angular and occassionally subrounded
17.00		Sandy gravel	At 17.00 (B43): Sandy gravel (30/70), yellowish brown (5Y 5/3), sand is fine to coarse, gravel is small to large, angular to rounded pebbles of flint.
18.00		Gravelly sand	At 18.00 (B45): Gravelly sand (40/60), yellowish brown (5Y 5/3), sand is fine to coarse, gravel is small to large, subangular to rounded pebbles.
19.00		Gravelly sand	At 19.00 (B47): Gravelly sand (40/60), greyish brown (2.5Y 5/2), sand is fine to medium, gravel is small to large, angular to rounded pebbles of flint.
20.00		Gravelly sand	At 20.00 (B49): Gravelly sand (40/60), yellowish brown (2.5Y 6/3), sand is fine to medium, gravel is small to large, angular to subrounded pebbles of flint.
21.00		Gravelly sand	At 21.00 (B51): Gravelly sand (30/70), yellowish brown (2.5Y 6/3), sand is medium, gravel is small to medium, angular to rounded pebbles of flint.
22.00		Gravelly sand	At 22.00 (B53): Gravelly sand (40/60), light yellowish brown (2.5Y 6/3), sand is fine to coarse, gravel is small to large, subrounded to rounded pebbles of flint.
23.00		Gravelly sand	At 23.00 (B55): Gravelly sand (40/60), yellowish brown (2.5Y /3), sand is fine to medium, gravel is small to large, subangular to rounded pebbles of flint.
24.00		Gravelly sand	At 24.00 (B57): Gravelly sand (40/60), yellowish brown (2.5Y 5/4), sand is fine to coarse, gravel is small to large, subangular to rounded pebbles of flint, quartz and igneous rock.
25.00		Sandy gravel	At 25.00 (B59): Sandy gravel (30/70), light brown (2.5Y 5/2), sand is fine to coarse, gravel is small to large, angular to rounded pebbles of flint.
26.00		Gravelly sand	At 26.00 (B61): Gravelly sand (40/60), yellowish brown (2.5Y 6/3), sand is medium, gravel is small to large, subangular to rounded pebbles of flint.
27.00		Gravelly sand	At 27.00 (B63): Gravelly sand, yellowish brown (2.5Y 6/4), sand is coarse, gravel is small to large, angular to rounded pebbles of flint.
27.60		Sand	At 27.60 (B65): Fine sand, dark grey (5Y 3/1-4/1) with occasional medium sand grains.

Borehole OA12

INT	OA12		
E	572442.27		
N	182597.18		
GL mOD	1.81		
TD	33.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	1.60	Sandy clay	Brown firm sandy clay with orange mottles and frequent rootlets. Sand fine to coarse TOPSOIL (drillers description).
			At 0.20 (B2): Yellowish brown (10YR 5/3) clayey silt, occassional small pebbles. Grass roots. Occassional fine CBM fragments.

INT	OA12		
E	572442.27		
N	182597.18		
GL mOD	1.81		
TD	33.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 1.20 (B5): Mid brown (2.5Y 4/2-5/2) firm silty clay with reddish brown mottles 2%.
1.60	2.00		Soft brown grey silty clay with frequent lenses of black organic matter (drillers description).
			Below this depth piston samples
2.00	**2.23**		**VOID (P8)**
2.23	5.00	Silty clay	At 2.23-3.00m (P8): Dark grey (5YR 4/1) soft structureless silty clay. No coarse inclusions, homogeneous with rare blackish mottling (5%)
			At 3.00-3.24m VOID
			At 3.24-3.61m (P10): Greyish brown (2.5Y 4/1), very soft, plastic clay, slightly silty. Frequent fine and small blackish patches and flecks. Massive, structureless. Diffuse lower boundary.
			At 3.61-4.00 (P10): Dark greyish brown (5Y 4/1) very soft, sticky plastic silty clay. Plentiful very fine blackish flecks (30%) some vertical blackish linear detritus 2-3mm thick. Massive, structureless.
			At 4.00-4.28m VOID (P12)
			At 4.28-5.00 (P12): Dark greyish brown (2.5Y 4/1) soft, plastic, silty clay. Small occasional diffuse bluish grey mottles (5B 6/1). Very fine black flecks: 4.00-4.29 (30%), 4.29-4.72 (10%). Few large blackish and dark reddish brown fragments of organic detritus (2%) more frequent (5%) at 4.32-4.52 and 4.54-4.62. Massive, structureless.
5.00	**5.23**		**VOID (P14)**
5.23	6.00	Clayey silt	At 5.23-5.51 (P14): Greenish grey (10Y 4/1) soft, plastic, clayey silt. Very fine to small (1mm) blackish and dark brown flecks of organic detritus (15%), yellowish brown vertical fibrous detritus 2-3mm thick. Massive, structureless. Clear basal boundary.
			At 5.51-6.00 (P14): Greenish grey (5GY 5/1 to 4/1) soft, clayey silt. Occasional small very dark brown patches of organic detritus (1-2mm). Patches of yellowish brown fibrous detritus 2-4mm, as in above unit but short fragments, 2%, horizontally deposited. Massive, structureless.
6.00	**6.23**		**VOID (P16)**
6.23	6.63	Laminated silty clay	At 6.23-6.63 (P16): Greenish grey (5GY 5/1 to 4/1) soft silty clay. Weak very thin brown organic rich discontinuous laminations. Abundant fine dark brown organic inclusions and blarck vertical plant remains. Clear lower contact.
6.63	6.68	Laminated silt	At 6.63-6.68 (P16): Dark brownish grey (2.5Y 4/1) soft silt with dark brown (2.5Y 3/1) organic laminations.
6.68	6.94	Peat	At 6.68-6.94 (P16): Black , slightly spongy silty peat. Occassional fine yellowish red horizontal plant remains (woody). Clear lower contact.
6.94	9.43	Silty clay	At 6.94-7.00 (P16): Light greenish grey (5G 5/1-6/1) slightly silty clay, soft with occasional small black peaty organic inclusions.
			At 7.00-7.17m VOID (P18)
			At 7.17-8.00 (P18): Brownish grey grading to bluish grey (10G 5/1) below 7.43. Plastic silty clay. Very fine to small (5mm) dark brown organic detritus. More frequent and larger (>50mm length) between 7.48-7.64. Two thin sand lenses (2mm thick) at 7.04 and 7.19. Reduced quantities of fine brown organic detritus from 7.43-83 (2%) . Massive, structureless.
			At 8.00-8.21m VOID (P20)
			At 8.21-9.00 (P20): Soft, silty clay. Gradual colour change from dark grey (5Y 4/1) at top to grey (2.5Y 5/1) at base. Irregularly spaced lenses of sand (2-3mm). Organic detritus 1%, increasing slightly towards top of unit.
			At 9.00-9.17m VOID (P22)

INT	OA12		
E	572442.27		
N	182597.18		
GL mOD	1.81		
TD	33.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
			At 9.17-9.43 (P22): Brownish grey (5GY 5/1) soft, plastic silt, slightly clayey. Small weak bluish grey mottles. Occasional blackish small organic inclusions 2%. Massive, structureless. Abrupt basal boundary, tilted plane possibly due to compaction.
9.43	11.00	Laminated sand and clayey silt	At 9.43-10.00 (P22): Firm, moist, laminated sand (typically structureless silty sand 50mm thick, but variable; laminations weak to distinct or just small sand lenses) and clayey silt bands. Dark greenish/brownish grey (5GY 4/1) changing to greenish grey (10GY 4/1) at 9.53m. No inclusions except for occasional patches of blackish detritus. Basal 10cm predominately clayey silt.
			At 10.00-10.24m VOID (P23)
			At 10.24-11.00 (P23): Laminated sand and clayey silt. Dark grey (5GY 4/1) very fine sand.laminae at 1mm intervals interspersed with grey (5GY 4/1 to 5/1) very soft clayey silt. Typically, 20mm of finely laminated sands are separated by 2-5mm (occasionally up to 20mm) of clayey silts. 10.14-10.41 the laminations are distorted. Occasional blackish vertical detritus. Rare mica.
11.00	**11.27**		**VOID (P26)**
11.27	12.79	Laminated silty sand	At 11.27-12.00 (P26): Dark greenish grey (Gley 1 4/1) loose silty sand. Fine silt and sand laminations (10mm thickness).
			At 12.00-12.40 VOID (P28)
			At 12.40-12.79 (P28): Dark greenish grey (Gley 1 4/1) loose silty sand. Occasional silty clay bands (20-30mm thick) with distinct contact between bands. Occasional fine laminations of silt and sand near the top, gradually fading away.
12.79	13.00	Clay silt	At 12.79-13.00 (P28): Greenish grey (Gley 1 5/1) firm clay silt.
			Below this depth bulk spot samples
13.00		Sandy silty clay	At 13.00 (B31): Soft, slightly sandy silty clay, mid greenish grey (10 GY 5/1-4/1). Small reddish brown mottles (Fe) 2%
13.90		Gravel	At 13.90 (B32): Gravel, slightly clayey (5%), greyish brown (5Y 4/1). Gravel is small to large pebbles with occasional cobbles of flint, subrounded to subangular.
14.00		Gravel	At 14.00 (B34): Gravel, slightly clayey (5%), greyish brown (5GY 4/1-5/1). Gravel is small to large pebbles of flint, subangular.
15.00		Sandy gravel	At 15.00 (B36): Slightly sandy gravel (5/95), yellowish brown (5Y 4/2-4/3). Gravel is mainly small pebbles with occasional cobbles of flint, angular to subrounded.
16.00		Sandy gravel	At 16.00 (B38): Slightly sandy gravel (5/95), brownish grey (10Y 5/1-4/1).sand is mainly fine, some coarse. Gravel is mainly small pebbles with occasional large pebbles of flint, subangular to subrounded.
17.00		Sandy gravel	At 17.00: Slightly sandy gravel (10/90), greyish brown (5Y 5/2-4/2). Sand is fine to coarse. Gravel is small to large pebbles of flint, subangular to subrounded.
18.00		Sandy gravel	At 18.00 (B42): Sandy gravel (30/70), light brownish grey (2.5Y 5/1-5/2). Sand is medium to medium, gravel is small to medium pebbles of flint, subangular to rounded.
19.00		Sandy gravel	At 19.00 (B44): Sandy gravel (20/80), light brownish grey (10Y 5/2). Sand is medium to coarse, gravel is small to medium pebbles of flint, angular to rounded.
20.00		Sandy gravel	At 20.00 (B46): Sandy gravel (20/80), light brownish grey (2.5Y 5/2). Sand is fine to coarse, gravel is small to medium pebbles of flint, angular to subrounded.

INT	OA12		
E	572442.27		
N	182597.18		
GL mOD	1.81		
TD	33.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
21.00		Sandy gravel	At 21.00 (B48): Sandy gravel (20/80), light yellowish brown (2.5Y 6/2). Sand is fine to coarse, gravel is small to large pebbles of flint, angular to rounded.
22.00		Sandy gravel	At 22.00 (B50): Sandy gravel (40/60), light yellowish brown (2.5Y 6/2). Sand is fine to coarse, gravel is small to medium pebbles of flint, angular to subrounded.
23.00		Sandy gravel	At 23.00 (B52): Sandy gravel (45/55), light brownish grey (2.5Y 5/2). Sand is fine to coarse, gravel is small to large pebbles, angular to subrounded.
24.00		Sandy gravel	At 24.00 (B54): Sandy gravel (30/70), light brownish grey (10Y 5/1). Sand is fine to coarse, gravel is small to medium pebbles with occasional large pebble of flint, angular to subrounded.
25.00		Gravelly sand	At 25.00 (B56): Gravelly sand (40/60), light yellowish brown (2.5Y 5/3-6/3). Sand is medium, gravel is small to medium pebble of flint, angular to rounded.
26.00		Sandy gravel	At 26.00 (B58): Sandy gravel (40/60), light yellowish brown (2.5Y 6/3). Sand is fine to medium, gravel is small pebbles of flint, angular to subrounded.
27.00		Gravelly sand	At 27.00 (B60): Gravelly sand (40/60), light yellowish brown (2.5Y 5/3-6/3). Sand is medium, gravel is small to medium pebble of flint, angular to rounded.
27.40		Sand	At 27.40 (B62): Fine sand, slightly clayey, dark grey (N4/). Occasional small angular to subrounded pebbles 5%.

Borehole OA13

INT	OA13		
E	571723.57		
N	181898.16		
GL mOD	2.61		
TD	33.50		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.05	Rubble	Concrete and bricks (drillers description)
0.05	0.80	Clayey gravelly sand	Light brown slightly clayey gravelly sand. Gravel is angular to subrounded fine to coarse of flint, concrete and occasional brick fragments **MADE GROUND** (drillers description)
			At 0.05 (B2): Brown 2.5Y 4/3 loose, moderately moist, crumbly, gravelly sandy clay. Angular to subrounded, small to large pebble of stone, brick and concrete.
0.80	1.20	Clayey gravelly sand	Brown clayey gravelly sand with occasional pockets of soft brown clay. Gravel is angular to subrounded coarse to fine of flint, concrete brick fragments and rebar. Occasional roots. **MADE GROUND** (drillers description).
			Ay 0.80 (B4): Dark brown 2.5Y 3/2 mixed with greenish grey 10Y 4/1 firm to stiff gravelly sandy clay. 20% brick fragments.
1.20	1.80	Sandy gravelly clay	Firm brown sandy gravelly clay. Gravel is angular to subrounded fine to coarse fragments of brick, flinT and concrete **MADE GROUND** (drillers description).
			At 1.2-1.65 (B6): Greyish brown 2.5Y 5/3 firm silty clay with few coarse sand grains and small pebbles (5%) and occasional fine roots.

1.80	2.00	Silty clay	Soft brown mottled orange brown and blue grey slightly sandy slightly silty clay. Sand is mainly fine (drillers description)
			At 1.80 (B8): Brown 10YR 5/3 firm to stiff silty clay. Very small brick fragments (2%), occasional slag and few roots.
2.00	3.00	Silty clay	Soft brown greyslightly sandy silty clay, sand is mainly fine (drillers description).
			At 2.00-3.00 (B10) Brown 10YR 5/2 to 6/2 moderately soft silty clay with few small to medium subangular to rounded pebbles (5%).
			Below this depth piston samples
3.00	3.25	VOID	VOID (P12)
3.25	7.00	Silty clay	At 3.25-3.56 (P12): Greenish grey (10Y 5/1 to 4/1) weak light greenish grey mottles, soft, structureless silty clay. Weakly stratified inclusions of fine sand. Few small blackish organic flecks, occasional weakly stratified shell fragments (1%). Diffuse basal boundary.
			At 3.56-4.00 (P12): Greenish grey (5GY 5/1) with brown mottles (10YR 5/2 to 4/2) from top to middle. Soft, slightly silty, clay. Lower part weakly stratified. Small inclusions of fibrous organic detritus and fine organic particles in the lower part.
4.00	4.20	VOID	VOID (P14)
			At 4.30-5.00 (P14): Greenish grey (5GY 5/1) with greyish brown mottles (2.5Y 5/2) 15%, decreasing with depth. Soft, slightly silty, clay, weakly stratified. Organic inclusions 3%, vertical plant detritus 7% between 4.62 to 4.79. Occasional mica present.
5.00	5.20	VOID	VOID (P16)
			At 5.20-5.89 (P16): Mid greenish grey (10Y 4/1), soft, structureless silty clay. Few fine brown organic inclusions (2%), few small brown organic inclusions (4%) at 5.65 to 5.77, occasional fine shell fragments (1%). Clear basal boundary.
			At 5.89-6.00 (P16): Mid bluish grey (5GY 4/1) with mottles of light bluish grey (10G 5/1). Soft silty clay, 30% small yellowish brown and blackish organic inclusions alternating with zones of slightly sandy silt.
6.00	6.26	VOID	VOID (P18)
			At 6.26-6.84 (P18): Mid bluish grey (5GY 4/1) slightly lighter and bluer 6.77 to base. Soft silty clay, small inclusions of fine sand (15%). Plentiful small dark brown and slightly larger (2 to 20mm) yellowish brown organic inclusions (wood?) especially between 6.40 and 6.62. Clear basal boundary.
			At 6.84-7.00 (P18): Dark grey (N4 to N3/) soft silty clay. Many (15%) small to medium size very dark brown and light yellowish brown organic inclusions (wood?).
7.00	7.74	VOID	VOID (P21)
7.45	7.82	Peat	At 7.74-7.82 (P21): Very dark reddish brown (5YR 2.5/1), firm, spongy moderately moist, organic rich sediment (peat) with few small yellowish brown inclusions (wood). Clear basal boundary.
			At 7.82-8.00 (P21): Very dark reddish brown (5YR 2.5/1), firm, organic rich sediment (peat), pockets of light bluish grey (5G 5/1) soft silty clay included.
8.00	9.00	missing	core missing
9.00	9.33	VOID	VOID (P26)
9.33	11.85	Sandy clay silt	At 9.33-9.64 (P26): Mid greenish grey 10Y 5/1 to 4/1, moderately firm, weakly stratified with broken lamination, fine sandy silt. Fine sand inclusions (40%). few small blackish organic inclusions (2%). Diffuse vertical brown band (root). Mid bluish grey (10G 5/1) silty clay band (20mm) at 9.21. Clear basal boundary.
			At 9.64-10.00 (P26): Mid bluish grey (5GY 4/1), soft slightly sandy, clayey silt with sand inclusions (25-30%). Sand is fine. Silty clay bands at top (40mm) and at 9.64 and 9.77 (20mm).
10.00	10.45	VOID	VOID (P28)
			At 10.45-10.67 (P28): Mid greenish grey (5GY 5/1), soft sticky non-plastic sandy clay. Sand is fine. Laminated with dark grey (5Y4/1 to 5Y 4/2) fine sand beds 0.5 to 2mm thick. Mica present. Occasional organic inclusions (2%). Clear lower boundary.

			At 10.67-11.00 (P28): Mid greenish grey (5GY 5/1), soft, slightly porous, non-plastic clayey fine sand. Weakly stratified. Occasional organic inclusions (1%). Mica present. Below 10.93 distinct laminations and increase in clay component. Yellowish grey clayey sand band at 10.90.
11.00	11.22	VOID	VOID (P30)
			At 11.22-11.85 (P30): Dark greenish grey (5GY 3/1 to 4/1), moist soft clayey silt, with many weakly stratified pockets of fine sand. Marine shell present, intact shell at 11.35. Rare organic inclusions (<1%). Diffuse lower boundary.
11.85	12.00	Silty clay	At 11.85-12.00 (P30): Bluish grey (5G 5/1 to 4/1), diffuse colour change at upper boundary. Moist soft silty clay, scattered small fine sand inclusions getting more frequent towards top. Rare organic inclusions. Diffuse lower boundary.
12.00	12.25	VOID	VOID (P32)
			At 12.25-12.38 (P32): Mid to dark greyish brown soft silty clay, weak lamination with 5mm beds. Clear basal boundary.
			At 12.38-12.43 (P32): Very dark brownish grey (10YR 2.5/1) with bluish grey mottles (10G 4/1) soft silty clay. Few organic fragments (5%) and plentiful shell fragments (20%) included. Clear basal boundary.
12.43	12.47	Peat	At 12.43-12.47(P32): Very dark greyish brown (5Y 2.5/1) firm fibrous peat. Occasional fine sand beds. Clear basal boundary.
12.47	12.99	Silty clay	At 12.47-12.99 (P32): Light bluish grey (10G 5/1 to 6/1), with small blackish mottles. Soft silty clay, structureless. Plentiful small and medium organic fragments (10- 20%) included. Diffuse lower boundary.
12.99	13.00	Peat	At 12.99-13.00 (P32): Very dark brown (2.5Y 2.5/1), firm, fibrous peat.
13.00	13.36	VOID	VOID (P35)
13.36	13.70	Organic clayey silt	At 13.36-13.70 (P35): Very dark grey / blackish (N2.5/) soft to moderately firm slightly clayey silt with fine sand inclusions (5-10%). Dark grey to greenish grey mottles below 13.55mBGL. Many (15%) small to medium size very dark brown and light yellowish brown organic inclusions (wood?). Diffuse lower boundary.
13.70	14.00	Silty clay	At 13.70-14.00 (P35): Greyish brown (5Y 4/1), below 13.90 yellow brown (5Y 4/3) with grey mottles. Soft slightly sandy silty clay. Inclusions: fine clasts of stiff silty clay (5%) few shell fragments (1%) Occasional fine blackish organic flecks.
14.00	14.31	VOID	VOID (P37)
14.31	14.86	Sandy silt	At 14.31-14.86 (P37): Mid greyish brown (2.5Y 5/2 to 4/2) firm sandy silt, structurless. Few vertical organic patches. Sub-rounded white pebbles at base (10%). Abrupt basal boundary.
14.86	15.00	Clayey sand	At 14.86-15.00 (P37): Dark greenish grey (5Y 4/1 to 4/2), firm, plastic, structureless and gritty clay sand (fine to coarse sand. Very small pebles present (2%).
			Below this depth bulk spot samples
15.10		Silty clay	At 15.10 (B41): Brown 5Y 4/1 soft moist silty clay, very slightly sandy, fine to coarse sand. Structureless. Occasional small to medium angular pebbles (5%).
15.20		Clayey gravel	At 15.20 (B43): Greyish brown 5Y 4/3 clayey gravel. Moderately soft, very moist sandy clay (60%). Sand is fine to coarse. Small to medium, subrounded to rounded pebbles, flint (60%).
16.00		Gravelly sand	At 16.00-16.45 (B45): Brown 2.5Y 5/3 gravelly sand. Moist, mainly fine, with small amount of medium to coarse sand (60%). Angular to rounded, small to medium pebbles of flint and occasional quartz (40%). .
16.30		Gravelly sandy clay	At 16.30-16.90 (B47): Yellowish brown 2.5Y 5/4 gravelly sandy clay. Moderately firm, moist very sandy clay (80%). Small to medium, subangular pebbles (20%).
17.00		Gravelly sandy clay	At 17.00-17.45 (B49): Yellowish brown 2.5Y 5/4 gravelly clayey sand. Soft, fine to medium sand, clayey, (70%). Subangular to rounded, small to large pebbles and small cobbles (30%).
18.00		Gravelly sand	At 18.00-18.45 (B51): Light greyish yellow 2.5Y 6/4 gravelly sand. Loose, fine to coarse sand (65%). Subangular to rounded, small to large pebbles and small to medium cobbles (35%).

19.00		Gravelly sand	At 19.00-19.45 (B53): Light yellowish brown 2.5Y 6/4 to 7/4 gravelly sand. Fine to coarse sand (65%). Subangular to rounded, small to large pebbles and occasional small to medium cobbles, flint (35%).
20.00		Sandy gravel	At 20.00-20.45 (B56): Light yellowish brown 2.5Y 6/4 sandy gravel. Fine to coarse sand (30%). Small, mainly medium to large, subangular to rounded pebbles and occasional small angular cobbles of flint and occasionally of quartz (70%)
21.00		Sandy gravel	At 21.00-21.45 (B58): Light yellow 2.5Y 6/4 sandy gravel. Fine to coarse sand (25%). Subangular to rounded, small to large, mostly medium pebbles and large cobbles (65%)
22.00		Sandy gravel	At 22.00-22.45 (B60): Light yellowish brown 2.5Y 6/4 sandy gravel. Fine to coarse gritty sand (40%). Small to large, subangular to rounded pebbles of flint (60%)
23.00		Sandy gravel	At 23.00-23.45 (B62): Yellowish brown 2.5Y 5/4 to 6/4 sandy gravel. Loose fine to coarse sand (10%). Angular to rounded, small to large pebbles and occasional cobbles, flint (90%).
24.00		Sandy gravel	At 24.00-24.45 (B64): Light yellow 2.5Y 7/4 to 6/4 sandy gravel. Fine to coarse sand (35%). Small to large pebbles and large cobbles (65%)
25.00		Gravelly sand	At 25.00-25.45 (B66): Light yellowish brown 2.5Y 6/4 gravelly sand. Fine to coarse sand (60%). Small to large, angular to rounded pebbles, flint (40%).
26.00		Sandy gravel	At 26.00-26.45 (B68): Yellowish grey 2.5Y 6/3 sandy gravel. Fine to coarse sand (40%). Subangular to rounded, small to large pebbles occasional cobbles (60%).
27.00		Sandy gravel	At 27.00-27.45 (B70): Light yellowish brown 2.5Y 6/4 sandy gravel. Fine to coarse sand (5%). Subangular to rounded Small to large pebbles and small to medium cobbles, flint (95%).
28.00		Gravelly sand	At 28.00-28.30 (B72): Yellowish brown 2.5Y 5/4 gravelly sand. Fine to coarse sand (60%). Subangular to rounded, small to large, pebbles and small cobbles (40%).
28.30		Sand	At 28.30 (B74): Dark grey 5Y 3/1 to 4/1 moderately firm, fine sand. Occasional angular medium and coarse grains and chips included (1%).

Borehole OA14

INT	OA14		
E	571725.86		
N	181798.84		
GL mOD	2.20		
TD	32.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.20	no description	Made ground (geotechnical log).
0.20	0.80	Gravelly sand	Brown with light brown slightly clayey gravelly sand. Gravel is angular to rounded fine to coarse of flint and concrete **MADE GROUND** (drillers description)
			At 0.20 (B2): Brown (2.5 Y 4/3) gravelly clay. Sandy clay (80%). Small to large pebbles and small cobbles, angular to rounded of concrete and igneous rock. Iron fragments inlcuded.
0.80	1.70	Gravelly sandy clay	Firm dark brown blue grey slightly gravelly sandy clay. Gravel ia angular to sunagular fine to medium of flint and concrete **MADE GROUND** (drillers description).
			At 0.80 (B4): Greyish brown (2.5Y 3/1) with small reddish brown mottles. Silty clay with inclusions of clast of black, organic rich silt, small pebbles, slag and brick fragments.

1.70	2.00	Silty clay	Soft brown and mottled blue green grey slightly sandy silghtly silty clay. Sand is fine (drillers description)
			At 1.70 (B9): Dark greenish grey (5GY 4/1) with dark reddish brown mottles (Fe) 10%. Firm to stiff silty clay with small blackish organic inclusions (2%).
			Below this depth piston samples
2.00	2.47	VOID	**VOID**
2.47	3.00	Silty clay	At 2.00-2.53 (P10): Dark greyish brown (2.5Y4/2) structureless silty clay.
3.00	3.16	VOID	VOID
3.16	4.00	Laminated silty clay	At 3.00-3.85 (P12): Greenish grey (10Y 5/1), grey mottled at top, soft, silty clay. Weak, irregular, broken, lamination with fine sand beds. Regular planar laminations 3.27 to 3.50.Few blackish organic flecks (1%).
4.00	4.28	VOID	VOID
4.28	5.00	Laminated silty clay	At 4.00-4.68 (P14): Dark greyish brown (10Y 3/1), dark grey (10GY 3/1) above base. Soft, laminated silty clay. Fine laminations with fine sand. Mica present. Rare fine blackish organic detritus (1%).
5.00	5.20	VOID	VOID
5.20	6.00	Laminated Sandy silt	At 5.00-5.80 (P16): Dark brownish grey (5Y 4/1) slightly silty sand. Sand is fine. Very fine laminations (<1mm) with 1- 0.5mm thick clayey silt beds. Mica present. Rare lenses of brown organic detritus in sandy layers between 5.03 and 5.23.
6.00	6.20	VOID	VOID
6.20	6.49	Clayey sand	At 6.00-6.49 (P18): Dark brownish grey (2.5Y 3/1), moderately firm moist to wet, clayey sand. Sand is fine. Weak traces of lamination. Mica present. Diffuse basal boundary.
6.49	7.00	Laminated silty sand	At 6.49-6.80 (P18): Dark grey (2.5Y 3/1), silty sand, stratified. Sand is fine. Very fine lamination (0.5mm). Few thicker clayey layers (1 to 5mm). Mica present. Occasional brown organic detritus in sandy layers.
7.00	7.20	VOID	VOID
7.20	7.62	Silty Clay	At 7.00-7.62 (P20): Dark greyish brown (2.5Y 3/1), soft, massive silty clay. Many fine sand inclusions 30 - 40%. Rare shell fragments (<1%), one small pebble and one large brown fibrous organic clast. Abrupt basal boundary.
7.62	8.00	Silty Clay	At 7.62-7.80 (P20): Mid bluish grey (5GY 5/1 to 4/1), soft silty clay, structureless, small inclusions of fine sand (10%). Few fine blackish flecks (5%) blackish organic detritus from 7.80 to base.
8.00	8.21	VOID	VOID
8.21	9.00	Silty Clay	At 8.20-9.00 (P22): Grey (5GY 5/1) soft silty clay, structureless, homogenous. Occasional small inclusions of fine sand, occasional organic flecks.
9.00	9.19	VOID	VOID
9.19	10.00	Laminated silty clay	At 9.19-10m (P24): Greenish grey (5GY 5/1) soft moist silty clay, weakly stratified/diffuse laminations. Distinct laminations at 9.17 to 9.2. Abundant inclusions of fine sand. Rare fine blackish organic flecks (1%).
10.00	10.22	VOID	VOID
10.22	10.62	Silty clay	At 10.22-10.62 (P26): Dark greenish grey (5GY 4/1), soft moist silty clay, structureless, with small inclusions of fine sand (25-30%), increasingly frequent towards base. Shell fragments at 10.43m and 10.51. Few fine blackish organic flecks (2%). Clear lower boundary.
10.62	11.00	Laminated silty clay	At 10.62-11.00 (P26): Dark bluish grey (5GY 4/1 to 3/1), laminated silty clay, 0.5 to 2mm thin fine sand beds. Laminations are slightly wavy and irregular. Also zones of broken laminations and sand inclusions. Rare black organic flecks.
11.00	11.20	VOID	VOID
11.20	12.00	Laminated sand	At 11.20-12m (P28): Greenish grey (10Y 4/1) moist, slightly silty fine sand. Stratified by frequent laminations of silty clay. Bands (60mm) of silty clay with inclusions of fine sand and organic detritus at 11.51 and 11.62. Broken laminations with dark plant detritus (4%) occur at 11.30. Intact marine shell at 11.72.
12.00	12.47	VOID	VOID

12.47	13.00	Clayey sand	At 12.47-13m (P30): Dark grey (2.5Y4/1) structureless soft clayey sand.
13.00	13.68	VOID	VOID
13.68	13.88	Silty Clay	At 13.68-13.88 (P32): Mid bluish grey (10GY 4/1), soft silty clay, structureless. Small to reddish brown organic inclusions (wood? 5%). 30mm above base diffuse colour change towards greyish brown and plentiful mid reddish brown to dark brown organic inclusions (wood? 30%). Clear wavy basal boundary.
13.88	14.00	Organic silt	At 13.88-14.00: Very dark greyish brown (5Y 2.5/1) moderately firm, structureless organic rich, slightly sandy, slightly clayey silt. Black layer (5mm) at top. Small diffuses light greyish brown mottles and moderately frequent fine blackish flecks.
14.00	14.39	VOID	VOID
14.39	14.62	Silty clay	At 14.39-14.62 (P34): Dark greyish brown (2.5Y 4/2) soft silty clay, with fine to medium coarse sand beds (20mm) thickness. Distinct basal boundary.
14.62	15.00	Silty sandy clay	At 14.23-14.62 (P34): Dark greyish brown (2.Y 4/2), soft silty clay, sand present, structureless, occasional rare grit inclusions.
			Below this depth bulk spot samples
14.00		Silt	Greenish grey (5GY 5/3) soft silty clay. Pockets of very dark brown spongy organic sediment with decayed plant remains.
14.80		Sandy gravel	Brown (2.5Y 5/3) sandy gravel. Sand is fine to medium (40%), gravel is small to large, angular to subrounded pebbles of flint (60%).
15.00		Sandy gravel	Brown (2.5Y 5/2) sandy gravel. Sand is fine to medium (40%). Gravel is small to large, angular to subrounded pebbles of flint (60%).
16.00		Sandy gravel	Greyish brown (2.5Y 5/2) sandy gravel. Sand is fine to coarse (30%). Gravel is small to large, angular to subrounded pebbles (70%) of flint.
16.80		Sandy clay	Yellowish brown (2.5Y 5/3) slightly sandy clay. Weak greyish brown mottles and small distinct yellowish brown mottles (2%). Mainly medium to coarse sand (10%).
17.00		Sandy clay	Yellowish brown (2.5Y 5/3) moderately soft sandy clay. Sand is mainly fine, gritty with few coarse grains. Small blackish organic rich lenses (2%).
17.40		Sandy gravel	Greyish brown (2.5Y 5/1) sandy gravel. Very moist, clayey sand (10%). Small to large, angular to subangular pebbles and occacsional small cobbles of flint (90%).
18.00		Gravelly sand	Greyish brown (2.5Y 5/2) fine to coarse sand (30%) and occasional clasts of sandy clay. Mainly small to medium, few large, angular to subrounded pebbles of flint (65%).
19.00		Gravelly sand	Brown (2.5Y 5/3) mainly medium sand, slighty silty (60%). Small to medium subangular to rounded pebbles of flint (40%).
20.00		Gravelly sand	Greyish brown (2.5Y 5/2) gravelly sand, mainly medium to coarse gritty sand (80%), small angular to subrounded pebbles (20%).
21.00		Sandy gravel	Brown (2.5Y 5/2) sandy gravel. Fine to coarse gritty sand (40%). Small to medium pebbles, mostly angular, few rounded of flint (60%).
22.00		Sandy gravel	Brown (2.5Y 5/2) sandy gravel. Mainly medium sand, slightly clayey (20%). Small to large pebbles, angular to rounded of flint (80%).
23.00		Sandy gravel	Yellowish brown (2.5Y 5/2) sandy gravel. Mainly medium sand (20%). Small to large pebbles and small cobbles, angular to subrounded of flint (80%).
24.00		Sandy gravel	Greyish brown (2.5Y 4/2) sandy gravel. Fine to medium sand, few coarse sand grains, slighty clayey (30%). Small to large pebbles and small cobbles, angular to subrounded of flint (70%).
25.00		Gravelly sand	Greyish brown (2.5Y 5/2) fine to medium sand (55%) Small to large, angular to subrounded pebbles (45%).
26.00		Sandy gravel	Greyish brown (2.5Y 5/2) sandy gravel. Fine to medium sand (40%) Mainly small to medium and occasional large pebbles, subangular to rounded of flint and quartz (60%).
26.40		Clayey Sand	Brownish grey (10Y 3/1 to 4/1) slightly clayey sand. Sand is mainly fine, with occasional angular coarse grains. Occasional small angular pebbles.
27.20		Silty sand	Dark brownish grey (5Y 3/1 to 4/2) very fine sand, slightly silty, occasional small angular pebbles (3%).

Borehole OA15

INT	OA15		
E	571767.23		
N	181798.88		
GL mOD	1.76		
TD	32.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.10	Sandy silty clay	Topsoil (drillers description)
			At 0.10 (B2): Greyish brown (5Y 4/1) with distinct reddish brown (5YR 3/3) mottles (30%) slightly sandy silty clay. Fine and small roots. No coarse inclusions.
0.10	0.60	Gravelly sandy clay	Firm grey brown with occasional orange brown grey mottling slightly gravelly sandy clay. Gravel is angular to subangular fine to medium of flint chalk and occasional brick **MADE GROUND** (drillers description).
0.60	1.20	Silty clay	Firm dark brown grey with occasional orange blue grey mottling sandy clay. Sand is mainly fine to medium. Occasional to frequent plant remains (drillers description).
			At 0.60 (B4): Brown (10Y 4/2) silty clay with distinct small reddish brown mottles (5%), mixed with grey and dark brown silty clay occasional organic (3%) inclusions and small pebbles (5%).
			At 1.00 (B6): Dark greyish brown 2.5Y 4/2 firm silty clay, grey mottles (20%) and few fine reddish brown (Fe) mottles (2%).
			Below this depth piston samples
1.20	1.57	VOID	**VOID**
1.57	1.89	Silty clay	at 1.57-1.89 (P7): Greyish brown (2.5Y 5/1 to 4/1) with bluish grey mottles (10Y 4/1) more frequent near top. Orange brown mottles and fine Fe-concretions (2%), more frequent in a band between 1.71 and 1.75. Soft structureless silty clay with pockets (2mm) of fine white sand. Top contains mixed sediment including CBM, roots and blades of grass (possible contamination with mixed, trampled surface material). Clear lower boundary.
1.89	2.20	Laminated silty clay	At 1.89-2.2M (P7): Olive grey (5Y 5/2) with light yellowish brown (2.5Y 5/4) mottles more frequent in lower part. Random pockets of Fe-concretions (2%). Moderately soft silty clay. Evenly distributed lenses (0.5 to 25mm) of light brownish yellow (10YR 6/8) sand. Rare organic inclusions (1%). Clear upper boundary.
2.00	2.35	VOID	VOID
2.35	2.45	Sandy silty	At 2.35-2.42 (P9): Mid brown (10YR 5/1 to 4/1) few light grey diffuse mottles. Firm slightly sandy silt, with small lenses of fine orange and light grey sand. Clear basal boundary.
2.45	2.96	Silty clay	At 2.45-2.96 (P9): Greyish brown (5Y 4/1) with large (40-50mm) diffuse bluish grey (5GY 4/1) mottles down to 2.70. Soft silt clay, small lenses of fine sand common (25%) between 2.45 and 2.60. Blackish plant detritus (10%) and very fine dark brown organic remains below 2.70. Very fine laminations with very thin beds of sand below 2.72 (0.5mm. Few thicker clayey layers (1 to 5mm). Clear upper and basal boundary.
2.99	3.00		(P9): Dark greyish brown (2.5Y 4/1) silty clay, soft moist plastic very sticky laminated with very fine thin sandy layers.
3.00	3.33	VOID	VOID

			At 3.33-4.0m (P11): Dark greenish grey (10Y 4/1), bluish towards the top. Soft, silty clay. Irregular, broken, less common laminations with fine sand beds. Unbroken planar lamination from 3.40-3.50, 3.58 to 3.73 and 3.79 to 3.85. Sand is mainly dark grey contains fine organic flecks. Some sand beds are mid brownish yellow. Occasional organic flecks (1%).
4.00	4.30	VOID	VOID
			At 4.30-5.00 (P13): Dark greenish grey (5GY 4/1), with light olive brown (2.5Y 5/3) mottles at top 90mm (80%). Soft, silty clay laminated with fine sand beds (0.5 to 30mm) particularly at 4.54 and 4.58m. Occasional organic flecks (<1%).
5.00	5.22	VOID	VOID
			At 5.22-5.45 (P15): Dark greenish grey (5GY 3/1) soft, silty clay. Structured by irregular, broken, laminations of fine sand. A vertical 5-8mm wide structure from top to base of moist clayey silt may be a filled root channel. Very few fine organic flecks. Clear boundary at base.
			At 5.45-6.00 (P15): Dark greenish grey (5GY 3/1) soft, silty clay laminated with fine sand and interbedded silty clay. Very fine laminations (>1 beds per 1mm). Fine very dark brown organic inclusions at 5.55 to 5.60 (10%) and 5.66 to 5.84 (5-15%).
6.00	6.24	VOID	VOID
6.24	7.00	Laminated clayey sand	At 6.24-7.00(P17): Greenish grey (5GY 4/1) with several light olive brown (2.5Y 5/4) bands. Slightly clayey sand. Lenses of soft silty clay in top 15cm, occasional silty clay lenses further down. Slight increase in clay with depth. Occasional organic inclusions (>1%).
7.00	7.44	VOID	VOID
			At 7.44-8.0 (P19): Dark greenish grey (10Y 4/1), very soft clayey fine sand. Laminated with 1mm thick slightly sandy silty clay. Laminations absent between 7.6 and 7.22m. Occasional fine organic inclusions (>1%), small lenses of organic material between 7.84 and 7.92. Lens of yellowish brown sand 30mm below top, may be contamination. Clear lower boundary.
8.00	8.27	VOID	VOID
8.27	8.36	Laminated silty clay	At 8.27-8.36 (P21): Brownish grey (2.5Y 4/1), soft, silty clay laminated with irregularly spaced beds (0.5 to 2mm) and pockets of greenish grey fine sand. Very rare inclusions of marine shell (<1%) and organic matter (<1%). Clear lower boundary.
			At 8.36-8.54 (P21): Greenish grey (10GY 5/1), soft, silty clay laminated with frequent closely spaced greenish grey fine sand beds (0.5 to 2mm). Very rare inclusions of marine shell (<1%) and organic matter (<1%). Sharp lower boundary
8.27	9.00	Peat	At 8.54-9.00 (P21): Peat. Reddish brown (7.5 YR 4/6) mottled with blackish brown. Changes to black after exposure to air. Stratified with few very thin horizontal beds of olive yellow plant detritus. Soft, friable.
9.00	9.28	VOID	VOID
9.28	9.45	Laminated silty clay	At 9.28-9.45 (P24): Greenish grey (5G 4/1) soft silty clay laminated with fine silty sand. Sparse laminations between 9.10 to 9.14. Dark green grey band (N 3/) at 9.01. Occasional bands of light yellow olive sand and silty clay may be contamination. Occasional organic inclusions (<1%). Sharp lower boundary.
9.45	9.51	Peat	At 9.45-9.51 (P24): Peat. Dark reddish brown (7.5YR 3/4), becomes dark after exposure to air. Soft, slightly spongy peat. Occasional fine lenses of organic material. Sharp lower boundary.
9.51	9.87	Laminated silty clay	At 9.51-9.60 (P24): Dark greenish grey (10Y 4/1), diffuse dark grey band (N4/) at 9.71 to 9.74. Soft, silty clay, laminated with very light to very dark grey soft fine sand beds (0.5 to 2mm). 9.65 to 9.69 fine sand with thin laminations of silty clay. Rare organic inclusions - occasional stratified thin lenses of dark yellowish brown organic detritus. Sharp lower boundary.
9.87	10.00	Clayey sand	At 9.87-10.00 (P24): Greenish grey (5G 5/1) clayey fine sand, structureless. Occasional organic inclusions.
10.00	10.27	VOID	VOID

10.27	10.82	Laminated sand	At 10.27-10.82 (P26): Mid greenish grey (5GY 4/1) very silty (40%) fine sand. Weak to moderately distinct laminations, few zones (20-30mm) of clayey silt with inclusions of fine sand. Rare fine blackish organic flecks. Clear lower boundary.
			At 10.83-11.00 (P26): Dark greenish grey (5G 4/1) fine sand with very weak broken laminations. 20mm bed of sandy clay at 10.86.
11.00	11.23	VOID	VOID
11.23	12.00	Silty clay	At 11.00-12.00 (P25): Mid greenish grey (5GY 4/1 to 3/1), soft silty clay with inclusions of fine sand. Few very dark brown organic inclusions (2%). Broken laminations with 2mm thin fine sand beds at 11.94 and 11.96.
12.00	12.29	VOID	VOID
12.29	12.50	Silty sand	At 12.29-12.50 (P30): Mid grey (5GY 41) very moist firm slightly clayey silty fine sand. Occasional very fine shell fragments (<1%) and few large brown fibrous organic inclusions 4%.Clear basal boundary.
12.50	12.72	Laminated sand and clay	At 12.50-12.72 (P30): Mid grey (5GY 4/1), slightly silty, medium to fine sand and soft plastic silly clay, laminated, layers 1mm to 30mm. Fine shell fragment common (2 -5 %), small dark brown organic inclusions (1%). Abrupt basal boundary.
12.72	12.92	Clayey silt	At 12.72-12.92 (P30): Dark grey (10Y 3/2) slightly clayey silt. Fine sand bed at top 20mm. Large to small shell fragments common (2 - 7%). Patches of dark brown and blackish plant detritus (5%). Abrupt basal boundary.
12.92	13.00	Peat	At 12.92-13.00 (P30): Blackish (5Y2.5/1) organic silt. Top 10mm dark reddish brown (10YR 2/2). Firm, few thin light brown broken beds of plant detritus.
13.00	13.22	VOID	VOID
13.22	13.37	Clayey silt	At 13.22-13.37 (P33): Mid brownish grey (2.5Y 4/1) clayey silt with many large dark grey (5Y 2.5/1) mottles and a change to medium brown at the base. Slightly reddish brown zone between 13.33 to 13.40 transgressing the basal boundary into the next unit. Diffuse basal boundary.
13.37	13.83	Sandy silt	At 13.37-13.83 (P33): Mid brown (5Y 4/2), slightly clayey sandy silt, massive and structureless. Mid brown bed of clayey sand at 13.74 to 13.77. Vertical (roots?) soft blackish organic inclusions (5%). Rare fine shell fragments (1%). Abrupt lower boundary.
13.83	14.00	Laminated sand	At 13.83-14.00 (P33): Mid brownish grey (5Y 4/1) medium to fine sand. Interbedded layers (10-20mm) of sandy clay. Many fine shell fragments present. (10-15%).
			Below this depth bulk spot samples
14.50		Sandy gravel	Greyish brown (2.5Y 4/1 to 5/1) sandy gravel. Fine to coarse clayey sand (40%). Small to medium, angular to subrounded pebbles of flint. Marine shell present.
15.00		Gravelly sand	Light yellowish brown (2.5Y 6/4) gravelly sand. Loose, fine to coarse gritty sand (70%). Mainly small to medium, few large pebbles (30%), subangular to rounded pebbles.
16.00		Gravelly sandy clay	Yellowish brown (10Y 5/1) sandy clay (80%), medium sand. Medium sized subangular pebbles (20%).
16.20		Sandy gravel	Light brown 2.5Y 6/3 sandy gravel. Fine to coarse gritty sand (20%). Small to large pebbles and small cobbles (80%), subrounded to rounded of flint.
17.00		Sandy clay	Yellowish brown 2.5Y 5/3 with small reddish brown (Fe-)mottles (2%). Moderately soft sandy clay, medium sand. Occasional small subrounded pebbles and blackish organic inclusions.
17.50		Gravelly sand	Light yellowish brown (5Y 5/1 to 6/1) gravelly sand. Fine to coarse slightly clayey sand (60%). Small to large, angular to subrounded pebbles (40%).
18.00		Gravelly sand	Light yellowish brown (2.5Y 6/3) gravelly sand. Mainly medium to coarse gritty sand (70%). Small, subangular to rounded pebbles of flint (30%).
19.00		Sandy gravel	Light yellowish brown (2.5Y 5/3) sandy gravel. Fine to coarse gritty sand (40%). Small to medium pebbles (60%), subangular to rounded, of flint.
20.00		Gravelly sand	Yellowish brown (2.5Y 5/3) gravelly sand. Fine to medium sand (60%). Small to medium, angular to rounded pebbles of flint (40%).

21.00		Gravelly sand	Yellowish brown (2.5Y 6/3) gravelly sand. Fine to coarse gritty sand (60%). Small to medium, subangular to rounded pebbles of flint and quartz (70%).
22.00		Sandy gravel	Light brown (2.5Y 6/2) sandy gravel. Loose, mainly medium to coarse gritty sand (40%). Mainly small to medium and few large pebbles (60%), subangular to rounded of flint.
23.00		Sandy gravel	Yellowish brown (2.5Y 5/4) sandy gravel. Fine to coarse slightly silty sand (40%). Small to large pebbles and small cobbles, angular to rounded of flint (60%).
24.00		Sandy gravel	Light brown (2.5Y 6/3) sandy gravel. Medium to coarse gritty sand (30%). Small to medium, subangular to rounded pebbles of flint and quartz (70%).
25.00		Sandy gravel	Light brown (2.5Y 6/3) sandy gravel. Fine to coarse gritty sand (40%). Small to large, angular to subrounded pebbles of flint (60%).
26.00		Sandy gravel	Light yellowish brown (2.5Y 6/4) loose sandy gravel. Fine to coarse gritty sand (15%). Small to large pebbles and small cobbles (85%), subangular to rounded of flint (60%).
27.00		Gravelly sand	Light yellowish brown (2.5Y 6/4) gravelly sand. Loose, fine to coarse gritty sand (70%). Mainly small to medium, few large pebbles, subangular to rounded (30%).
27.20		Silty sand	Dark brownish grey (5Y 3/1 to 4/2) very fine sand, slightly silty, occasional small angular pebbles (3%).

Borehole OA16

INT	OA16		
E	572955.16		
N	181797.77		
GL mOD	3.15		
TD	40.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.05	no description	Topsoil (drillers dscription).
0.05	0.20	Gravelly sand	Brown gravelly sand. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to coarse of flint concrete and brick . Occasional wood fragments **MADE GROUND** (drillers description).
0.20	1.00	Sandy clay	Concrete railway sleeper at 0.8m **MADE GROUND** (drillers description)
1.00	1.49	Chalk	Chalk fill **MADE GROUND** (drillers description),
			At 1.20-1.49 (U5): White, brittle, chalk silt. Very rare organic inclusions (<1%).
1.49	1.52	Organic rich sediment	At 1.49-1.52 (U5): Black (10YR 2/1), moist fibrous organic layer, silty. Thin roots. Humic smell. Sharp upper and lower boundary. Buried soil?
1.52	3.00	Silty clay	At 1.52-1.65 (U5): Dark greyish brown (2.5Y 4/2) slightly soft clayey silt rich in organic inclusions (5%), structureless, homogenous deposit. Sharp upper boundary. Alluvium
			At 2.00-2.27 (U9): Dark brownish grey (10Y 4/1), very fine bluish grey mottles common (10%) plentiful fine blackish flecks (30-40%). Firm, slightly moist clayey silt. Massive. Weak broken fine sand beds (1-2mm) below 2.15mBGL. Distinct yellowish red fine to medium sand bands above and below boundary (2.23, 2.30,and 2.33). Rare shell fragments. Diffuse basal boundary.
			At 2.27-2.45 (U9): Mid brown (5Y 4/1) very fine diffuse bluish grey mottles. Firm slightly moist silty clay. Structureless. Very thin weak broken fine sand beds common. Distinct yellowish red fine sand bands at 2.30 and 2.33, same as bed above boundary at 2.23. Few blackish flecks above 2.37.
			Below this depth piston samples

3.00	3.19	VOID	VOID (P13)
3.19	4.00	Laminated sand	At 3.19-4.00 (P13): Dark grey (5Y 4/1) soft, moist fine sand. Stratified. Frequent lamination by beds (0.5-3mm) of dark greenish grey (10Y4/1) soft silty clay above 3.52. Occasional bands of silty clay below 3.52. Occasional organic inclusions, sometimes ins lenses. Shell fragments present at 3.22 and 3.56.
4.00	4.18	VOID	VOID (P16)
4.18	4.39	Silty sand	At 4.18-4.39 (P16): Light yellowish brown (2.5Y 5/2) mottled with yellowish red (iron-oxide). Moderately firm, moist silty sand, structureless. Diffuse lower boundary.
4.39	4.58	Silty sand	At 4.39-4.58(P16): Mid grey mottled with plentiful yellowish red (iron oxidisation). Moderately firm, moist silty sand, structureless as above. Diffuses lower boundary.
4.58	4.75	Silty sand	At 4.58-4.75 (P16): Dark grey (5Y 4/1) mottled with yellowish red (iron oxidisation). Moderately firm, moist silty sand, mica present. Structureless. Sharp lower boundary.
4.75	5.00	Laminated sand	At 4.75-5.00 (P16): Dark grey 5Y 4/1 moderately firm, moist, stratified fine sand with lenses of silty clay, mica present. Shell fragments included.
5.00	5.56	VOID	VOID (P17)
5.56	6.00	Silty clay	At 5.56-6.00 (P17): Dark grey (2.5Y 3/1) structureless silty clay, slightly sandy, with no coarse inclusions.
6.00	6.17	VOID	VOID (P18)
6.17	7.00	Laminated sandy clay	At 6.17-7.00m (P18): Dark grey (2.5Y 4/1) sandy clay, frequent distinct fine to medium sand laminations (10-20mm). Below 6.91 sand beds increase in thickness (20-30mm).
7.00	8.00	Silty sand	At 7.00-8.00 (B21): Dark brownish grey (10GY 4/1) slightly silty fine sand, weakly stratified with beds of clayey sand, mica present. (piston sample failed at 7.00-8.00m).
8.00	8.60	VOID	VOID (P22)
8.60	9.00	Silty sand	At 8.60-9.00 (P22): Dark grey (2.5Y 4/1) loose silty sand with coarse component. Occasional to rare silty clay inclusions. Structureless.
9.00	9.76	VOID	VOID (P23)
9.76	10.00	Silty sand	At 9.76-10.00 (P23): Mid brown (10Y 4/1 to 5/1) moderately firm, moist very fine sand, slightly silty. Mica present. Stratified by occasional beds (3 to 10mm) of brown (2.5Y 5/2) soft slightly silty clay.
			Below this depth bulk spot samples
10.00		Silty sand	Dark grey (5GY 4/1) moderately firm, moist, slightly silty fine sand, mica present. Structureless Very rare, well preserved organic remains (grass/reeds?).
11.00		Clayey sand	Dark greenish brown (5GY 4/1 to 5/1) wet, soft to moderately firm, slightly clayey fine to medium sand, mica present. Structureless, no coarse inclusions.
12.00		Silty sand	Dark greenish brown (5GY 3/1 to 4/1) very moist, moderately firm, slightly silty fine sand, mica present. Structureless, rare small blackish detritic plant remains (<1%).
13.00		Silty sand	Dark brownish grey (5Y 4/1 to 4/2) with few small mid grey mottles. Moist, loose to moderately firm, silty fine sand, mica present. Stratified, beds weakly discernible.
14.00		Gravelly silty clay	Dark greyish brown (2.5Y 4/2 to 3/2) moderately soft to firm, moist, silty clay (80%), small amount of coarse gritty sand present. Small to medium, angular to subrounded pebbles of flint (10%).
14.60		Clayey gravel	Dark brownish grey (2.5Y 4/2) firm, very moist sandy clay, sand is fine to medium. Small to medium subangular pebbles of flint.
15.00		Sandy gravel	Dark brownish grey (2.5Y 4/2) sandy gravel. Loose, moist, fine to coarse silty sand (10%). Mainly small to medium and occasional large pebbles, angular to subangular of flint.
16.00		Sandy gravel	Dark brownish grey (2.5Y 4/1) sandy gravel. Loose, very moist to wet, fine to coarse silty sand (10%). Small to large, angular to rounded pebbles of flint and yellow sandstone.

17.00		Gravelly sand	Mid greyish brown (2.5Y 5/3) gravelly sand. Loose, moist, sand (90%). Sand is mainly medium. Small to medium, angular to subrounded pebbles of flint and sandy limestone (10%).
18.00		Gravelly sand	Light yellowish brown (2.5Y 6/3) gravelly sand. Loose, moist, medium to coarse sand (80%). Small to medium, subangular to subrounded pebbles of flint (20%).
19.00		Gravelly sand	Light yellowish brown (2.5Y 6/3 to 6/4) gravelly sand. Loose, very moist, fine to coarse, slightly gritty sand (70%). Small to large, subangular to rounded pebbles of flint (30%).
20.00		Gravelly sand	Light yellowish brown (2.5Y 6/3 to 6/4) gravelly sand. Loose, very moist, mainly coarse, gritty sand (60%). Small to large, angular to subangular pebbles (40%) of flint.
21.00		Sandy gravel	Mid yellowish brown (5Y 6/4) sandy gravel. Fine to coarse slightly gritty sand (40%). Mainly small, few medium to large pebbles, subangular to subrounded.
22.00		Sandy gravel	Brownish yellow (5Y 6/4) sandy gravel. Loose, moist, mainly medium to coarse sand (25%). Mainly small, few medium to large pebbles, subangular to well rounded.
23.00		Sandy gravel	Light greyish brown (5Y 6/2) sandy gravel. Fine to coarse slightly silty sand (20%). Small to large pebbles and small to medium cobbles (80%), angular to rounded of flint.
24.00		Sandy gravel	Light brown (5Y 6/3) and light yellowish brown (5Y 6/6) sandy gravel. Moist, mainly coarse gritty sand (20%). Small to large pebbles and small cobbles (80%), angular to rounded of flint.
25.00		Gravelly sand	Mid greyish brown (5Y 5/3) gravelly sand. Loose, moist, fine to coarse sand (80%). Small to medium, angular to subrounded pebbles (20%) of flint, sandstone and limestone.
26.00		Gravel	Mid greyish brown (10Y 4/1) slightly sandy gravel. Slightly clayey, mainly medium sand (5%). Small to large subangular to subrounded pebbles of flint.
26.60		Gravelly sand	Very dark grey (10Y 3/2) mottled with dark greyish brown gravelly sand. Firm, moist to moederately wet, fine to medium sand (80%), mica present. Angular to rounded, coarse sand grains to small pebbles (20%).
40.00		Silty sand	Very dark brownish grey (5GY 3/1) wet, slightly liquid very fine silty sand with rare coarse sand grains.

Borehole OA17

INT	OA17		
E	572817.49		
N	181798.43		
GL mOD	1.88		
TD	30.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00 below ground level	2.50m	VOID	
0.00	1.20	Gravelly clay	Firm, brown, sandy gravelly clay with frequent rootlets. Sand is fine to coarse. Gravel is subangular to rounded, fine to medium of flint, concrete and brick **MADE GROUND** (Drillers descriptions)
			At 0.05 (B2): Dark brown (10YR 3/2) silty clay, slightly sandy. Small angular pebbles of slag, mortar and brick. Distinct reddish brown mottles 10%, small rootlets.
1.20	4.20	Gravelly clay	Soft dark brown sandy gravelly clay with frequent pockets (50mm) of black silty oil products. Moderate to strong hydrocarbon odour. Sand is fine to coarse, gravel is subangular to rounded, fine to coarse of flint, concrete and brick. Occassional rootlets. **MADE GROUND** (drillers description)

			At 1.50 (B8): Dark greyish brown (10Y 3/1) mixed with very dark brown and light grey mottled sediment. Stoney (concrete).Drillers description?
			At 2.50 -3.000 (P9): Black (2.5Y 2.5/1) soft silty clay. Occasional subangular chalk inclusions (30-50mm). Strong petrochemical smell - possible contamination. Mixed deposit, .
			At 3.00-4.00 (P10) Very dark blackish grey, soft, moist, massive clayey silt. Occasional small blackish clasts and shell fragments. Sheet seems to be missing
4.00	5.00	Silty clay	Soft grey, slightly silty clay with occassional lenses of black silty organic matter (drillers description).
5.00	5.37	VOID	VOID (P14)
5.37	8.00	Laminated silty sand	At 5.37-6.00 (P14): Dark grey (2.5Y 4/1) loose silty sand. Frequent fine silty clay laminations (10-20mm thick). Occasional humic clay laminations (20-30mm thickness) at 5.26, 5.31 and 5.50m. Evenly spaced (10-20mm) laminations with well defined boundaries (Alluvium).
		VOID	AT 6.00-6.27M VOID
			At 6.27-7.00 (P15): Dark grey (2.5Y 4/1) loose silty sand with fine laminations of silty clay (10mm thickness). Laminations evenly spaced and well defined (Alluvium)
		VOID	7.00-7.23M VOID (P16)
			At 7.23-8.00 (P16): Dark grey (2.5Y 4/1) loose silty sand with frequent fine silt clay laminations (10-20cm thickness). Some undulation and possible distortion of the upper laminations (7.00-7.27m). Followed by structureless silty sand deposition. Fine laminations of silty clay between 7.37-57m. Laminations gradually fade out.
8.00	8.25	VOID	VOID (P17)
8.25	9.00	Laminated sand	At 8.25-8.54 (P17): Greyish brown (2.5Y 5/2) firm, moist fine sand. Horizontal laminations of silty clay, greyish brown (10YR 5/2), typically 2mm wide, between 8.00-8.07, 8.12-8.14, and 8.20-8.25m, with intervals of homogeneous fine sand. Occasional lenses of plant detritus, e.g. at 8.11m, <1%. Mica 1%. Very small (<1mm) fragments of possible marine shell. Occasional mottling of bluish grey sand - contamination? (Alluvium).
			At 8.54-8.80 (P17): Greenish grey (10Y 5/1) firm, moist, nonplastic fine sand. Frequent grey (5Y 5/1) laminations of silty clay, 1.5mm wide, occasionally associated with a yellowish brown colour change. Mica present, no organic inclusions. Sharp upper boundary (Alluvium)
			At 8.80-9.00 (P17): Grey (5Y 6/1) firm, moist, nonplastic fine sand. Many paler grey and also reflective particles mixed in. Laminations of silty clay, 3%, particularly between 8.70-73m, occasionally also higher in the unit. Lens of dark grey (5Y 4/1) fine sand at 8.69m. No organic inclusions. Sharp upper boundary, marked by a band of yellowish brown fine sand (slightly more yellow than 5Y 5/4) 4mm wide - also hint of this more yellowish sediment at 8.59m. Mica present
1.00	9.57	VOID	VOID (P18)
9.57	10.00	Laminated silty sand	At 9.57-10.00 (P18): Dark grey (2.5Y 4/1) loose silty sand with occasional fine silty clay laminations (10mm thick). Laminations evenly spaced between 2-3cm and clearly defined.
10.00	10.25	VOID	VOID (P19)
10.25	10.46	Laminated sand	At 10.25-10.46 (P19): Dark grey (2.5Y 4/1) loose medium sand with rare distorted silty clay laminations.
10.46	11.00	Laminated silty sand	At 10.46-11.00M (P19): Dark grey (2.5Y 4/1) loose silty sand with frequent silty clay laminations (10mm thick). Laminations well defined and evenly spaced with 10-20mm spacings. Regular breaks in the sequence of laminations with the deposition of fine to medium sand.
11.00	12.00	Laminated sand	Probably laminated silty sand to sand (PISTON SAMPLE FAILED/MISSING)

12.00	14.00	Laminated sand	At 12.54-13.00 (P21): Fragile, soft, structureless fine sand, with small proportion of medium sand. Mixture of two colours of grain - pale, olivey yellow (5Y 6/3) and darker olive (5Y 4/4), with varying proportions across the unit creating a mottled appearance. Small lens of clayey silt, 1mm, at 12.02m. Fe staining at 12.05m - sediment appears to have been in contact with a small circular ferrous object. Increasing organic bluish grey mottling in lower half of unit; flecks of black organic material elsewhere. Piece of gravel 10mm wide at 12.13m. Fissures created irregularly across the surface when disturbed, with sediment easily crumbling away in sheets. Mica present, occasional voids.
			At 13.28-14.00 (P22): Friable, fine to medium sand, colour gradually changing from dark grey (2.5Y 4/1) at base to light yellowish brown (2.5Y 6/3) at top. Horizontally stratified lenses of silty clay, very dark grey (N3), up to 5mm wide, particularly occurring 13.57-60m, otherwise at irregular intervals. Marine shell inclusions, increasing in frequency with depth, occasional mica. Lens of organic material 3mm wide at 13.28m. Zone of finer sand 13.31-42m. (Alluvium)
14.00	15.50	Laminated silty sand	At 14.00-15.00 Brownish grey and black silty sand. Sand is fine to mediun (drillers description, P23 failed)
15.74	15.83	Laminated silty sand	At 15.74-15.83 (P25): Dark greyish brown (2.5Y 4/2) soft sandy clay with fine sand lenses (1cm thickness). Distinct lower boundary.
			At 15.83-15.15.86(P25): Very dark greyish brown (2.5Y 3/2) loose silty sand with frequent shell fragments.
			At 15.86-15.90 (P25): Dark greyish brown (2.5Y 4/2) soft sandy clay with fine sand lenses (1cm thickness). Distinct lower boundary.
			At 15.90-16.00 (P25): Very dark greyish brown (2.5Y 3/2) loose silty sand with frequent shell fragments.
			Below this depth bulk spot samples
15.50		Sandy silty gravel	At 15.50 (B27): Firm, brownish grey (5Y 4/1) sandy silt gravel (20/80). Gravel is small to large angular to subrounded pebbles of flint.
16.00		Gravelly sand	At 16.00-16.45 (B29): Gravelly sand (40/60), greyish brown (5Y 4/2) fine to medium slightly clayey sand. Gravel is small to large pebbles, angular to subrounded.
17.00		Gravelly sand	At 17.00-17.45 (B31): Grey (10Y 4/1), gravelly sand (80/20). Sand is medium, moist and loose. Gravel is small to large subangular pebbles of flint.
18.00		Gravelly sand	At 18.00-18.45 (B33): Yellowish brown (2.5Y 5/2) gravelly sand (40/60). Sand is medium. Gravel is small to large pebbles, angular to rounded.
19.00		Gravelly sand	At 19.00-19.45 (D35): Greyish brown (2.5Y 5/2) gravelly sand (40/60). Dand is medium. Gravel is small to large pebbles of flint and igneous rock, angular to subrounded.
20.00		Gravelly sand	At 20.00-20.45 (B37): Greyish brown (2.5Y 5/2) gravelly sand (40/60). Sand is medium. Gravel is mainly small but occasional medium and large pebbles of flint.
21.00		Gravelly sand	At 21-21.45 (B40): Light greyish brown (5Y 5/2) gravelly sand (40/60). Sand is fine to coarse. Gravel is small to medium pebbles, subangular to subrounded, of flint. Rare large pebbles.
22.00		Sandy gravel	At 22.00-22.45 (B42): Brown (5Y 5/2) sandy gravel (10/90). Sand is fine to coarse, slightly clayey. Gravel is small to large pebbles of quartz and flint, angular to subrounded.
23.00		Sandy gravel	At 23.00-23.45 (B44): Greyish brown (5Y 5/2) sandy gravel (30/70). Sand is fine to coarse. Gravel is small to large pebbles of flint, angular to rounded.
24.00		Sandy gravel	At 24.00-24.45 (B46): Light yellowish brown (2.5Y 6/3) sandy gravel (10/90). Sand is medium to coarse. Gravel is medium to large pebbles, subangular to subrounded, of flint.
24.60		Sandy gravelly clay	At 24.60-25.00 Firm brown mottled grey sandy gravelly clay. Sand is fine to coarse. Gravel is subangular to rounded, fine to medium of flint (Drillers description).
25.00		Sand	At 25.00 (B51): Dark grey (N4/) moderately firm, slightly clayey fine sand. Occasional angular coarse sand grains.

30.00		Sand	At 30.00 (B58): Dark grey (N4/) wet fine sand, slightly clayey, moderately firm. Occasional coarse sand grains (1%).

Borehole OA18

INT	OA18		
E	571078.93		
N	182496.93		
GL mOD	1.31		
TD	23.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.20	No description	Made ground (drillers description).
			At 0.20 (B2) Silty clay. Dark greyish brown (2.5Y 3/1). Stiff, fine polyedric peds (soil), humic, abundant grass roots, clast free.
0.20	0.60	Sandy clay	Grey brown firm slightly sandy clay with abundant rootlets (drillers description).
0.60	1.70	sandy clay	Brown firm slightly sandy clay mottled with orange brown and blue grey. Occasional pockets of orange fine sand and silt and occasional rootlets. Closely spaced, randomly orientated fissures from 1.20m. (drillers description).
			At 0.60 (B4): Silty clay, very dark brown (10YR 3/1). Stiff, breaks into peds (polyedric). Small distinct reddish brown mottles. Fine rootlets, humic.
			At 1.20 (B6): Silty clay. Light brownish grey (2.5Y 5/1). Light reddish brown mottles (7.5YR 4/3) 40%, occasional smalll brown organic inclusions 1% and occasional light brown sand 1%.
1.70	3.00	Sandy silty clay	Very soft brown green blue grey, slightly silty, becoming silty with depth, slightly sandy clay. Sand is fine (drillers description).
			At 2.00 (B10): Very soft greyish brown (2.5Y 4/1-5/1) silty clay.
			Below this depth piston samples
3.00	3.21	VOID	VOID (P12)
3.20	4.52	Laminated silty clay	At 3.00-3.74 (P12): Dark grey (2.5Y 4/1) soft to slightly firm, plastic, clayey silt. Stratified with thin fine broken sand laminations 0.5mm-2mm or small lenses of fine sand 5-30%. 15mm thick layer at 3.35, 10mm thick layer with sand and 3mm organic brown layer at 3.42m.
			At 4.00-4.20 VOID
			At 4.20-4.52 (P14): Dark grey (2.Y 4/1) soft silty clay. Frequent, evenly spaced (2-3mm) poorly defined fine silty laminations (10mm thick). Diffuse lower boundary.
4.52	5.00	Silty clay	At 4.52-5.00 (P14)L Dark greyish brown (2.5Y 4/2) soft silty clay. Structureless.
5.00	5.16	VOID	VOID (P16)
5.16	6.00	Laminated silty sand	At 5.16-6.00 (P16): Very dark grey (2.5Y 3/1) loose silty sand. Frequent, evenly distributed fine laminations of sandy clay 1cm thick, well defined and 2-3cm apart.
6.00	6.29	VOID	VOID (P18)
6.29	6.36	Silty clay	At 6.29-6.36 (P18): Very dark grey (2.5Y 3/1) soft, structureless silty clay. No coarse inclusions.
6.36	6.52	Organic silty clay	At 6.36-6.52 (P18): Black (2.5Y 2.5/1) soft silty clay. Marine shell band within a fine silty sand matrix. Partial structure with occasional humic banding
6.52	6.73	Silty clay	At 6.52-6.73 (P18): Dark greenish grey (Gley 1 4/1) firm structureless silty clay. Homogeneous, no coarse inclusions.
			At 6.73-7.00 (P18): Dark greenish grey (Gley 1 4/1) soft structureless silty clay with sand inclusions.
7.00	7.15	VOID	VOID (P20)

7.15	8.00	Laminated silty clay	At 7.15-7.47 (P20): Very dark grey (2.5Y 3/1) soft silty clay. Irregularly spaced laminations of dark grey (5Y 4/1) silty clay 5-10mm thick. Organic inclusions including charcoal and wood. Diffuse lower boundary
			At 7.47-7.57 (P20): Black (2.5Y 2.5/1) silty clay with very fine sandy clay laminations towards top of deposit 1mm wide in band 20mm across. Diffuse lower boundary.
			At 7.57-8.00 (P20): Very dark grey (2.5Y 3/1) soft silty clay with sandy clay laminations up to 2mm wide at intervals of up to 40mm.
8.00	8.23	VOID	VOID (P23)
8.23	8.49	Silty clay	At 8.23-8.49 (P23): Grey (2.5Y 4/1) firm silty clay with patches of olive brown (2.5Y 4/4) fine sandy clay. Diffuse lower boundary
8.49	9.00	Sandy clay	At 8.49-8.90 (P23): Olive brown (2.5Y 4/4) soft, fine sandy clay with no coarse inclusions. Structureless and homogeneous.
			At 8.90-9.00 (P23): Light olive brown (2.5Y 5/4) soft sandy clay. No coarse inclusions
9.00	9.86	VOID	VOID (P25)
9.86	10.00	Gravelly sand	At 9.86-10.00 (P25): Mid yellow (2.5Y 5/4 to 4/4) moist, moderately firm gravelly sand. Medium sand, slightly clayey. Small angular to subangular pebbles (30%), occasional medium to large subrounded pebbles (5%).
10.00	11.00	Gravelly silty clay	At 10.00 (B28): Gravelly, slightly sandy, silty clay. Very soft, light brown (2.5Y 5/3). Gravel is small to large pebbles of flint, angular (15%). (No piston sample taken at 10.00-11.00).
11.00	11.19	VOID	VOID (P30)
11.00	13.00	Laminated sand and clayey silt	At 11.19-12.0m (P30): Firm, plastic clayey silt, yellowish brown (10YR 5/4), stratified by lenses of fine to medium sand, yellowish brown (10YR 5/6). Sand lenses becoming better defined towards top of unit, up to 3mm wide; earlier stratification is less pronounced, with an increase in the proportion of sand, occurring in diffuse pockets and bands. Inclusions of coarse sand to small pebbles up to 7mm, including flint, 1%. Occasional fine marine shell fragments.
			At 12.00-12.34 VOID (P32)
			At 12.34-13.00 (P32): Mid yellow 2.5Y 5/1 sand with laminations of mid brown (10YR4/3) silty clay. Very fine slightly clayey to pure sand. Moist, wet between 12.39-12.45m. Soft medium sand between 12. 71-81m, laminated with soft to firm silty clay. Occasional thin red Fe bands. No coarse inclusions. Some small bluish grey mottles at 12.47m.
13.00	13.67	VOID	VOID (P34)
13.67	13.93	Sand	At 13.67-13.93 (P34): Moist, slightly gritty, very loose and crumbly sand - mostly medium with some fine and rare coarse. Mixture of three main colour grains: yellow (10YR 7/8), yellowish brown (10YR 5/6) and greyish brown (10YR 5/2 to 5/3). Relative proportions of the colours is variable, often in stratified bands of one dominant colour - where the first two are dominant there are reddish bands. Small pebbles 15mm at 13.73. Sharp lower boundary
			At 13.93-14.00m (P34): Slightly moist, soft fine to medium sand. Mostly yellowish brown (10YR 6/6 to 5/6) with some reddish yellowish brown (10YR 5/8). Stratified with lenses of moderately firm, sticky brown 7.5YR 5/4 silty clay up to 10mm thick, sometimes broken but mostly well structured. Occasional small black organic flecks <1%.
			Below this depth bulk spot samples
14.20		Sandy gravel	At 14.20 (B39): Sandy gravel (15/85), yellowish brown (2.5Y 5/4 to 6/4). Sand is slightly clayey. Gravel is small subangular to rounded pebbles with a few medium large pebbles of flint.
15.00		Sandy gravel	At 15.00 (B41): Slightly sandy gravel (10/90), yellowish brown (2.5Y 6/3). Sand is fine, slightly silty. Gravel is small to large subangular to rounded pebbles of flint.
17.00		Sandy clayey gravel	At 17.00 (B45): Slightly sandy clayey gravel (10/90)l, yellowish brown (2.5Y 5/4 to 6/4). Gravel is small to large subangular to rounded pebbles of flint. Clay forms large lenses.

17.30		Silty clay	At 17.30 (B47): Dark greyish brown (5Y 4/1-3/1) mod. soft silty clay. Fine sand inclusions 20% dark green grey (5GY 4/1), a few coarse grains, angular.

Borehole OA19

INT	OA19		
E	571172.83		
N	182498.19		
GL mOD	1.41		
TD	39.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.05	Clayey silt	Dark brown (10YR 3/2) clayey silt, many grass roots, humic rich. Topsoil.
0.05	1.00	Sandy clay	Firm brown with red brown and blue grey staining sandy clay with abundant rootlets. Sand is fine and medium (drillers description).
1.00	1.60	Sandy clay	Firm fisuured brown with orange red brown and blue grey mottled, slightly sandy clay. Fissures very closely spaced, randomly orientated and closed. Occasional pockets (<10mm) of orange brown fine sand and silt (drillers description)
			At 1.00 (B4) Firm yellowish brown (2.5Y 5/3) silty clay, few roots, small yellow mottles.
			From 1.20-1.97m VOID (P5)
			At 1.77-2.00 (P5): Greenish grey 10Y 5/1 firm, moist, nonsticky plastic silty clay with orange (Fe) mottles. Thin lenses of white, fine sand. Organic inclusion 1%, occasional coarse sand <1%. Stratification increasingly pronounced with depth.
			From 2.00-2.84m VOID / disturbed with wax at 2.54 (P8)
2.54	3.00	Silty clay	At 2.54-3.00 (P8): Very soft dark greyish brown (2.5Y 4/1 to 2.5 3/1) slightly soft silty clay with many fine sand inclusions. Occasional pockets (<20mm) of orange fine sand (drillers description). Occasional fine fibrous organic inclusions (dark brown)
3.00	6.80	Silty clay	At 2.50-6.80: Very soft brown blue grey slightly sandy silty clay (drillers description) Piston failed 3.00-4.00m.
			At 2.50 (B10): Greyish brown silty clay (5Y 5/1), very soft, fine organic inclusions 2%.
			At 4.00-5.00 (B14): Very soft, brownish grey (5Y 4/1) silty clay with dark grey (N4/) mottles 10% . Piston failed at 4.00-5.00m
			At 5.00-5.20m VOID (P15)
			At 5.20-5.38 (P15): Very dark grey 2.5Y 3/1 soft silty clay. Structureless, no coarse inclusions.
			At 5.38-5.54 (P15): Black 2.5Y 2.5/1 soft humic silty clay. No coarse inclusions. Clay rich structureless deposit. Sharp upper boundary.
			At 5.54-5.72 (P15): Dark grey 2.5Y 4/1 loose sandy silt with frequent, evenly spaced (2-3cm) silty clay **laminations** (1cm thickness). Diffuse upper and lower boundaries.
			At 5.72- 6.00m (P15): Very dark grey 2.5Y 3/1 soft clayey silt with frequent humic clayey deposits interstratified. Diffuse boundaries between humic/mineral deposits.
			At 6.00-7.00 piston failed
6.80	8.00	Silty clay	At 6.80 (B19): Mixed brown (10YR 4/1) and grey (N6/) silty clay. Organic inclusions 10%, occassional rounded pebbles.
			At 7.00-7.33 VOID (P20)
			At 7.33-7.82 (P20): Dark grey 2.5Y 4/1 firm silty clay with no coarse component

			At 7.82-8.00m (P20): Dark greyish brown 2.5Y 4/2 firm structureless silty clay
8.00	8.50	VOID	VOID
8.50	8.76	Sandy clay	At 8.50-8.76 (P23): Dark greyish brown 2.5Y 4/2 firm to stiff sandy clay. Occasional subrounded gravel and gypsum precipitate. Very heterogeneous deposits with signs of oxidation.
8.76	9.00	Sandy clay and gravel	At 8.76-8.50 (P23)Firm to stiff mixed deposit of sandy clay and sandy gravel deposits. Very diffuse upper boundary. Well sorted subrounded gravel (1-3cm).
			At 8.70 (B25): Firm yellowish brown (2.5Y 6/4) silt.
9.00	9.26	VOID	VOID (P26)
9.26	11.00	Clayey sand	At 9.26-9.55 (P26) Mid reddish yellow 2.5Y 5/6 firm, slightly plastic clayey sand. Sand fine to medium, clay 20%, silt 15%. Greyish brown mottles, rare very fine reddish flecks, rare small mollusc shell fragments. Structureless, massive, distinct basal boundary. (Alluvium)
			At 9.55-10.00 (P26): Light yellowish brown 2.5Y 6/4 firm, slightly plastic, slightly clayey silt. Diffuse, weak small to medium greyish brown mottles. Fine pores (0.1mm) common - probably root voids. Weak structure of stratification recognisable in the way the sediment disintegrates (Alluvium)
			At 10.00-10.31m VOID (P27)
			At 10.31-11.00 (P27): Yellowish brown 10YR 5/4 moist, moderately soft, slightly sticky, modertately plastic, slightly clayey fine sand with lenses of clayey silt. Towards top of unit, clays become more dominant, with sands appearing as slightly stratified pockets and fine lenses. 10.34-42m, clayey silt apears in lenses up to 4mm wide. At base of unit sand particularly dominant, with a lens of fine to medium sand 10mm wide at 10.64m. Angular gravel up to 8mm diameter 1%, particularly between 10.39-49m. Rare mica (Alluvium)
11.00	11.49	VOID	VOID (P28)
11.49	12.00	Sandy clay	At 11.49-12.00 (P28) Light yellowish brown 10YR 4/3 very sandy (fine sand) clay. Structureless, massive. Occasional very fine very light yellow and dark orange fragments and flecks, occasional fine mica (Alluvium)
12.20	18.20	Sandy gravel	Medium dense, orange brown with occassional dark grey, slightly clayey sandy gravel. Gravel is angular to rounded fine to coarse predominantly fine and medium of flint (drillers description).
			At 12.20 (B31): Sandy gravel (20/80), yellowish brown (2.5Y 6/4). Sand is fine, clayey. Gravel is small to medium angular to rounded pebbles of flint and quartz.
			At 13.00-13.45 (B33): Gravelly sand (10.90), yellowish brown (2.5Y 5/4-6/4). Sand is fine to medium. Gravel is small to large, subangular to subrounded pebbles of flint.
			At 14.00-14.45 (B36) Slightly gravelly sand (5/95), yellowish brown (2.5Y 6/4). Sand is fine to mediun. Gravel is small angular to rounded pebbles of flint.
			At 15.00-15.45 (B38) Sandy gravel (40/60), light yellowish brown (5Y 6/4). Sand is medium to coarse. Gravel is small to medium angular to rounded pebbles.
			At 16.00-16.45 (B40): Gravelly sand (40/60), light yellowish brown (2.5Y 6/4). Sand is medium. Gravel is small to medium pebbles, subangular to rounded, of flint.
			At 17.00-17.45 (B42): Gravelly sand (40/60), light yellowish brown (2.5Y 6/4). Sand is medium and coarse. Gravel is small to large angular to rounded pebbles.
18.20	19.45	Sandy clay	Stiff becoming very stiff blue grey mottled red orange brown slightly sandy clay. Sand is fine. Occassional pockets (17mm) of ornage fine sand. Occasional partings (>2mm) of light grey silt (drillers description).
			At 18.20 (B46): Grey (N5/) silty clay, stiff. Coarse sand and small angular pebbles 5%
			At 19.00-19.30 (P47): Dark greenish grey 5G 4/1 firm, moist sandy clay. Horizontal lenses of fine sand up to 3mm thick. Lenses of organic material 2%. Mica present. Stratified.

19.45	22.45	Sandy clay	At 19.45-22.45: Very stiff, dark grey, slightly silty sandy clay. Sand is fine. Occasional partings (<2mm) of light grey silt. Occasional to frequent fine sand sized selenite crystals (drillers description).
			At 20.00-20.08 (U49): Dark grey N4 soft, nonplastic fine sand, mottled with dark yellowish brown (10YR 5/4) 40%. Bands of greenish grey 10GY 5/1 silty clay, becoming wider (up to 15mm) and more dominant at base of unit. Friable, very dark brown organic inclusion revelaed in top of core, 12mm.
			At 20.08-20.10 (U49): Very compacted, dry, silty textured, brittle and breaks with a little pressure cleanly into irregular blocks. Brownish yellow 10YR 6/8. Structureless. Clear upper and lower boundaries. **(Redeposited chalk)**
			At 20.10-20.31 (U49): Grey 5N firm, moist silty sand, with unstratified pockets of fine sand mixed in. Mica present, no organic inclusions.
			At 20.31-20.36 (U49): Very cemented, almost dry pale greyish yellow 2.5Y 7/6, silty texture, breaks with some difficulty into irregular, platey blocks with clean edges. Occasional stone inclsuions up to 5mm, Structureless. Upper boundary clear but some material mixed into overlying unit. **(Redeposited chalk)**
			At 20.36-20.45 (U49): Grey 5N fairly soft, quite plastic sandy silt with unstratified pockets of fine sand. No organic inclusions. Sharp upper boundary, structureless.
			At 21.00-21.45 (U51): Greenish grey (5G 5/1) slightly moist, quite firm, fairly plastic sandy silt. Slightly darker, greyer shade in upper 10cm. Irregular lenses of pale green 10GY 8/1 clayey silt throughout the unit. Pocket of yellowish brown fine sand at 21.11m. Mica present. Infrequent organic inclusions <2mm, <1%.
			At 22.00-22.12 (U53): Beds of dark grey N4 silty sand and slightly plastic dark grey N5 clayey silt. 22.10-13, band of greenish/yellowish grey fine sand. Occasional organic lenses <1%. Mica present. Massive, fairly firm, moist.
			At 22.12-22.22 (U53): Almost dry, non-plastic, firm, silty textured sediment, crumbles into small, blocky fragments when disturbed, dull white (8N but slightly whiter) Appears calcareous.Pocket of yellow 10 YR 6/8 sediment of similar composition at base of unit. No coarse inclusions. Sharp upper boundary. **(Redeposited chalk)**
			At 22.22-22.36 (U53): Very similar to 22.00-12m, stratigraphy slightly more weakly defined, clayey silt slightly more dominant. No organic inclusions. Sharp upper boundary
			Below this depth bulk spot samples and U100s
23.10		Clayey gravel	At 23.10 (B58): Slightly sandy clayey gravel (30/70). Sand is fine. Gravel is small angular to subrounded pebbles (30%) and medium to large rounded pebbles (40%).
23.90		Sandy silt	At 23.90 (B60): Sandy silt, grey (N4/). Sand is fine, few marine shell fragments..
25.00		Sand	At 25.00 (B63): Grey (N4/) silty sand, 5% shell fragments. Sand is fine.
27.00		Sand	At 27.00 (B66): Sand, grey (N5/). Sand is fine, slightly silty, 2% shell fragments, occasional small pebbles 1%
30.00		Sandy silt	At 30.00 (B70): Slightly sandy silt, dark grey (N3/). Small mollusc shell 15%, white platy stone fragments 5%.
31.00		Silty clay	At 31.00-31.45 (B72) Silty clay, dark grey (N3/), moderately firm. Small white platey stone fragments 20%, humic smell.
32.00		Silty sand	At 32.00-32.33 (U73): Very dark grey 5Y 3/1 moist, fairly soft silty sand. Marine shell inclusiions 2%, concentration slightly decreasing towards top of unit. Fine sand lens at 32.08m, and 32.25m. Structureless.

33.00		Clayey silt	At 33.00-33.45 (U75): Dark grey 2.5Y 4/1 moist, firm clayey silt, banded with very pale grey, almost white 2.5Y 8/1 medium sand 2-8mm wide at irregular but frequent intervals. Laminations of fine dark grey sand 1mm wide irregularly spaced throughout. Patch of organic inclusion at 33.07m. Marine shell inclusions including complete pieces at 33.24 and 33.31m, also high frequency in upper 4cm of unit, and a band of fragments at 33.05m. Mica present (Alluvium?)
34.00		Silty sand	At 34.00-34.45 (U77): Dark grey 5Y 4/1 moist, soft friable silty sand. Structureless, homogeneous, no organic inclusions. Occasional nonstratified pockets of medium to coarse sand 5%. Mica present. Marine shell fragments 5-15mm at 34.26, 34.4 and 34.34m. (Alluvium?)
36.00		Sandy silt	At 36.00-36.30 (U80): Dark greyish brown 10YR 3/2 firm, slightly moist sandy silt. Sandy component much reduced from 36.20m downwards. Lenses of fine to medium sand, irregularly spaced 10%, rare from 36.20m. Sand greenish grey, lenses 2-4mm wide. Organic inclusions 2%. Marine shell fragments 1% in uppermost 4cm of unit. Band of clayey silt 26.20-22m. Dark colour of unit suggests highly organic.
37.00		Organic sandy silt	At 37.00-37.19 (U82): Very dark greyish brown 10YR 2/2, highly organic sandy silt. Lenses of compacted, platey black organic plant remains making up up to 40% of the total composition of the unit. Upper 5cm contains large pockets of dark, greyish brown silty clay mixed into the sand, possible contamination. Infrequent, randomly spaced small lenses of pale, brownish yellow medium sand 1%. 37.16-17m, a pocket of coarser sand with stone inclusions up to 6mm across. Mica present. Moist, non plastic, mosty firm.(Alluvium containing high percentage of eroded topsoil?)
38.00		Peat	At 38.00-38.12 (U84): Dark organic layer. Lowest 6cm extremley crumbly and poorly held togther; may have originally had some structure but has been lost due to its fragile character.This zone is predominately composed of poorly decomposed wood/leaf remains arranged in platey, flat blocks up to 6cm in length and up to 7mm wide. This region of the unit is consistently black, and not very spongey. Upper 7cm of unit well held together, firm, dark reddish brown 5YR 3/3 with lenses of black organic material. Contains lenses of greenish grey clayey silt 2mm between 38.03-05m. Rare mica.

Borehole OA20

INT	OA20		
E	571678.30		
N	182499.51		
GL mOD	2.87		
TD	40.45		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.20	No description	Topsoil
0.20	0.70	Gravelly clay	Brown, soft gravelly clay. Gravel is angular to subangular fine to coarse of brick fragments, flint and concrete **MADE GROUND** (drillers description)
			At 0.20 (B2): Firm silty clay, dark brown (2.5Y 3/2). 20% gravel of brick, stone and flint as small to large pebbles. Frequent roots.
0.70	1.20	Gravelly sandy clay	Grey brown firm slightly gravelly sandy clay. Blue grey and orange brown mottles. Gravel is angular to subangular fine to medium of brick fragments, flint, concrete and clinker. Occasional pockets of yellow orange fine and medium sand. Organic odour. **MADE GROUND** (drillers description).
			At 0.70 (B4): Dark brown (2.5Y 6/4) mixed with grey (10G 5/1), silty clay. 20% gravel of slag, stone and brick fragments
			At 1.00 (B6): Dark brown (7.5YR 3/1) firm silty clay with reddish brown mottles 5%. 20% gravel of flint, brick. Occasional black organic inclusions.

			Below this depth piston samples
1.20	1.81	VOID	**(P7)**
1.81	2.20	Silty clay	At 1.20-1.59 excl. the void, (P7): Light olive brown 2.5Y 5/3 moist, plastic, slightly firm, very slightly sticky silty clay. Orange (Fe) and light blue (bleached) mottles and tiny iron clasts, probably unstratified.Breaks fairly cleanly. Coarse sand inclusions, 2%, decreasing in size between 1.43-55m. Occasional small pebbles including pebble 27mm at 1.26m - atypical, may be contamination. Occasional fibrous plant detritus, <1%, some fine root material.
2.20	2.39	VOID	(P10)
2.39	2.43	Clayey silt	(P10) Soft silty clay, dark brown (5Y 4/1), with light bluish grey mottles. Includes reddish brown organic concretions (2%).Clear basal boundary.
2.43	3.20		(P10): Light brown 2.5Y 4/1 and light bluish grey 5BG 4/1 zones of moderately soft, plastic, slightly sticky clayey silt. Occasional small brownish organic inclusions, plentiful blackish organic detritus (10-15%) and occasional brown organic fragments 2.31-56m. Many small organic fragments, dark greyish brown diffuse mottles. Occasional small brown/blackish inclusions in light bluish clay from 2.78m to base..
3.20	3.40	VOID	
3.40	7+B30.2	Silty clay	At 3.40-3.62 (P14): Mid yellowish brown (2.5Y 5/1to 5/2) soft silty clay, structureless. Few fine small dark brown organic inclusions (5-7%). Diffuse lower contact.
			At 3.62-3.80 (P14): Grades to brownish grey (10YR 4/1) soft silty clay, fine organic inclusions (25%).
			At 3.80-3.92 (P14): Clear change to dark greyish brown (2.5Y 4/5 to 3/1) sandy clayey silt with inclusions of fine sand 25%. Rare shell fragments.
			At 3.92-4.20 (P14): Light greenish grey (5Y 5/1), very soft silty clay with organic inclusions (3%).
			At 4.20-4.43 VOID
			At 4.43-4.93 (P16): Dark greyish brown (10Y 3/1 to 4/1) soft, structureless silty clay. Frequent fine sand inclusions. Occasional shell fragment. Clear basal boundary
			At 4.93-5.20 (P16): Mid greenish grey 5GY 4/1 soft silty clay, massive. Zones with many fine sand inclusions, rare small shell fragments
			At 5.20-5.41 VOID (P18)
			At 5.41-6.20 (P18): Dark greyish brown 2.5Y 4/1 to 3/1 soft, massive silty clay. Small sand inclusions. Occasional shell inclusions <1%. Structureless except for zones of sand inclusions.
			At 6.2-6.43 VOID (P20)
			At 6.43-7.2m (P20): Dark greenish grey 5GY 4/1 moist, soft, sticky silty clay. Small lenses of weakly stratified fine sand, particularly concentrated in band 6.89-93m. Complete marine shell 17mm at 6.56.
7.20	7.36	VOID	VOID (P22)
7.36	7.76	Peat	At 7.20-7.73 (P22): Very dark brown (10YR 2/1) to dark reddish brown (5YR 2.5/2) below 7.41.Firm, spongy, crumbly silty peat. Wood inclusions.
7.76	8.20	Silty clay	At 7.73-8.20 (P22): Bluish grey (10GY 5/1 to 4/1) silty clay. Soft, structureless, frequent woody/detrital inclusions.
8.20	8.39	void	VOID (P24)
8.39	9.20		At 8.39-9.20 (P24): Bluish grey (10GY 5/1) silty clay. Soft, structureless, frequent woody/detrital inclusions.
9.20	9.36	void	VOID (P26)
9.36	10.12	Clayey silt	(P26): Light bluish grey (5GY 4/1) soft to moderately firm, massive, structureless, plastic, slightly sticky, clayey silt. Greyish brown diffuse mottling from top to 9.58m. Plentiful yellowish brown organic fragments (wood?) 10-15%, more frequent 9.32-52m (20%). Small blackish organic flecks, 5-10%. Organic fragments linear, 2-3mm wide. Lamination 20mm from 9.94-96m light bluish grey and very dark greyish brown thin layers of clayey silt. Abrupt basal boundary.

10.12	10.20	Organic clayey silt	(P26): Very dark brown/blackish 5Y 2.5/1 soft, plastic, moist, slightly sticky, organic rich clayey silt. Occasional small diffuse light bluish grey mottles. Yellowish brown linear organic remains (wood/roots) 2-3mm thick.
10.20	10.52	VOID	(p28) VOID
10.52	10.60	Organic silt	At 10.20-10.28 (P28): Very dark brown (10Y 2.5/1) soft, plastic, clayey silt. No stratification or coarse inclusions. High organic content.Lower boundary abrupt.
10.60	11.20	Clayey sand	(P28): Fairly light greenish grey (5G 6/1), soft, plastic, clayey sand. Dark grey mottles and clay content increases towards the top of the unit, possibly due to contamination form the finer, darker sediment overlying it. Weakly stratified. Black/brown organic flecks, 2%. Slightly porous. Occasional mica.
11.20	11.50	void	VOID (P31)
11.50	11.75	Sandy silt	At 11.20-11.45 (P31): Light greenish grey (10G 5/1) slightly clayey sandy silt. Small fine sand inclusions (10%). Rare diffuse black organic inclusions. Diffuse lower contact.
11.75	12.20	Silty clay	At 11.45-11.90 (P31): Mid bluish grey (5G 4/1 to 5/1) soft silty clay. Strucureless. Increasing quantities of fine sand inclusions as small lenses at top (7-15%). Organic flecks rare. Vertical root traces.
12.20	12.35	void	VOID (p33)
12.35	12.51	Sandy silty clay	At 12.20-12.36 (P33): Greenish/bluish grey (10G 6/1) slightly firm, sandy silty clay. Occasional black organic inclusion, 1%. Rare small pebbles <1%. Structureless, homogeneous. Lower boundary clear
12.51	13.20	Silty clay	(P33): Greyish brown (2.5Y 5/2) moderately soft silty clay with abundant fine sand inclusions. Occasional black organic flecks 1%. Occasional coarse sand grain inclusions <1%. Structureless, homogeneous.
13.20	13.50	void	VOID (P36)
13.50	13.72	Clayey silt	(P36): Greyish brown (5Y4/1) slightly sandy clay silt. Moderately firm, structureless. Clear lower contact.
13.72	14.20	Silty clay	At 13.42-13.90 (P36): Greyish brown (5Y4/1) firm silty clay. Weak startification of diffuse thin light greyish brown (5Y 5/1) laminations. Sand is fine (30%).
14.20	14.50	VOID	VOID (P38)
14.50	15.20	Silty clay	At 14.20-14.90 (P38): Mid yellowish brown (2.5Y 4/2) with light yellowish brown laminations (2.5Y 5/2), firm, moderately moist, plastic silty clay, stratified by light yellowish brown bands of slightly silty clay and dark yellowish brown layers of sandy clay, 5-15mm. All bedding quite wavey and often discontinuous, probably due to distortion and compaction.
15.20	15.79	VOID	VOID (P41)
15.79	15.85	Sandy and silty clay	At 15.20-15.26 (P41): Mid yellowish brown (2.5Y 3/2) moderately firm sandy and silty clay. Weak lamination of fine sand, no coarse inclusion, clear basal boundary.
15.85	16.10	Sandy clay	At 15.26-15.51 (P41): Mid brown (2.5Y 4/1 to 3/1) firm very sandy clay. Sand is fine. Occasional coarse sand grains and small subrounded white pebbles (2-3%). Massive, structureless. Clear basal boundary.
16.10	16.20	Gravelly sand	At 15.51-15.61 (P41): Mid brown (2.5Y 4/2) fine sand, clayey and gravelly (25-30%) with large patch of yellow (2.5Y 5/4) fine sand. Firm angular to rounded small pebbles
			Below this depth bulk spot samples
16.00		Clayey gravel	At 16.00 (B45): Clayey gravel (20/80), yellowish brown (2.5Y 5/3-5/4). Moderately soft. Sand is fine. Gravel is small to large subangular to rounded pebbles.
17.00		Sandy gravel	At 17.00 (B47): Sandy gravel (30/70). Light brown (2.5Y 6/3). Sand is fine. Gravel is small to large subangular to subrounded pebbles of flint.
18.00		Gravelly sand	At 18.00 (B49): Gravelly sand (30/70). Yellowish brown (2.5Y 5/4). Sand is fine to medium. Gravel is small to large angular to subrounded pebble of flint.
19.00		Gravelly sand	At 19.00 (B51): Gravelly sand (40/60), yellowish brown (2.5Y 5/4-6/4). Sand is medium. Gravel is small, angular to subrounded, pebbles of flint.

20.00		Gravelly sand	At 20.00 (B53): Gravelly sand (20/80). Yellowish brown (2.5Y 5/4). Sand is fine to medium. Gravel is small to medium angular to subrounded pebbles of flint.
21.00		Gravelly sand	At 21.00 (B55): Gravelly sand (30/70). Yellowish brown (2.5Y 6/4). Sand is fine to medium. Gravel is small to medium angular to subangular pebbles of flint.
22.00		Gravelly sand	At 22.00 (B57): Gravelly sand (40/60), light brown (2.5Y 6/3). Sand is medium to coarse. Gravel is small, with a few medium to large pebbles, subangular to subrounded of flint.
23.00		Gravelly sand	At 23.00 (B59): Gravelly sand (30/70), light brown (2.5Y 6/3). Sand is fine to coarse. Gravel is small to large, subangular to rounded of flint.
24.00		Sandy gravel	At 24.00 (B61): Sandy gravel (20/80). Brown (2.5Y 5/4). Sand is fine to coarse. Gravel is small to medium angular to subrounded pebbles of flint and sandstone.
25.00		Sandy gravel	At 25.00 (B63): Sandy gravel (40/60). Yellowish brown (2.5Y 5/4). Sand is fine to coarse. Gravel is small to large angular to subrounded pebbles of flint and quartz, loose.
26.00		Sandy gravel	At 26.00 (B65): Sandy gravel (40/60). Yellowish brown (2.5Y 5/4). Sand is medium to coarse. Gravel is small to medium angular to subrounded pebbles of flint.
27.00		Sandy gravel	At 27.00 (B67): Sandy gravel (40/60). Yellowish brown (2.5Y 5/4). Sand is fine to coarse. Gravel is medium angular to subrounded pebbles of flint. Very fine, thin, white flakes (shell or stone?).
28.00		Gravel	At 28.00 (B69): Gravel, Small to large pebbles of flint, subangular to rounded. 2% coarse sand.
28.40		Sandy silt	At 28.40 (B71): Sandy silt, very dark grey (5Y 2.5/1). Firm to stiff. Sand is fine. Small coarse sand componant of white flakes (shell or stone).

Borehole OA21

INT	OA21		
E	572176.59		
N	182091.42		
GL mOD	2.63		
TD	32.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
0.00	0.05	No description	Topsoil (drillers description).
0.05	1.00	Sandy clay	Firm, brown locally orange brown, slightly gravelly sandy clay. Gravel angular to subrounded fine to coarse of flint, brick fragments and concrete. Abundant roots and rootlets. **MADE GROUND** (drillers description).
1.00	1.50	Sandy clay	Firm, brown mottled blue grey orange brown, slightly gravelly sandy clay. Gravel angular to subangular fine to medium of brick fragments, flint and rare concrete. Occasional rootlets and rare plant remains. **MADE GROUND** (drillers description).
			At 1.00 (B4): Firm to stiff greyish brown (2.5Y 5/1) silty claywith abundant reddish Fe mottles 20%
1.50	2.00	Silty clay	At 1.50-6.50m: Very soft, brown green blue grey slightly silty slightly sandy clay. Sand is fine (drillers description).
			At 1.50 (B7) yellowish brown (2.5Y 5/3) soft silty clay with reddish brown Fe concretions 1%, rare small angular pebbles.
		VOID	VOID 2.0-2.29M (P8)

INT	OA21		
E	572176.59		
N	182091.42		
GL mOD	2.63		
TD	32.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
2.29	3.00	Silty clay	At 2.29-3.0M (P8): Brownish grey (5Y 5/1 to 5/2), soft silty clay. Small, discrete organic mottles, frequent and slightly stratified, becoming more diffuse and less frequent by 2.32 and disappearing by 2.40 to be replaced by black flecks of plant material. 2.00-2.15m contains occasional Fe clasts in unstratified pockets, 2-3%, also slightly mottled with greenish grey.
		VOID	VOID 3.00-3.21M
3.21	3.28	Silty clay	At 3.21-3.28 (P11): Dark brownish grey (10Y 3/1 to 4/1) soft silty clay. Very dark brown small organic clasts (20%). Diffuse lower boundary
3.28	3.84	Silty clay	At 3.28-3.84 (P11): Mid bluish grey (5GY 4/1) massive, structureless, soft silty clay. Small, weak diffuse mid brown mottles. Many dark brown/yellowish medium to fine organic clasts (wood?). Diffuse lower boundary.
3.84	4.00	Silty clay	At 3.84-4.00 (P11): Light bluish grey (5GY 5/1 to 4/1) soft silty clay. Occasional fine to small blackish/very dark brown organic fragments, decreasing quantity (10-5%) with depth.
4.00	4.20	VOID	VOID
4.20	4.51	Silty clay	At 4.20-4.51 (P12): Greenish grey (5GY 5/1) soft silty clay. Many organic inclusions: 4.00-4.13 mostly as fine material with mottles of black/brown. 4.13-4.18 is a band mottled brown to dark grey (5Y 4/1) with stratified fragments of possible eroded peat. 4.18-4.31 contains many fibrous plant fragments, 4%. Diffuse lower boundary.
4.51	4.79	Silty clay	At 4.51-4.79 (P12): Dark greyish brown (2.5Y 4/2) soft silty clay with stratified mottles of greenish grey (15%). Abundant fibrous plant material (15%) particularly well stratified 4.51-4.62. 4.69-4.71 greenish grey dominant, suggesting an interruption in organic inwashing. Diffuse lower boundary.
4.79	5.00	Silty clay	At 4.79-5.00 (P12): Greenish grey (5GY 5/1) soft silty clay. Dark brown fibrous plant fragments (eroded peat?) with some stratification.
		VOID	VOID
5.21	5.52		At 5.51-5.52 (P13): Greenish grey (5G 5/1) soft silty clay. Mottled with slightly olive grey (approaching 5Y 5/2). 5.49-5.52 a diffuse band of dark, slightly bluish greenish grey (10GY 4/1) silty clay. Small black organic flecks, occasional larger fibrous plant detritus towards top of unit.
5.52	6.00		At 5.52-6.0m (P13): Dark greenish grey (10Y 4/1) soft silty clay. Dark brown/black fibrous plant remains (possibly eroded peat) 7%, slightly stratified, with stratification increasing with depth.
		VOID	VOID
6.25	6.78		At 6.25-6.78 (P14): Dark brownish grey (2.5Y 3/1 to 4/1), mid bluish grey below 6.13 (5GY 4/1), soft structureless silty clay. Small organic black detritus 10%, light yellow organic fragments (wood?) frequent below 6.60m (15-20%). Abrupt lower boundary
6.25	7.00	Peat	At 6.25-7.00 (P14): Black (N2.5/) loose, crumbly, spongy peat with plant detritus (25%).
		VOID	VOID 7.00-7.29M
7.29	7.31	Peat	At 7.29-7.31 (P17): Black (N2.5/) loose, crumbly, spongy peat with plant detritus (25%). Structureless, abrupt boundary to base. (Peat)
7.31	7.45	Silty clay	At 7.31-7.45 (P17): Dark greyish brown (5Y 3/1 to 4/1) with mid bluish grey mottles changing to light bluish grey (5G 5/1) below 7.08m. Soft silty clay. Very dark brown organic inclusions above 7.08m (30%) yellowish red inclusions (wood?) below 7.08m (15%) Clear basal boundary
7.45	7.48	Organic silt	At 7.45-7.48 (P17): Reddish brown (5Y 3/1) soft silt. Plentiful organic inclusions in stratified beds. Diffuse basal boundary

INT	OA21		
E	572176.59		
N	182091.42		
GL mOD	2.63		
TD	32.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
7.48	8.00	Silty clay	At 7.48-8.00 (P17): Light bluish grey, soft, structureless silty clay. Fine to medium sized (50mm) organic inclusions; dark grey and yellowish brown (wood) above 7.41, black, medium sized clasts (peat?) below 7.41, 10mm light brown band at 7.36-7.37.
		VOID	VOID 8.00-8.23M
8.23	9.00	Silty clay	At 8.23-9.00 (P18): Greenish grey (5GY 5/1) silty clay. Fibrous, poorly stratified plant detritus 7% (possibly eroded peat) particularly between 8.19-8.21 and 8.49-8.52. Occasional small, weakly stratified pockets of fine sand, particularly 8.01-8.07, 8.65-8.77, and 8.13-8.17.
		VOID	VOID AT 9.00-9.28M
9.28	10.00	Sandy silt	At 9.28-10.00 (P19): Mid greenish grey (5GY 4/1), bluish grey below 9.57. Fine sandy silt with small amount of clay. Plastic. Fine small sand inclusions and shell fragments at 9.42.
		VOID	VOID AT 10.0-10.31M
10.31	10.82	Sandy silty clay	At 10.31-10.82 (P20): Soft sandy silty clay. Proportions of fine sand variable, appearing in weakly stratified broken lenses/small pockets and in places, particularly towards the base of the unit, becoming dominant as sandy clay/clayey sand. Band of mottling 10.14-10.15m of olive grey (5Y 5/2) possible contamination. Black organic flecks rare <1%.
10.82	11.00	Sandy clay	At 10.82-11.0 (P20): Greenish grey (5G 5/1) sandy clay, with pockets of slightly clayey fine sand. Occasional organic inclusions 1%.
		VOID	VOID 11.00-11.25M
11.25	13.00	Silty clay	At 11.25-12.00 (P21): Mid grey (N3/ to N4/) soft silty clay. Fine sand inclusions (20-25%) above 11.28 and below 11.39. Laminated 11.28-11.39. Thin (5-10mm) light yellowish brown bands between 11.10-11.19. Occasional shell fragments.
			VOID AT 12.0-12.22M
12.22	12.44	Silty clay	At 12.22-12.44 (P22): Dark greenish grey (5BG 4/1) soft silty clay. Weakly stratified pockets of fine sand common. Occasional marine shell fragments <1%, including 6mm piece at 12.16m. Olive grey (5Y 5/2) mottling at top of unit. Lower boundary diffuse.
12.44	12.58	Silty clay	At 12.44-12.58 (P22): Greenish grey (5GY 4/1) soft, slightly stratified, silty clay. Band 12.34-12.37 in which marine shell fragments are common. Lower boundary clear.
12.58	13.00	Silty clay	At 12.58- 13.00 (P22): Greenish grey (10GY 5/1) soft, plastic, silty clay. Abundant fragments of brown fibrous plant material - probably eroded peat - and black organic mottles, 7%. Slightly stratified, no coarse inclusions.
		VOID	VOID AT 13.0-13.26m
13.26	13.58	Silt	At 13.00-13.58 (P23): Dark grey (2.5Y 5/1 - 4/1) silt. Occasional broken lenses of fine sand. Occasional fine lenses of greenish grey silt. Diffuse lower boundary.
13.58	14.00	Silt	At 13.58-14.00 (P23): Soft slightly clayey silt. Light yellowish brown (2.5Y 6/3). Occasional black mottling and Fe staining, possibly representing decayed organics.
		VOID	VOID 14.00-14.26m
14.26	14.75	Sandy silty clay	At 14.26-14.75 (P26): Mid greenish grey (10Y 5/1 to 4/1) soft sandy, silty clay. Mid yellowish brown bands at 14.10-14.19. Occasional blackish organic inclusions (roots?). Diffuse lower boundary.
14.75	15.00	Sandy silt	At 14.75-15.00 (P26): Mid greenish grey (5Y 5/2 to 4/2), moderately firm, sandy silt, slightly clayey, breaks when cleaned. Few yellowish brown light mottles at 14.67.
		VOID	VOID at 15.0-15.42m

INT	OA21		
E	572176.59		
N	182091.42		
GL mOD	2.63		
TD	32.00		
Depth (m)		**Keyword**	**Description**
From	**To**		
15.00	15.80	Clayey silt	At 15.42-16.00m (P27): Greyish brown (slightly darker than 2.5Y 5/2) plastic clayey silt. Occasional weakly stratified lenses of fine sand. Coarse sand to small pebbles up to 10mm diameter, rounded to subangular -sparse at top of core, with gradual increase in quantity with depth to become common (3%) by base of unit. Organic black mottling 1-2% between 15.42-15.75m. Between 15.75-15.92m mottling is 15-20%.
			Below this depth bulk spot samples
15.80		Gravelly sand	At 15.80 (B29): Gravelly sand (40/60), greyish brown (5Y 4/2-5/2). Sand is medium. Gravel is small to medium angular to rounded pebbles. Pockets of yellow brown clayey sand and grey silty clay (N4/).
16.00		Gravelly sand	At 16.00-16.45 (B32): Gravelly sand (30/70), yellowish brown (5Y 4/3). Sand is fine to medium, slightly clayey. Gravel is small to large, subangular to subrounded pebbles of flint..
17.00		Gravelly sand	At 17.00-17.45 (B34): Gravelly sand (10/90), light yellowish brown (2.5Y 6/3). Sand is fine to coarse with 1% shell fragments. Gravel is small to large angular to rounded.
18.00		Gravelly sand	At 18.00-18.45 (B36): Gravelly sand (20/80), light yellowish brown (2.5Y 6/2). Sand is fine to coarse. Gravel is small to large angular to subrounded of flint and quartz. Shell fragments present.
19.00		Gravelly sand	At 19.00-19.45 (B38): Light yellowish brown (2.5Y 5/4) gravelly sand (40/60). Sand is fine to medium. Gravel is small to large subangular to subrounded pebbles.
20.00		Sandy gravel	At 20.00-20.45 (B40): Light brown (2.5Y 6/3) sandy gravel (40/60). Sand is fine to coarse. Gravel is small to large angular to rounded pebbles of flint.
21.00		Sandy gravel	At 21.00-21.45 (B42): Light brown (5Y 6/3) sandy gravel (10/90). Sand is fine to medium. Gravel is small to large subangular to rounded pebbles of igneous rock and a few flint. Occassional cobbles.
22.00		Sandy gravel	At 22.00-22.45 (B44): Light yellowish brown (2.5Y 6/3) sandy gravel (40/60). Sand is medium to coarse. Gravel is small to large angular to rounded pebbles of flint.
23.00		Sandy gravel	At 23.00-23.45 (B46): Light brown (2.5Y 6/2) sandy gravel (10/90). Sand is fine to coarse. Gravel is small to large angular to rounded pebbles of flint.
24.00		Sandy gravel	At 24.00-24.45 (B48): Light greyish brown (2.5Y 5/2) sandy gravel (30/70). Sand is fine to coarse. Gravel is mainly small angular to subangular pebbles. Occassional medium to large pebbles. Occasional pockets of grey clayey sand (3%).
25.00		Sandy gravel	At 25.00-25.45 (B50): Yellowish brown (2.5Y 4/2) sandy gravel (40/60). Sand is fine to coarse. Gravel is small to large angular to subrounded pebbles of flint.
26.00		Gravelly sand	At 26.00-26.45 (B52): Light yellowish brown (2.5Y 5/) gravelly sand (30/70). Sand is fine to coarse. Gravel is small to large angular to rounded pebbles, plus cobbles, of flint.
26.30		Sand	At 26.30 (B54): Sand, dark greyish brown (10Y 3/1-4/1), slightly clayey, no inclusions.

APPENDIX 4. FORAMINIFERA AND OSTRACOD ECOLOGICAL REQUIRMENTS

FORAMINIFERAL ECOLOGY

Below are listed the main foraminiferal species that occur in the samples from the London Gateway boreholes. The best information on their ecology and distribution is to be found in Murray, (1979) and in "Appendix I, Ecological Data" of Murray (2006), from which the following is derived.

BRACKISH SPECIES

***Jadammina macrescens*:** Epifaunal on decaying vegetation and infaunal down to 60cm, an herbivore and detrivore. Widespread on high to mid saltmarsh.

***Trochammina inflata*:** Epifaunal and infaunal down to 60cm. An herbivore and detrivore. Widespread on high to mid saltmarshes.

Tiphotrocha comprimata* and *Arenoparrella mexicana: Mid-high saltmarsh species originally of the Caribbean region; usually rare and subsidiary in NW Europe, as here. Have identical lifestyle to *J. macrescens* and *T. inflata* (see above).

***Ammonia* spp.:** Infaunal and an herbivore; common in sediments with highly variable mud and TOC contents; mid-low saltmarsh to subtidal, in salinities not usually below 10‰; also able to tolerate low oxygen. [The small, flat unornamented forms are difficult to name specifically (several species may be present) but they usually indicate low brackish conditions, as in estuarine tidal mudflats and low-mid saltmarsh].

***Elphidium williamsoni*:** Infaunal and an herbivore; common in sediments with highly variable mud and TOC contents; mid-low saltmarsh, intertidal to subtidal; euryhaline.

***Haynesina germanica*:** Infaunal, an herbivore on diatoms and cyanobacteria; common in sediments with highly variable mud and TOC contents; mid-low saltmarsh, intertidal to subtidal; euryhaline.

OUTER ESTUARINE/MARINE SPECIES

***Nonion depressulus*:** Infaunal-epifaunal, sometimes on seagrass. An herbivore (on cyanobacteria and diatoms). Inner shelf species penetrating into the intertidal seaward parts particularly of open estuaries.

Lagenids: Species of *Lagena* and *Oolina.* Both marine shelf genera living on muddy substrates, with postmortem transport during storms leading to their deposition in estuary mouths.

Bolivinids: A species of *Bolivina.* Shallow infaunal inner shelf, marine form often transported into the muddy parts of estuaries.

In BH7 (of 2003), however, several more species occur in part of the sequence:

Ammonia batavus* and *A. "tepida" - marine forms of the genus, the former characterised by an umbilical boss and some ornamentation. Lifestyle is as for brackish species (see above), but these forms are confined to shallow marine/subtidal regimes.

Miliolids: Comprises mainly *Miliolinella subrotunda* and some *Quinqueloculina* spp. Essentially epifaunal species, clinging to seaweeds. They are all inner shelf species, colonizing the mouths of estuaries. Can also be brought in on floating algae.

Cibicides lobatutus,* discorbids and *Planorbulina mediterranensis: All inner shelf marine species, living clinging to seaweeds or firm substrates. When disturbed by storms their tests are often washed into estuaries.
***Cyclogyra involvens*:** Marine, inner shelf species clinging to firm substrates and seaweeds. Found in mouths of estuaries.
Gavelinopsis praegeri and *Planorbulina mediterranensis:* Both inner shelf marine species, living clinging to seaweeds or firm substrates. When disturbed by storms their tests are often washed into estuaries.

[Euryhaline – able to withstand a wide range of salinities (>0-35‰)] [TOC – Total Organic Carbon]

OSTRACOD ECOLOGY

Below are listed some of the main ostracod species recorded from the London Gateway boreholes. Information is from Athersuch *et al.* (1989) for the brackish and marine species and Meisch (2000) for the non-marine forms.

BRACKISH SPECIES

***Leptocythere* spp.:** An excellent genus for ecological reconstruction as the many species have particular niches. The three main species found here - *Leptocythere castanea, L. lacertosa* and *L. porcellanea* are all euryhaline estuarine taxa, living on tidal mudflats, with the last named occurring particularly in sheltered creeks. *L. psammophila,* which is very rare here, perhaps preferring more open estuaries.
***Cyprideis* torosa:** A mud-crawler characteristic of protected estuarine creeks, usually associated with *Leptocythere porcellanea.* Can tolerate a wide range of brackish salinities, the shell developing nodes below 5‰. All valves are smooth here.
***Loxoconcha elliptica*:** A fast swimmer on the mud/water interface. Found in estuarine mudflats all over Europe.
Cytheromorpha fuscata: A brackish species of tidal rivers. Common in many Holocene sites particularly on the East Coast, but now curiously absent from modern estuaries, the reason for which is unknown.
Cytherura gibba: The only cytherurid restricted to brackish sites (estuarine creeks).
Xestoleberis nitida: The only true brackish xestoleberid. A phytal species living on algal mats in mudflats and creeks.

OUTER ESTUARINE/MARINE SPECIES

***Pontocythere elongata*:** An inner shelf marine and outer estuarine sediment dwelling species. The adults are very large and thick-shelled. Here mainly juveniles were present.
***Paradoxostoma* spp.:** Mainly marine ostracods with specialised mouthparts for living and feeding on algae and sea-grass. Will have been brought in on floating weed (cf. miliolid foramiifera, see above).
Hemicythere villosa* and *Heterocythereis albomaculata: Both shallow marine species living on algal mats on surface sediment and on marine algae.
***Leptocythere pellucida* and *L. tenera*:** Respectively, a large and a rather small species of the genus - exclusively restricted to inner shelf and outer estuarine locales.

***Hirschmannia viridis* :** Live on both marine algae and algal mats on surface sediment. Marine, only penetrating into the outer part of estuaries.
***Semicytherur*a spp.:** Live on both marine algae and algal mats on surface sediment. Marine, only penetrating into the outer part of estuaries.
***Palmoconcha laevata* and *P. guttata*:** Both live on marine algae in the littoral and sublittoral realm.

"EXOTIC" MARINE SPECIES
Either not part of the present day British shallow marine faunas or living today only in the southern England at the absolute northern limit of their distribution. Have climatic and some environmental implications.
Cold/northern indicators found here include: ***Finmarchinella finmarchica, Robertsonites tuberculatus, Elofsonella concinna*** and ***Hemicytherura clathrata.*** The first three live today no further south than NE England and Scotland whereas ***H. clathrata*** is not part of the modern fauna, being pan-Arctic in its distribution. However, they all occur in interglacials in southern England where they are thus considered as non-analogue faunas.
Warm/southern indicators include: ***Aurila convexa*** and ***Carinocythereis whitei***. Both restricted today to the southernmost part of the UK. Occur more extensively in previous interglacials. By association, the extinct species ***Callistocythere curryi*** is considered to be a warm indicator , but is thought to be extinct since (at least) last interglacial (MIS 5e) times (Whittaker and Horne, 2009).
Outer-shelf faunas include two bairdiids, ***Neonesidea globosa*** and ***Anchistrocheles acerosa.*** Assumed to have been brought in by storm surges during active sea-level rise.

NON-MARINE SPECIES.
Particularly significant in boreholes OA17c and OA20 an at the base of OA12. Can be divided into, if not necessarily *in situ* faunas, nevertheless contemporary ones, and those which are possibly/definitely reworked. All of the former (colour-coded light blue) are primarily inhabitants of freshwater but all species recorded here are able to tolerate low salinities in coastal pools on the landward edge of estuaries and in fringing saltmarsh. Some like ***Heterocypris salina***, as the name suggests, actually prefer low brackish waters. See Meisch (2000) for further ecological information. Others, colour-coded darker blue, namely ***Candona candida, Fabaeformiscandona balatonica, Cytherissa lacustris*** and ***Limnocytherina sanctipatricii*** are all denizens of cool/cold and often deep water (particularly in the case of. ***C. lacustris***). Although all are living in Britain today, they have been found extensively in Devensian deposits in the Thames/Medway area. They could indicate either a Devensian or early Holocene phase of the Thames.
Three other species are found which are extinct and must be considered reworked. Their possible provenance is interesting, their known stratigraphic distributions being listed in Whittaker and Horne (2009). These are:
Limnocythere falcata: A cold-climate indicator with an age-range of MIS11-3. Known locally only from several sites at Ebbsfleet, Kent (Devensian).
Leucocythere batesi: Another cold-climate indicator (known age-range: MIS11-5/3). Has widespread occurrence in the Devensian tundra-pool faunas of the Warblington-

Bognor area (Bates *et al.,* 2009). Also known locally from the Devensian of the Thames/Medway at Powdermill Lane and Ebbsfleet.

Ilyocypris salebrosa: (colour-coded lilac). Known only in the UK from the proto-Thames/Medway of the MIS 9 interglacial – at Allhallows, Barling and Purfleet. Therefore most likely to be reworked from Purfleet or from another, so far unidentified site of similar age nearer to Shellhaven.

Context	Foraminiferal species	Ostracod species
Cool/cold deep freshwater		*Candona candida* *Fabaeformiscandona balatonica* *Cytherissa lacustris Limnocytherina sanctipatricii*
Cold freshwater indicators		*Limnocythere falcata* *Leucocythere batesi*
Mid/High saltmarsh	*Jadammina macrescens* *Trochammina inflata* *Tiphotrocha comprimata Arenoparrella mexicana*	
Estuarine tidal mudflats, creeks and low-mid saltmarsh	*Ammonia* (brackish) spp. *Elphidium williamsoni* *Haynesina germanica* *Elphidium waddense*	*Leptocythere castanea* *Leptocythere lacertosa* *Leptocythere porcellanea* *Cyprideis torosa* *Loxoconcha elliptica* *Xestoleberis nitida* *Cytherura gibba* *Cytheromorpha fuscata*
Intertidal to subtidal, seaward parts of open estuaries	*Elphidium williamsoni* *Haynesina germanica* *Ammonia batavus* *Ammonia "tepida"* *Nonion depressulus* *Elphidium excavatum* *Cyclogyra involvens* *Patellina corrugata* miliolids	*Leptocythere psammophila* *Leptocythere pellucida* *Pontocythere elongata* *Leptocythere tenera* *Hirschmannia viridis* *Semicytherura* spp. *Hemicythere villosa* *Loxoconcha rhomboidea* *Palmoconcha laevata* *Heterocythereis albomaculata* *Paradoxostoma* spp.
Inner shelf	*Nonion depressulus* *Elphidium margaritaceum* *Elphidium excavatum* lagenids bolivinids *Cyclogyra involvens* *Gavelinopsis praegeri* *Planorbulina mediterranensis* *Cibicides lobatutus* *Patellina corrugata* discorbids	*Leptocythere tenera* *Hirschmannia viridis* *Semicytherura* spp. *Hemicythere villosa* *Leptocythere pellucida* *Palmoconcha guttata* *Pontocythere elongata*
Outer shelf		*Neonesidea globosa Anchistrocheles acerosa* *Jonesia acuminata*
Cool/cold water marine indicators		*Finmarchinella finmarchica* *Robertsonites tuberculatus* *Elofsonella concinna Hemicytherura clathrata*
Warm "southern" marine indicators		*Aurila convexa* *Carinocythereis whitei* *Callistocythere curryi* (extinct)

Table 1. Ecological groupings for key microfossil species (foraminifera and ostracods

Lab. Ref.	Sample Type	Site	Borehole	Depth BGL	top of BH (m OD)	sample top (m OD)	sample bott (m OD)	Material Dated	Conventional ^{14}C yr BP	δ13C ‰	Calibrated date BC (OxCal. 3.10) at 95.4% unless otherwise stated
GU-24569	Charred stems/leaves	CSGE008	OA06	11.43-11.45m	2.00	-9.43	-9.44	Charcoal	failed		
SUERC-36692 (GU-25192)	Organic sediment (peat)	CSGE008	OA06	11.43-11.45m	2.00	-9.43	-9.44	Humic fraction (64g sample)	7010+/-35	-26.6	5990-5800
SUERC-37082 (GU-25193)	Organic sediment (peat)	CSGE008	OA06	11.43-11.45m	2.00	-9.43	-9.44	Humin fraction (from 64g sample)	7005 ± 30	-26.8	5990-5800
SUERC-35564 (GU-24566)	Charred stems/leaves	CSGE008	OA06	11.37-11.39m	2.00	-9.37	-9.39	Charcoal	6640+/-35	-25.6	5630-5510
GU-25261	Calcareous foraminifera	CSGE008	OA06	10.89-10.91	2.00	-8.89	-8.91	mixed taxa	failed		
SUERC-36738 (GU-25260)	Calcareous foraminifera	CSGE008	OA06	7.86-7.88m	2.00	-5.86	-5.88	mixed taxa	6685±50	n/a	5710-5510
GU-25259	Agglutinating foraminifera	CSGE008	OA06	7.64-7.66m	2.00	-5.64	-5.66	*Trochammina inflata*	failed		
GU-24568	Charred stems/leaves			7.22-7.24	2.00	-5.22	-5.24	mixed taxa	failed		
SUERC-36691 (GU-25190)	Organic sediment (peat)	CSGE008	OA06	7.22-7.24m	2.00	-5.22	-5.24	Humic fraction (60g sample)	5605+/-30	-26.8	4500-4350
SUERC-37081 (GU-25191)	Organic sediment (peat)	CSGE008	OA06	7.22-7.24m	2.00	-5.22	-5.24	Humin fraction (60g sample)	5620 ± 30	-26.7	4520-4360
SUERC-35565 (GU-24567)	leaf fragment, w aterlogged	CSGE008	OA06	6.75-6.77m	2.00	-4.75	-4.77	Monocotyledon indet.	4095+/-35	-27.8	2870-2800 (20.6%); 2760-2560 (70.9%), 2530-2490 (3.9%)
SUERC-35570 (GU-24575)	Organic sediment	CSGE008	OA09	9.72-9.74m	2.05	-7.67	-7.69	Humic fraction (117g sample)	8930+/-35	-26.7	8250-8160 (3.6%), 8150-7960 (61.8%)
GU-24576	Organic sediment	CSGE008	OA09	9.72-9.74m	2.05	-7.67	-7.69	Humin fraction (117g sample)	failed		
SUERC-36731 (GU-25252)	Calcareous foraminifera and ostracods	CSGE008	OA11	15.15-15.17m	2.03	-3.12	-3.14	mixed taxa	6080±50	n/a	5210-5090 (13.1%); 5480-4840 (81.6%)
GU-25251	Calareous foraminifera	CSGE008	OA11	13.02-13.04m	2.03	-10.99	-11.01	mixed taxa	5650±35	-6.6	4550-4360
GU-25250	Agglutinating foraminifera	CSGE008	OA11	3.01-3.03m	2.03	-0.98	-1.00	*Trochammina inflata*	failed		
SUERC-36733 (GU-25254)	Calcareous foraminifera and ostracods	CSGE008	OA12	12.66-12.68m	1.81	-10.85	-10.87	mixed taxa	8085±55	n/a	7300-7320 (3.5%); 7190-6820 (91.9%)
SUERC-37455 (GU-25255)	Calcareous foraminifera	CSGE008	OA12	9.60-9.62m	1.81	-7.79	-7.81	mixed taxa	7410±35	n/a	6390-6220
GU-25256	Calcareous foraminifera	CSGE008	OA12	5.72-5.74m	1.81	-3.91	-3.93	mixed taxa	failed		
SUERC-35575 (GU-24577)	Organic sediment	CSGE008	OA15	13.35-13.37m	1.76	-11.59	-11.61	Humic fraction (130g sample)	8985+/-35	-26.8	8290-8180 (79.8%), 8120-8060 (4.8%), 8050-7980 (10.8%)
GU-24580	Organic sediment	CSGE008	OA15	13.35-13.37m	1.76	-11.59	-11.61	Humin fraction (130g sample)	failed		
SUERC-36732 (GU-25253)	Calcareous foraminifera and ostracods	CSGE008	OA17c	15.83-15.85m	1.88	-13.95	-13.97	mixed taxa	5685±50	n/a	4690-4440 (91.2); 4420-4370 (4.2%)
SUERC-35569 (GU-24573)	Organic sediment (peat)	CSGE008	OA20	10.53-10.55m	2.87	-7.66	-7.68	Humic fraction (131g sample)	8575+/-35	-26.7	7650-7530
SUERC-35997 (GU-24574)	Organic sediment (peat)	CSGE008	OA20	10.53-10.55m	2.87	-7.66	-7.68	Humin fraction (131g sample)	8490+/-30	-26.7	7585-7515
SUERC-35568 (GU-24572)	Charred stems/leaves	CSGE008	OA20	10.15-10.17m	2.87	-7.28	-7.30	Charcoal	6505+/-35	-24.8	5540-5370
SUERC-35567 (GU-24571)	Charred stems/leaves	CSGE008	OA20	7.73-7.75m	2.87	-4.86	-4.88	Charcoal	5755+/-35	-25.2	4710-4500
SUERC-35566 (GU-24570)	Charred tw igs/stems	CSGE008	OA20	7.43-7.45m	2.87	-4.56	-4.58	Charcoal	4675+/-35	-25.1	3530-3590 (6.1%) 3530-3360 (89.3%)
SUERC-36737 (GU-25258)	Calcareous foraminifera and ostracods	CSGE008	OA20	7.17-7.19m	2.87	-4.30	-4.32	mixed taxa	4490±50	n/a	3950-3650
GU-25258	Calcareous foraminifera	CSGE008	OA20	3.58-3.60m	2.87	-0.71	-0.73	mixed taxa	failed		
SUERC-35574 (GU-24577)	Organic sediment	CSGE008	OA21	13.54-13.56m	2.63	-10.91	-10.93	Humic fraction (73g sample)	8230+/-35	-27.4	7450-7410 (1.3%), 7360-7120 (90.8%), 7110-7080 (3.2%)
SUERC-35998 (GU-24577)	Organic sediment	CSGE008	OA21	13.54-13.56m	2.63	-10.91	-10.93	Humin fraction (73g sample)	8225 ± 30	-27.3	7350-7130 (92.8%) 7110-7080 (2.6%)

Table 2. Radiocarbon dates for the current phase of work

LONDON GATEWAY (CSGE008)
BOREHOLE 6 (OA06)

4095±35 BP at 6.75-6.77m
5605±30 BP at 7.22-7.25m
6685±50 BP at 7.86-7.88m
7010±35 BP at 11.43-11.45m
6640±35 BP at 11.37-11.39m

ORGANIC REMAINS

CORE	16		20					22			24			27			28				30		
Depth (below ground level)	4.57-4.59m	4.94-4.96m	6.26-6.28m	6.46-6.48m	6.58-6.60m	6.64-6.66m	6.66-7.38m	7.38-7.40m	7.64-7.66m	7.86-7.88m	8.37-8.39m	8.62-8.64m	8.85-8.87m	9.38-9.40m	9.60-9.62m	9.88-9.90m	10.42-10.44m	10.62-10.64m	10.89-10.91m	10.91-11.52m	11.52-11.54m	11.67-11.69m	11.80-11.82m
Depth (O.D.)	-2.57/2.59m	-2.94/2.96m	-4.26/4.28m	-4.46/4.48m	-4.58/4.60m	-4.64/4.66m	-4.66/5.38m	-5.38/5.40m	-5.64/5.66m	-5.86/5.88m	-6.37/6.39m	-6.62/6.64m	-6.85/6.87m	-7.38/7.40m	-7.60/7.62m	-7.88/7.90m	-8.42/8.44m	-8.62/8.64m	-8.89/8.91m	-8.91/9.52m	-9.52/9.54m	-9.67/9.69m	-9.80/9.82m
plant debris + seeds	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x
diatoms (>75µ)	x	x	x	x	x						x	x	x	x		x			x				
brackish foraminifera	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x				
brackish ostracods	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	x				
molluscs		x	x		x	x						x	x					x	x				
insect remains		x	x			x		x	x	x	x		x	x									
outer estuarine/marine foraminifera				x	x								x	x									
freshwater ostracods						x							x										
fish/amphibian remains						x																	
outer estuarine/marine ostracods													x										

Ecology	Creeks and tidal flats; some fringing saltmarsh	Limited marine influence	Tidal flats	Mid-high saltmarsh	Creeks and tidal flats; some fringing saltmarsh	Limited marine influence	Creeks and tidal flats	Freshwater, fluviatile

Gravel below at 12.00m

onset of tidal access

BRACKISH FORAMINIFERA

CORE	16		20					22			24			27			28				30		
Depth (below ground level)	4.57-4.59m	4.94-4.96m	6.26-6.28m	6.46-6.48m	6.58-6.60m	6.64-6.66m	6.66-7.38m	7.38-7.40m	7.64-7.66m	7.86-7.88m	8.37-8.39m	8.62-8.64m	8.85-8.87m	9.38-9.40m	9.60-9.62m	9.88-9.90m	10.42-10.44m	10.62-10.64m	10.89-10.91m	10.91-11.52m	11.52-11.54m	11.67-11.69m	11.80-11.82m
Depth (O.D.)	-2.57/2.59m	-2.94/2.96m	-4.26/4.28m	-4.46/4.48m	-4.58/4.60m	-4.64/4.66m	-4.66/5.38m	-5.38/5.40m	-5.64/5.66m	-5.86/5.88m	-6.37/6.39m	-6.62/6.64m	-6.85/6.87m	-7.38/7.40m	-7.60/7.62m	-7.88/7.90m	-8.42/8.44m	-8.62/8.64m	-8.89/8.91m	-8.91/9.52m	-9.52/9.54m	-9.67/9.69m	-9.80/9.82m
Trochammina inflata	x	xx	o	x	x			xxx	xxx	x	x		o										
Jadammina macrescens	x	x		o	x			xxx	xx	x	x		x	o									
Tiphotrocha comprimata	x	x																					
Arenoparrella mexicana								x															
Haynesina germanica	x	x	x	xx	xx	xx		x	x	xxx	xx	x	xx	xx	xx	xxx	xx	x					
Quinqueloculina sp. (brown)	x	x																					
Ammonia sp. (brackish)	o	x	x	xx	xx	xx		x	x	xxx	xx	xx	xx	xx	xx	xx	xx	xx	xx				
Elphidium williamsoni		o	x	x	x	x				xx	x	xx	xx	x	xx	xx	x	x					
Elphidium waddense			x	x				o		xx	x	x	xx	xx	xx	xxx							

OUTER ESTUARINE/MARINE FORAMINIFERA

CORE	16		20					22			24			27			28				30		
Depth (below ground level)	4.57-4.59m	4.94-4.96m	6.26-6.28m	6.46-6.48m	6.58-6.60m	6.64-6.66m	6.66-7.38m	7.38-7.40m	7.64-7.66m	7.86-7.88m	8.37-8.39m	8.62-8.64m	8.85-8.87m	9.38-9.40m	9.60-9.62m	9.88-9.90m	10.42-10.44m	10.62-10.64m	10.89-10.91m	10.91-11.52m	11.52-11.54m	11.67-11.69m	11.80-11.82m
Depth (O.D.)	-2.57/2.59m	-2.94/2.96m	-4.26/4.28m	-4.46/4.48m	-4.58/4.60m	-4.64/4.66m	-4.66/5.38m	-5.38/5.40m	-5.64/5.66m	-5.86/5.88m	-6.37/6.39m	-6.62/6.64m	-6.85/6.87m	-7.38/7.40m	-7.60/7.62m	-7.88/7.90m	-8.42/8.44m	-8.62/8.64m	-8.89/8.91m	-8.91/9.52m	-9.52/9.54m	-9.67/9.69m	-9.80/9.82m
lagenids				x	x								x	x									
Nonion depressulus					x								x										
bolivinids													o										

BRACKISH OSTRACODS

CORE	16		20					22			24			27			28				30		
Depth (below ground level)	4.57-4.59m	4.94-4.96m	6.26-6.28m	6.46-6.48m	6.58-6.60m	6.64-6.66m	6.66-7.38m	7.38-7.40m	7.64-7.66m	7.86-7.88m	8.37-8.39m	8.62-8.64m	8.85-8.87m	9.38-9.40m	9.60-9.62m	9.88-9.90m	10.42-10.44m	10.62-10.64m	10.89-10.91m	10.91-11.52m	11.52-11.54m	11.67-11.69m	11.80-11.82m
Depth (O.D.)	-2.57/2.59m	-2.94/2.96m	-4.26/4.28m	-4.46/4.48m	-4.58/4.60m	-4.64/4.66m	-4.66/5.38m	-5.38/5.40m	-5.64/5.66m	-5.86/5.88m	-6.37/6.39m	-6.62/6.64m	-6.85/6.87m	-7.38/7.40m	-7.60/7.62m	-7.88/7.90m	-8.42/8.44m	-8.62/8.64m	-8.89/8.91m	-8.91/9.52m	-9.52/9.54m	-9.67/9.69m	-9.80/9.82m
Leptocythere porcellanea	xx	xx	xx	x	xxx							xx		x	x	x		x	x				
Loxoconcha elliptica	o	x	o	x	x								o	x	x	x		x	x				
Leptocythere castanea			xx	xx	xx	x				x			xx	xx	xx	xx							
Leptocythere lacertosa			xx	xx	xx	x					x	x	xxx	xx	xxx	xxx							
Cyprideis torosa (smooth)			x	x	o	xx				x	x	xx	xx	xx	xx	xx	x	x	x				
Cytherura gibba			o																				
Leptocythere psammophila													o										

OUTER ESTUARINE/MARINE OSTRACODS

CORE	16		20					22			24			27			28				30		
Depth (below ground level)	4.57-4.59m	4.94-4.96m	6.26-6.28m	6.46-6.48m	6.58-6.60m	6.64-6.66m	6.66-7.38m	7.38-7.40m	7.64-7.66m	7.86-7.88m	8.37-8.39m	8.62-8.64m	8.85-8.87m	9.38-9.40m	9.60-9.62m	9.88-9.90m	10.42-10.44m	10.62-10.64m	10.89-10.91m	10.91-11.52m	11.52-11.54m	11.67-11.69m	11.80-11.82m
Depth (O.D.)	-2.57/2.59m	-2.94/2.96m	-4.26/4.28m	-4.46/4.48m	-4.58/4.60m	-4.64/4.66m	-4.66/5.38m	-5.38/5.40m	-5.64/5.66m	-5.86/5.88m	-6.37/6.39m	-6.62/6.64m	-6.85/6.87m	-7.38/7.40m	-7.60/7.62m	-7.88/7.90m	-8.42/8.44m	-8.62/8.64m	-8.89/8.91m	-8.91/9.52m	-9.52/9.54m	-9.67/9.69m	-9.80/9.82m
Hirschmannia viridis													x										
Paradoxostoma spp.													x										

FRESHWATER OSTRACODS

CORE	16		20					22			24			27			28				30		
Depth (below ground level)	4.57-4.59m	4.94-4.96m	6.26-6.28m	6.46-6.48m	6.58-6.60m	6.64-6.66m	6.66-7.38m	7.38-7.40m	7.64-7.66m	7.86-7.88m	8.37-8.39m	8.62-8.64m	8.85-8.87m	9.38-9.40m	9.60-9.62m	9.88-9.90m	10.42-10.44m	10.62-10.64m	10.89-10.91m	10.91-11.52m	11.52-11.54m	11.67-11.69m	11.80-11.82m
Depth (O.D.)	-2.57/2.59m	-2.94/2.96m	-4.26/4.28m	-4.46/4.48m	-4.58/4.60m	-4.64/4.66m	-4.66/5.38m	-5.38/5.40m	-5.64/5.66m	-5.86/5.88m	-6.37/6.39m	-6.62/6.64m	-6.85/6.87m	-7.38/7.40m	-7.60/7.62m	-7.88/7.90m	-8.42/8.44m	-8.62/8.64m	-8.89/8.91m	-8.91/9.52m	-9.52/9.54m	-9.67/9.69m	-9.80/9.82m
Candona sp. (juvs.)						x																	
Limnocythere inopinata													o										

Organic remains are recorded on a presence (x)/absence basis only
Foraminifera and ostracods are recorded: o - one specimen; x - several specimens; xx - common; xxx – abundant/superabundant

agglutinating foraminifera of mid-high saltmarsh
calcareous foraminifera of low-mid saltmarsh and tidal flats
essentially marine foraminifera and ostracod species, but able to penetrate outer estuaries
brackish ostracods of tidal flats and creeks
freshwater ostracods of coastal pools
peat

AMS date from foraminifera/ostracods

Table 4. LONDON GATEWAY (CSGE008)
BOREHOLE 11 (OA11)

5630±35 BP at 13.02-13.04m ▼ *6080±50 BP at 15.15-15.17m* ▼

ORGANIC REMAINS

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m
plant debris + seeds	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
diatoms (>75µ)	x	x	x	x	x			x																	x	x	x	x		x	
brackish foraminifera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
insect remains		x	x	x	x	x	x	x		x		x	x	x		x		x		x		x		x	x	x		x	x	x	
brackish ostracods			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
freshwater ostracods			x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	
outer estuarine/marine foraminifera			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
outer estuarine/marine ostracods				x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
molluscs				x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	
charophyte oogonia				x			x					x					x						x	x			x			x	
						very silty (large residue <150µ)																									sandy gravel

Ecology	*Mid-high saltmarsh*	*Onset of regressive phase*	*Very diverse assemblages indicative of open estuarine mudflats, protected creeks and saltmarsh, with strong marine and freshwater components. Reworking, evidenced by the freshwater (much of it probably Devensian) and "exotic" marine elements (?strong tidal influence)*	*Marine and freshwater influence becoming much diminished*	*Mudflats and saltmarsh with some open estuarine influence from the onset*	*Freshwater*

▲ onset of tidal access

BRACKISH FORAMINIFERA

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36	
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m	
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m	
Trochammina inflata	xx	xxx	x	xx	xx	x	xx	xx	xx	xxx	xx	xxx	xx	xx	xx	xx	xx	xxx	xxx	xx	xx	xx	xx	xxx	x			x	x	x	agglutinating foraminifera of mid-high saltmarsh
Jadammina macrescens	xx	xx	xx	x	xx	x	x	x	x	x		x	x	x	x		x	x		x		x	x	x	x			x		x	
Arenoparrella mexicana	x	x											x	x	x	x			x	x	x		x	x							
Haynesina germanica			xxx	xxx	x	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx	xx	xx	xx	xx	xx	xx	calcareous foraminifera of low-mid saltmarsh and tidal flats
Ammonia sp. (brackish)			xx	xxx	x	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx	xx	x	xx	xx	xx	xx	
Elphidium williamsoni			x	x		xx	xx	xx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xxx	xxx	x	x	xx	x	xx	xx	
Elphidium waddense						x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	xx	x		xx	x	x	x	

OUTER ESTUARINE/MARINE FORAMINIFERA

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36	
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m	
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m	
Nonion depressulus			x	xx		xx	xx	x	x	x	x	x	xx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
lagenids			x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x			x	x			essentially marine species, but can penetrate outer estuaries
miliolids				xx		xx	xx	xx	x	xx	xx	xx	xx	xx	xx	xx	x	xx	xx	xx	xx	x	x	xx	x	x	x	x	x	x	
Elphidium margaritaceum				x		x	x	x	x	x	x	x		x	x	x	x	x		x		x		x					x		
Patellina corrugata				x		x									o	o								o	o		x				
Ammonia batavus						x	x	x	xx	x	xx	xx	xx	x	xx	x	x	xx	xx	xx	xx	x	xx	xx			x	x	x	x	
discorbids						x				x		x		x								x									
Elphidium excavatum						x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	
Planorbulina mediterranensis								x			x				x	o															

BRACKISH OSTRACODS

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36	
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m	
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m	
Cyprideis torosa (smooth)			x	x		x	xx	x	x	xx	xx	xxx	xx	xx	xx	xxx	xx	xxx	xxx	xxx	xxx	x	xx	xxx	x	x	xx	x	xx	x		brackish ostracods of tidal flats and creeks
Leptocythere lacertosa				xx		xx	xx	xx	xx	xx	xx	xx	xx	x	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx		
Leptocythere porcellanea				x		xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xxx	xx	x	xx	xx	x	x	xx	xx	xx	x		
Loxoconcha elliptica				x		x	xx	xx	xx	xx	xx	xxx	xx	xx	xx	xxx	xxx	xx	xx	xx	xx	x	xxx	xx	x		x	x	xx	xx		
Leptocythere castanea				x		x	xx	xx	x	xx	xx	xxx	xx	x	xx	xxx	xx	xxx	xx	xx	xxx	xx	xx	xx	x	x	xx	x	x	x		
Leptocythere psammophila				x		x	x	xx	x	x	x	xx	x	x	x	xx	x	x	x	x	xx	x	x	xx	x	x	x	x	x	x		
Cytherura gibba				x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						o		
Cytheromorpha fuscata							x	x	o	x	x	x	x	x	x	x	x	x	x	x	x	x		x					x	x		
Xestoleberis nitida							x	x	x	x	x	x	x	x	x	xx	x	x	x	x	x	x	x	x			x		x	x		

OUTER ESTUARINE/MARINE OSTRACODS

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36	
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m	
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m	
Hirschmannia viridis			x	x		xx	xx	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	essentially marine species, but can penetrate outer estuaries
Semicytherura spp.			x	x		xx	xx	x	x	x	xx	xx	x	x	x	x	x	x	x	x	x	xx	x	x			x	x	x	x	
Paradoxostoma spp.				x		xx	xx	x	x	x	xx	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x		
Pontocythere elongata				x		x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	o			x	x	x	
Hemicythere villosa				x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	
Heterocythereis albomaculata						x				x	x	x	x	x	x	x	x		x	x				x			x			o	
Palmoconcha laevata						x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	o		x		o	x	
Loxoconcha rhomboidea						x				x	x	x	x		x		x	x	x	x		x	x	x			x				
Leptocythere tenera						x		x		x	x		x	x				x				x		x			x		x	x	
Leptocythere pellucida								x	x		x		x		x	x	x	x	x	x			x								
Palmoconcha guttata									x		x	x	x			x	x	x	x		x			x			x			x	

"EXOTIC" MARINE OSTRACODS

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36	
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m	
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m	
Finmarchinella finmarchica						x					x		x	x					o					o							cold "northern" marine species
Hemicytherura clathrata															o									o							
Elofsonella concinna																					o										
Robertsonites tuberculatus																		o													
Aurila convexa								x	o	x			x		x	x	x	o	x			x	x						o	x	warm "southern" marine species
Carinocythereis whitei								o	o		o	o	o																		
Neonesidea globosa								o							o							o									shelf-living species, brought in by tidal surges
Anchistrocheles acerosa											o		o																		
Callistocythere curryi																		o										o			extinct warm species (MIS 13 - MIS 7; ?MIS 5e)

FRESHWATER OSTRACODS

CORE	9		12			14		16		18		20		22		24		26		28		30		32		34			36	
Depth (below ground level)	2.62-2.64m	3.01-3.03m	3.51-3.53m	3.89-3.91m	4.12-4.14m	4.79-4.81m	5.05-5.07m	5.65-5.67m	6.01-6.03m	6.61-6.63m	7.02-7.04m	7.65-7.67m	8.01-8.03m	8.57-8.59m	9.01-9.03m	9.62-9.64m	9.99-10.01m	10.51-10.53m	10.94-10.96m	11.62-11.64m	11.94-11.96m	12.60-12.62m	12.78-12.80m	13.02-13.04m	13.69-13.71m	13.98-14.00m	14.60-14.62m	14.90-14.92m	15.04-15.06m	15.15-15.17m	16.12-16.14m	
Depth (O.D.)	-0.59/0.61m	-0.98/1.00m	-1.48/1.50m	-1.86/1.88m	-2.09/2.11m	-2.76/2.78m	-3.02/3.24m	-3.62/3.64m	-3.98/4.00m	-4.58/4.60m	-4.99/5.01m	-5.62/5.64m	-5.98/6.00m	-6.54/6.56m	-6.98/7.00m	-7.59/7.61m	-7.96/7.98m	-8.48/8.50m	-8.91/893m	-9.59/9.61m	-9.91/9.93m	10.57/10.59m	10.75/10.77m	10.99/11.01m	11.66/11.68m	11.95/11.97m	12.57/12.59m	12.87/12.89m	13.01/13.03m	13.12/13.14m	14.09/14.11m	
Limnocytherina sanctipatricii			x			o			o				o		o		o		x				o								extant cold/cool indicators
Candona candida									x			o				x	x	x				o	x	x							
Cytherissa lacustris								x	x	x	o	x	o		o		x	x	x					x							
Fabaeformiscandona balatonica																		x		x											
Limnocythere inopinata				xx		xx	xx	xx	x	x	x	x			x			x	o	x					x					x	freshwater ostracods of estuaries and coastal pools
Darwinula stevensoni				x		x	x	x	x	x	o	x	x		x	x	x	x			x			x				x	o	o	
Candona angulata				x		x	x	x	x							x															
Heterocypris salina				x		x	x	xx	x	x		o	o	o				o	o	x	o										
Cyclocypris laevis (LV>RV)				x							o	x			o			x	x	x			o	o				x			
Candona neglecta						x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	xx					x	o	
Herpetocypris sp.						o	x											o					o								
Pseudocandona sp.							x	x	x		x	o	x		x	x	x	x	x		x	o		x							
Ilyocypris spp.								x	x			o	x		x		x	x	x	x	x			x							
Leucocythere batesi								o	o						o				o			o									extinct cold-indicator species (MIS11 – MIS3)
Limnocythere falcata									o																						
Ilyocypris salebrosa																								o							extinct, Thames-Medway MIS9 marker

Organic remains are recorded on a presence (x)/absence basis.
Foraminifera and ostracods are recorded: o – one specimen; x – present (several specimens); xx – common; xxx – abundant/superabundant

AMS date from foraminifera/ostracods

Table 5 LONDON GATEWAY (CSGE008)
BOREHOLE 12 (OA12)

7410±35 BP 9.60-9.62m ▼ *85±55 BP at 12.66-12.68*

ORGANIC REMAINS

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
plant debris + seeds	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
brackish foraminifera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
brackish ostracods					x					x	x	x	x	x	x	
diatoms (>75µ)					x	x	x	x	x	x	x	x	x	x		
insect remains					x		x		x	x	x				x	
outer estuarine/marine foraminifera												x	x	x	x	
outer estuarine/marine ostracods												x	x	x	x	
freshwater ostracods												x	x	x	x	
molluscs												x	x	x	x	
charophyte oogonia															x	
rhizoliths (plant tubes)																x

very silty (large residue <150µ)

Ecology	*Mid-high saltmarsh*	*Mudflats*	*Mudflats with fringing saltmarsh*	*Open estuarine mudflats, creeks and saltmarsh with marine and freshwater influences*	*Freshwater*

gravel at c.13.90m

▲ onset of tidal access

BRACKISH FORAMINIFE

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
Jadammina macrescens	x	xxx	xxx	x			x	x	x		x	x	o			
Trochammina inflata		xx	xx	xx			x	x	x	x	xx	x	o	x	x	
Arenoparrella mexicana			x	xx			x				o				o	
Ammonia sp. (brackish)					xx	xx		xx	xx	xx	x	xx	xx	xxx	xxx	
Haynesina germanica					x	xx		x		x	x	xx	xx	xxx	xxx	
Elphidium williamsoni						x				x		x	x	xx	xxx	
Elphidium waddense										x		x	x	xx	x	

agglutinating foraminifera of mid-high saltmarsh

calcareous foraminifera of low-mid saltmarsh and tidal flats

OUTER ESTUARINE/MARINE FORAMINIFERA

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
Nonion depressulus												x	x	x	x	
miliolids												x	x	x	x	
lagenids												x	x	x	x	
Ammonia batavus													x	xx	xx	
Cibicides lobatulus															x	
discorbids															x	

essentially marine species, but can penetrate outer estuaries

BRACKISH OSTRACODS

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
Cyprideis torosa (smooth)					x					x		x	x	x	xx	
Leptocythere porcellanea										xx	x	xx	xx	x	xxx	
Leptocythere lacertosa										x	x	xx	xx	xx	xx	
Loxoconcha elliptica										o		x	x	x	xx	
Leptocythere psammophila										o	o		x	x	xx	
Xestoleberis nitida												o	x	x	xx	
Leptocythere castanea														x	xx	
Cytheromorpha fuscata														x	x	
Cytherura gibba														x	x	

brackish ostracods of tidal flats and creeks

OUTER ESTUARINE/MARINE OSTRACODS

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
Hirschmannia viridis												x	x	x	xx	
Hemicythere villosa												x	x	x	x	
Paradoxostoma spp.												x	x	x	xx	
Semicytherura spp.												x	x	x	xx	
Leptocythere tenera												x	x		x	
Leptocythere pellucida													x		x	
Pontocythere elongata													x	x	x	
Palmoconcha laevata													x	x	x	
Heterocythereis albomaculata														x	x	
Loxoconcha rhomboidea															x	
Palmoconcha guttata															x	

essentially marine species, but can penetrate outer estuaries

"EXOTIC" MARINE OSTRACODS

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
Aurila convexa															x	
Hemicytherura clathrata															o	

warm "southern" marine species

cold "northern" marine species

FRESHWATER OSTRACO

CORE	8	10		12	14		16	18		20	22		23	26	28	
Depth (below ground level)	2.57-2.59m	3.43-3.45m	3.79-3.81m	4.60-4.62m	5.33-5.35m	5.72-5.74m	6.46-6.48m	7.20-7.22m	7.74-7.76m	8.59-8.61m	9.34-9.36m	9.60-9.62m	10.60-10.62m	11.56-11.58m	12.66-12.68m	12.89-12.91m
Depth (O.D.)	-0.77/0.79m	-1.63/1.65m	-1.99/2.01m	-2.80/2.82m	-3.53/3.55m	-3.92/3.94m	-4.66/4.68m	-5.40/5.42m	-5.95/5.96m	-6.79/6.81m	-7.54/7.56m	-7.80/7.82m	-8.80/8.82m	-9.76/9.78m	10.86/10.88m	11.09/11.11m
Cytherissa lacustris													o		x	
Heterocypris salina												o			x	
Pseudocandona sp.													o	o	x	
Ilyocypris spp.															x	
Candona neglecta															x	
Darwinula stevensoni															x	
Limnocythere inopinata															x	
Potamocypris zschokkei															x	
Herpetocypris sp.															o	

extant cold/cool indicators

freshwater ostracods of estuaries and coastal pools

Organic remains are recorded on a presence (x)/absence basis.
Foraminifera and ostracods are recorded: o – one specimen; x – present (several specimens); xx – common; xxx – abundant/superabundant *AMS dates from foraminifera/ostracods*

Table 6. LONDON GATEWAY (CSGE008)

BOREHOLE 15 (OA 15) [with missing interval replicated by BH 14 (OA14)]

985±35BP at 13.35/13.37n

ORGANIC REMAINS

CORE	7	9	11	13	15		17	19	21			24				26		28	30	32	32		33			34
Depth (below ground level)	2.02-2.04m	2.67-2.69m	3.55-3.57m	4.60-4.62m	5.36-5.38m	5.73-5.75m	6.64-6.66m	7.76-7.78m	8.31-8.33m	8.31-8.77m	8.75-8.77m	9.35-9.37m	9.47-9.49m	9.69-9.71m	9.93-9.95m	0.53-10.55m	0.92-10.94m	11.94-11.96	12.86-12.88m	13.75-13.77m	13.33-13.35m	13.93-13.95m	13.51-13.53m	13.73-13.75m	13.95-13.97m	4.50-14.52m
Depth (O.D.)	-0.26/0.28m	-0.91/0.93m	-1.79/1.81m	-2.84/2.86m	-3.60/3.62m	-3.97/3.99m	-4.88/4.90m	-6.00/6.02m	-6.55/6.57m	-6.55/7.01m	-6.99/7.01m	-7.59/7.61m	-7.71/7.73m	-7.93/7.95m	-8.17/8.19m	-8.77/8.79m	-8.72/8.74m	-9.74/9.76m	11.66/10.68m	11.55/11.57m	11.57/11.59m	11.73/11.75m	11.75/11.77m	11.97/11.99m	12.19/12.21m	12.30/12.32m
plant debris + seeds	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x		x	x	x	
brackish foraminifera	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x						
diatoms (>75µ)		x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x							
brackish ostracods			x	x	x	x	x	x	x			x		x	x	x	x	x	x	x						
insect remains			x		x		x		x		x	x		x			x	x	x							
molluscs				x	x	x	x	x	x		x	x		x	x	x	x	x								
outer estuarine/marine foraminifera				x	x	x	x	x	x			x		x	x	x	x	x	x							
outer estuarine/marine ostracods					x	x	x	x	x			x		x	x	x		x	x							
freshwater ostracods					x	x	x	x	x			x							x							
crab claw								x																		
fish/amphibian remains																			x							
charophyte oogonia																			x							
iron (limonite/pyrite)																					x		x	x		x
rhizoliths																							x	x	x	x
amphibian bone																							x			
					very silty (large residue <150µ)					peat with Pholas		peat						very silty (large residue <150µ)								

Ecology	Mid saltmarsh and mudflats	Mudflats and fringing saltmarsh with both open estuarine/marine and freshwater influences; regressive latterly	Stillstand	Mudflats and fringing saltmarsh with open estuarine/marine influence quickly developing. Beginnings of regression latterly	Initially a creek	Freshwater, fluviatile. Liable to drying out/weathering	sandy gravel at c.14.50m

onset of tidal access

BRACKISH FORAMINIFERA

CORE	7	9	11	13	15		17	19	21			24				26		28	30	32	32		33			34
Depth (below ground level)	2.02-2.04m	2.67-2.69m	3.55-3.57m	4.60-4.62m	5.36-5.38m	5.73-5.75m	6.64-6.66m	7.76-7.78m	8.31-8.33m	8.31-8.77m	8.75-8.77m	9.35-9.37m	9.47-9.49m	9.69-9.71m	9.93-9.95m	0.53-10.55m	0.92-10.94m	11.94-11.96	12.86-12.88m	13.75-13.77m	13.33-13.35m	13.93-13.95m	13.51-13.53m	13.73-13.75m	13.95-13.97m	4.50-14.52m
Depth (O.D.)	-0.26/0.28m	-0.91/0.93m	-1.79/1.81m	-2.84/2.86m	-3.60/3.62m	-3.97/3.99m	-4.88/4.90m	-6.00/6.02m	-6.55/6.57m	-6.55/7.01m	-6.99/7.01m	-7.59/7.61m	-7.71/7.73m	-7.93/7.95m	-8.17/8.19m	-8.77/8.79m	-8.72/8.74m	-9.74/9.76m	11.66/10.68m	11.55/11.57m	11.57/11.59m	11.73/11.75m	11.75/11.77m	11.97/11.99m	12.19/12.21m	12.30/12.32m
Jadammina macrescens	x	x	x	xx	x	x	x		x					x	x		x	x	x							
Trochammina inflata		xx	x	x	x	o	x	x	x			x		x	x	o	xx	x	x							
Arenoparrella mexicana				o		o											x									
Ammonia sp. (brackish)		xx	x	x	xx	xxx	xxx	xxx	xx		x	xx		xx	xx	xx	xx	xxx	xxx	xx						
Haynesina germanica		x	x	xx	xxx	xxx	xxx	xxx	xx		x	xx		xx	xxx	xxx	xxx	xxx	xxx	x						
Elphidium williamsoni				x	xx	xx	xx	xx	x		x	xx		x	xx	xx	xx	xx	xx							
Elphidium waddense						x	x	x						x	xx	x	x	x	xx							

OUTER ESTUARINE/MARINE FORAMINIFERA

CORE	7	9	11	13	15		17	19	21			24				26		28	30	32	32		33			34
Depth (below ground level)	2.02-2.04m	2.67-2.69m	3.55-3.57m	4.60-4.62m	5.36-5.38m	5.73-5.75m	6.64-6.66m	7.76-7.78m	8.31-8.33m	8.31-8.77m	8.75-8.77m	9.35-9.37m	9.47-9.49m	9.69-9.71m	9.93-9.95m	0.53-10.55m	0.92-10.94m	11.94-11.96	12.86-12.88m	13.75-13.77m	13.33-13.35m	13.93-13.95m	13.51-13.53m	13.73-13.75m	13.95-13.97m	4.50-14.52m
Depth (O.D.)	-0.26/0.28m	-0.91/0.93m	-1.79/1.81m	-2.84/2.86m	-3.60/3.62m	-3.97/3.99m	-4.88/4.90m	-6.00/6.02m	-6.55/6.57m	-6.55/7.01m	-6.99/7.01m	-7.59/7.61m	-7.71/7.73m	-7.93/7.95m	-8.17/8.19m	-8.77/8.79m	-8.72/8.74m	-9.74/9.76m	11.66/10.68m	11.55/11.57m	11.57/11.59m	11.73/11.75m	11.75/11.77m	11.97/11.99m	12.19/12.21m	12.30/12.32m
miliolids				x	xx	x	x	xx	x			x		x	x	x	x	xx	x							
lagenids				x	xx	x	x	x	x			x		x	x	x	x	x	x							
Nonion depressulus				x	xx	xx	x	x	xx			x		xx	x	x		x	x							
discorbids					x		x		x																	
Cyclogyra involvens					x		x							x	x	x										
Elphidium margaritaceum							x	x				x				o										
Patellina corrugata																			o							

BRACKISH OSTRACODS

CORE	7	9	11	13	15		17	19	21			24				26		28	30	32	32		33			34
Depth (below ground level)	2.02-2.04m	2.67-2.69m	3.55-3.57m	4.60-4.62m	5.36-5.38m	5.73-5.75m	6.64-6.66m	7.76-7.78m	8.31-8.33m	8.31-8.77m	8.75-8.77m	9.35-9.37m	9.47-9.49m	9.69-9.71m	9.93-9.95m	0.53-10.55m	0.92-10.94m	11.94-11.96	12.86-12.88m	13.75-13.77m	13.33-13.35m	13.93-13.95m	13.51-13.53m	13.73-13.75m	13.95-13.97m	4.50-14.52m
Depth (O.D.)	-0.26/0.28m	-0.91/0.93m	-1.79/1.81m	-2.84/2.86m	-3.60/3.62m	-3.97/3.99m	-4.88/4.90m	-6.00/6.02m	-6.55/6.57m	-6.55/7.01m	-6.99/7.01m	-7.59/7.61m	-7.71/7.73m	-7.93/7.95m	-8.17/8.19m	-8.77/8.79m	-8.72/8.74m	-9.74/9.76m	11.66/10.68m	11.55/11.57m	11.57/11.59m	11.73/11.75m	11.75/11.77m	11.97/11.99m	12.19/12.21m	12.30/12.32m
Leptocythere lacertosa			x	x	xx	xx	xx	xx	xx			xx		xx	xx	xx	xx	xx	xx							
Leptocythere porcellanea				x	x	x	xx	xx	x			xx		x	x	xx	xx	xx	xx	x						
Leptocythere castanea				x	x	x	xx	xx	x			x		x	x	x	xx	x	x							
Cyprideis torosa (smooth)					x	x	x	x	xx			x		x	x	x	x	x	x	xxx						
Loxoconcha elliptica					x	x	x	x	x			x		x	x	x	x	x	xx	x						
Xestoleberis nitida					x		x	x	x						x				x							
Leptocythere psammophila					x	xx	x	xx	x			x				x	x		x							
Cytherura gibba								x				o						o	x							

OUTER ESTUARINE/MARINE OSTRACODS

CORE	7	9	11	13	15		17	19	21			24				26		28	30	32	32		33			34
Depth (below ground level)	2.02-2.04m	2.67-2.69m	3.55-3.57m	4.60-4.62m	5.36-5.38m	5.73-5.75m	6.64-6.66m	7.76-7.78m	8.31-8.33m	8.31-8.77m	8.75-8.77m	9.35-9.37m	9.47-9.49m	9.69-9.71m	9.93-9.95m	0.53-10.55m	0.92-10.94m	11.94-11.96	12.86-12.88m	13.75-13.77m	13.33-13.35m	13.93-13.95m	13.51-13.53m	13.73-13.75m	13.95-13.97m	4.50-14.52m
Depth (O.D.)	-0.26/0.28m	-0.91/0.93m	-1.79/1.81m	-2.84/2.86m	-3.60/3.62m	-3.97/3.99m	-4.88/4.90m	-6.00/6.02m	-6.55/6.57m	-6.55/7.01m	-6.99/7.01m	-7.59/7.61m	-7.71/7.73m	-7.93/7.95m	-8.17/8.19m	-8.77/8.79m	-8.72/8.74m	-9.74/9.76m	11.66/10.68m	11.55/11.57m	11.57/11.59m	11.73/11.75m	11.75/11.77m	11.97/11.99m	12.19/12.21m	12.30/12.32m
Paradoxostoma spp.					x	x	x	x	x					x	x	x		x	x							
Hirschmannia viridis					x	x	x	x	x			x		x	x	x		x	x							
Semicytherura spp.					x	x	x	x	x			x			x	x			x							
Pontocythere elongata						x	x	x	x									x	x							
Hemicythere villosa						x	x	x							o	o										
Loxoconcha rhomboidea						o	o	o	x									x								
Palmoconcha laevata							x	x	x																	
Leptocythere tenera								x																		

FRESHWATER OSTRACODS

CORE	7	9	11	13	15		17	19	21			24				26		28	30	32	32		33			34
Depth (below ground level)	2.02-2.04m	2.67-2.69m	3.55-3.57m	4.60-4.62m	5.36-5.38m	5.73-5.75m	6.64-6.66m	7.76-7.78m	8.31-8.33m	8.31-8.77m	8.75-8.77m	9.35-9.37m	9.47-9.49m	9.69-9.71m	9.93-9.95m	0.53-10.55m	0.92-10.94m	11.94-11.96	12.86-12.88m	13.75-13.77m	13.33-13.35m	13.93-13.95m	13.51-13.53m	13.73-13.75m	13.95-13.97m	4.50-14.52m
Depth (O.D.)	-0.26/0.28m	-0.91/0.93m	-1.79/1.81m	-2.84/2.86m	-3.60/3.62m	-3.97/3.99m	-4.88/4.90m	-6.00/6.02m	-6.55/6.57m	-6.55/7.01m	-6.99/7.01m	-7.59/7.61m	-7.71/7.73m	-7.93/7.95m	-8.17/8.19m	-8.77/8.79m	-8.72/8.74m	-9.74/9.76m	11.66/10.68m	11.55/11.57m	11.57/11.59m	11.73/11.75m	11.75/11.77m	11.97/11.99m	12.19/12.21m	12.30/12.32m
Limnocythere inopinata					x	xx	xx	x				o														
Heterocypris salina					x	x		x											x							
Herpetocypris sp.					o																					
Candona angulata					o	x	o	x	o																	
Candona neglecta						x		x																		
Sarscypridopsis aculeata						x													o							
Darwinula stevensoni							x	x																		
Cyclocypris sp.								o																		

Organic remains are recorded on a presence (x)/absence basis.
Foraminifera and ostracods are recorded: o – one specimen; x – several specimens; xx – common; xxx – abundant/superabundant

agglutinating foraminifera of mid-high saltmarsh
calcareous foraminifera of low-mid saltmarsh and tidal flats
brackish ostracods of tidal flats and creeks

essentially marine foraminifera and ostracods, but can penetrate outer estuaries
freshwater ostracods of estuaries and coastal pools

peat

Table 7. LONDON GATEWAY (CSGE008)
BOREHOLE 17c (OA17), complete borehole

85±50BP at 15.83-15.85

ORGANIC REMAINS

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
plant debris	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
insect remains	x	x					x	x		x	x		x	x	
molluscs	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
diatoms (>75µ)	x	x			x										
brackish foraminifera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
brackish ostracods	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
outer estuarine/marine foraminifera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
outer estuarine/marine ostracods	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
freshwater ostracods	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
charophyte oogonia							x	x				x		x	
							very silty (large residue <150µ)								

Ecology	Very diverse assemblages indicative of open estuarine mudflats, protected creeks and saltmarsh; both marine and freshwater components quickly developing, with some reworking evidenced by the freshwater (much of it probably Devensian) and "exotic" marine elements (?strong tidal influence)	Mudflats

Gravel at 16.00m

BRACKISH FORAMINIFERA

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
Trochammina inflata	xx	xx	x	xx	x	x	xx	xx	xx	xx	xx	xx	xx	xx	x
Jadammina macrescens	xx	x	x	x						x			x	x	o
Arenoparrella mexicana	x	x								x				x	
Haynesina germanica	xxx	xxx	xx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xx
Ammonia sp. (brackish)	xxx	xxx	xx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xx
Elphidium williamsoni	xx	xx	xx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	x
Elphidium waddense		x	x	x	x	x	xx	x	x	x	xx	xx	x	x	x

agglutinating foraminifera of mid-high saltmarsh

calcareous foraminifera of low-mid saltmarsh and tidal flats

OUTER ESTUARINE/MARINE FORAMINIFERA

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
miliolids	xx	xx	x	xx	xx	xxx	xx	xxx	xx	xx	x	xx	x	x	x
Nonion depressulus	xx	xx	xx	xx	xx			x	x	x	x	x	x	x	
lagenids	x	x	x	x	x	x	x	x	x	xx	x			x	x
Ammonia batavus	x	x	xx	x	xx	x	x	xx	xx	xx	x	xx	x	x	x
Elphidium margaritaceum	x	x	x	x	x	xx	x	x	x		x	x		x	
discorbids	x			x	x		x	x							
Cibicides lobatulus	x	x	x			x	x	x		x	x	x	x	x	
Elphidium excavatum		x	x	x		x	x	x	x	x	x	x	x	x	
Planorbulina mediterranensis			x	x	x			x							
Patellina corrugata			x	x	x		o	x							

essentially marine foraminiferal species, but able to penetrate outer estuaries

BRACKISH OSTRACODS

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
Leptocythere porcellanea	xx	xx	xx	xx	xx	xx	xx	xx	xx	xxx	x	xx	xx	xx	x
Leptocythere lacertosa	xx	x	xx	xx	xx	x	xx	x	x	xxx	xx	xx	xx	xx	x
Leptocythere psammophila	xx	xx	x	xx	xx	xx	x	xx	x	xx	x	x	x	x	
Leptocythere castanea	x	x	x	xx	x	x	xx	xx	xx	xxx	x	xx	xx	xx	x
Loxoconcha elliptica	x	x	x	xx	x	x	xx	xx	xx	xx	xx	xx	x	xx	x
Cyprideis torosa (smooth)	x	x	x	x	x	x	xx	xx	xx	xxx	xx	xx	xx	xx	x
Cytherura gibba	o	x	x	x			x	x		x		x	o	o	
Xestoleberis nitida	o	x	x	x	x	x	x	x	x	xx	x	x	x	x	
Cytheromorpha fuscata				x	o	o	x	x		xx	o	x	x		

brackish ostracods of tidal flats and creeks

OUTER ESTUARINE/MARINE OSTRACODS

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
Paradoxostoma spp.	x	xx	x	xx	x	x	x	x	x	xx	x	x	x	x	
Hirschmannia viridis	x	x	x	x	x	x	xx	xx	x	x	x	x	x	x	x
Pontocythere elongata	x	x	x	x	x	x	xx	xx	xx	x	x	x	x	x	
Semicytherura spp.	x	xx	xx	x	x	x	x	xx	x	x	x	xx	x	x	
Hemicythere villosa	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Loxoconcha rhomboidea	x	x	x	x	x	x	x	x	x	x	x	x		x	
Leptocythere tenera	x	x	x	x	x		x	x	x	x	x	x	x	x	
Palmoconcha laevata		x	x	x	x	x	x	x		x	x	x	x	o	
Leptocythere pellucida		x		x	x	x	xx	xx	xx	x	x	xx		x	
Heterocythereis albomaculata		x	x	x	o		x	x		x	x	x	x	x	
Palmoconcha guttata				x		x	x	x							

essentially marine ostracod species, but able to penetrate outer estuaries

"EXOTIC" MARINE OSTRACODS

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
Anchistrocheles acerosa		x			o			o		o					
Neonesidea globosa			o	o			x	x		o					
Jonesia acuminata							x	x							
Aurila convexa				x	x		x	x	x	x	x	x	x	x	
Carinocythereis whitei				x			o	o							
Callistocythere curryi							o								
Elofsonella concinna				x			o		x						
Hemicytherura clathrata					o		o		o	o		x			
Finmarchinella finmarchica							x	x	o		o	x	o	o	

shelf-living species, brought in by tidal surges

warm "southern" marine species

extinct warm species (MIS 13 - MIS 7; ?MIS 5e)

cold "northern" marine species

FRESHWATER OSTRACODS

CORE	14	15	16	17			19		21	22			25		
Depth (below ground level)	5.66-5.68m	6.63-6.65m	7.54-7.56m	8.42-8.44m	8.69-8.71m	8.90-8.92m	10.43-10.45m	10.94-10.96m	12.85-12.87m	13.39-13.41m	13.63-13.65m	13.85-13.87m	15.79-15.81m	15.83-15.85m	15.88-15.90m
Depth (O.D.)	-3.78-3.80m	-4.75-4.77m	-5.66-5.68m	-6.54-6.56m	-6.81-6.83m	-7.02-7.04m	-8.55-8.57m	-9.06-9.08m	10.97-10.99m	11.51/11.53m	11.75/11.77m	11.97/11.99m	13.91/13.93m	13.95/13.97m	14.00/14.02m
Limnocythere inopinata	x	x	x	x	x		o	x			o	x	x		
Candona neglecta	x	x		x	x	x	xx	xx	x	xx	xx	xx	x	x	
Pseudocandona sp.	o		x		x			x	x	xx		x	x		
Cyclocypris laevis (LV>RV)	o									x				o	
Darwinula stevensoni		x	x		o			x				o			
Ilyocypris spp.			x	x	x		x	x		x	x				
Cypridopsis vidua				x			o	x		x					
Heterocypris salina							x	x		x	x	x			
Candona angulata							x	x		x		x			
Herpetocypris reptans							o	o							
Prionocypris zenkeri							o	o							
Sarscypridopsis aculeata										x		o			
Limnocytherina sanctipatricii		x						x			o		o		
Cytherissa lacustris		o		x	x		x	x	x	o	x	x	o	x	
Candona candida										x	x	x			
Fabaeformiscandona balatonica										x	x			x	
Leucocythere batesi									o						
Ilyocypris salebrosa										o					

extant cold/cool indicators

extinct cold-indicator species (MIS11 – MIS3)

extinct, Thames-Medway MIS9 marker

freshwater ostracods of coastal pools

Organic remains are recorded on a presence (x)/absence basis.

Table 8. LONDON GATEWAY (CSGE008)
BOREHOLE 20 (OA20)

4490±50 BP at 7.17-7.19m
4675±35BP at 7.43-7.45m
5755±35 BP at 7.73-7.75m
6505±35 BP at 10.15-10.17m
8575±35 and 8490±30BP at 10.53-10.55m

ORGANIC REMAINS

CORE	7	10			14			16			18			20				22			24		26					28				31		33		36		38		41	
Depth (below ground level)	2.01-2.03m	2.56-2.58m	2.83-2.85m	3.06-3.08m	3.58-3.60m	3.82-3.84m	4.11-4.13m	4.56-4.58m	4.81-4.83m	5.09-5.11m	5.56-5.58m	5.79-5.81m	6.06-6.08m	6.64-6.66m	6.99-7.01m	7.17-7.19m	7.19-7.82m	7.82-7.84m	7.96-7.98m	8.13-8.15m	8.71-8.73m	9.08-9.10m	9.45-9.47m	9.68-9.70m	9.81-9.83m	10.07-10.09m	10.09-10.60m	10.60-10.62m	10.69-10.71m	10.88-10.90m	11.05-11.07m	11.61-11.63m	11.99-12.01m	12.62-12.64m	12.99-13.01m	13.71-13.73m	14.04-14.06m	14.67-14.69m	15.11-15.13m	15.85-15.87m	16.11-16.13m
Depth (O.D.)	+0.86/0.84m	+0.31/0.29m	+0.04/0.02m	-0.19/0.21m	-0.71/0.73m	-0.95/0.97m	-1.43/1.45m	-1.69/1.71m	-1.94/1.96m	-2.22/2.24m	-2.69/2.71m	-2.62/2.64m	-3.19/3.21m	-3.77-3.79m	-4.12/4.14m	-4.30/4.32m	-4.43/4.95m	-4.95/4.97m	-5.09/5.11m	-5.26/5.28m	-5.84/5.86m	-6.21/6.23m	-6.58/6.60m	-6.81/6.83m	-6.94/6.96m	-7.20/7.22m	-7.22/7.73m	-7.73/7.75m	-7.82/7.84m	-8.01/8.03m	-8.18/8.20m	-8.74/8.76m	-9.12/9.14m	-9.75/9.77m	-10.12/10.14m	-10.84/10.86m	-11.20/11.22m	-11.80/11.82m	-12.24/12.26m	-12.98/13.00m	-13.24/13.26m
plant debris + seeds	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x							
brackish foraminifera	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x															
brackish ostracods					x	x		x	x	x	x	x	x	x	x	x																										
diatoms (>75µ)					x	x	x	x	x	x	x	x	x	x		x																										
molluscs								x	x	x	x	x	x	x	x	x																										
insect remains									x				x			x							x		x	x															
rhizoliths (plant tubes)																																		x	x	x	x	x	x		

Ecology	Mid-high saltmarsh	Regressive phase begins	Mudflats and sheltered creeks	Mid-high saltmarsh	Tidal flats	Freshwater, fluviatile; liable to drying out and/or weathering

onset of tidal access

BRACKISH FORAMINIFERA

CORE	7	10			14			16			18			20				22			24		26					28				31		33		36		38		41	
Depth (below ground level)	2.01-2.03m	2.56-2.58m	2.83-2.85m	3.06-3.08m	3.58-3.60m	3.82-3.84m	4.11-4.13m	4.56-4.58m	4.81-4.83m	5.09-5.11m	5.56-5.58m	5.79-5.81m	6.06-6.08m	6.64-6.66m	6.99-7.01m	7.17-7.19m	7.19-7.82m	7.82-7.84m	7.96-7.98m	8.13-8.15m	8.71-8.73m	9.08-9.10m	9.45-9.47m	9.68-9.70m	9.81-9.83m	10.07-10.09m	10.09-10.60m	10.60-10.62m	10.69-10.71m	10.88-10.90m	11.05-11.07m	11.61-11.63m	11.99-12.01m	12.62-12.64m	12.99-13.01m	13.71-13.73m	14.04-14.06m	14.67-14.69m	15.11-15.13m	15.85-15.87m	16.11-16.13m
Depth (O.D.)	+0.86/0.84m	+0.31/0.29m	+0.04/0.02m	-0.19/0.21m	-0.71/0.73m	-0.95/0.97m	-1.43/1.45m	-1.69/1.71m	-1.94/1.96m	-2.22/2.24m	-2.69/2.71m	-2.62/2.64m	-3.19/3.21m	-3.77-3.79m	-4.12/4.14m	-4.30/4.32m	-4.43/4.95m	-4.95/4.97m	-5.09/5.11m	-5.26/5.28m	-5.84/5.86m	-6.21/6.23m	-6.58/6.60m	-6.81/6.83m	-6.94/6.96m	-7.20/7.22m	-7.22/7.73m	-7.73/7.75m	-7.82/7.84m	-8.01/8.03m	-8.18/8.20m	-8.74/8.76m	-9.12/9.14m	-9.75/9.77m	-10.12/10.14m	-10.84/10.86m	-11.20/11.22m	-11.80/11.82m	-12.24/12.26m	-12.98/13.00m	-13.24/13.26m
Trochammina inflata	x	x	x	xx	x		xx											x	xx	x	xxx	xx	x	xx	xx	x														
Jadammina macrescens	x	x	x	x	x		xxx											x	x	x	xx	x	x	x	x	x														
Arenoparrella mexicana																				x		x	x	x																	
Haynesina germanica					xx	xxx	x	xxx	xx	xxx	xxx	xx	xx	xx	xx	xx										x																
Ammonia sp.					xx	x	x	xx	x	xx	x	x	x	xx	x	x										xx																
Elphidium williamsoni					x	xx		x	x	x		xx		x	xx	x																										
Quinqueloculina sp. (small)					x																																				
Elphidium waddense						x			x	x		x	x		x																										

BRACKISH OSTRACODS

CORE	7	10			14			16			18			20				22			24		26					28				31		33		36		38		41	
Depth (below ground level)	2.01-2.03m	2.56-2.58m	2.83-2.85m	3.06-3.08m	3.58-3.60m	3.82-3.84m	4.11-4.13m	4.56-4.58m	4.81-4.83m	5.09-5.11m	5.56-5.58m	5.79-5.81m	6.06-6.08m	6.64-6.66m	6.99-7.01m	7.17-7.19m	7.19-7.82m	7.82-7.84m	7.96-7.98m	8.13-8.15m	8.71-8.73m	9.08-9.10m	9.45-9.47m	9.68-9.70m	9.81-9.83m	10.07-10.09m	10.09-10.60m	10.60-10.62m	10.69-10.71m	10.88-10.90m	11.05-11.07m	11.61-11.63m	11.99-12.01m	12.62-12.64m	12.99-13.01m	13.71-13.73m	14.04-14.06m	14.67-14.69m	15.11-15.13m	15.85-15.87m	16.11-16.13m
Depth (O.D.)	+0.86/0.84m	+0.31/0.29m	+0.04/0.02m	-0.19/0.21m	-0.71/0.73m	-0.95/0.97m	-1.43/1.45m	-1.69/1.71m	-1.94/1.96m	-2.22/2.24m	-2.69/2.71m	-2.62/2.64m	-3.19/3.21m	-3.77-3.79m	-4.12/4.14m	-4.30/4.32m	-4.43/4.95m	-4.95/4.97m	-5.09/5.11m	-5.26/5.28m	-5.84/5.86m	-6.21/6.23m	-6.58/6.60m	-6.81/6.83m	-6.94/6.96m	-7.20/7.22m	-7.22/7.73m	-7.73/7.75m	-7.82/7.84m	-8.01/8.03m	-8.18/8.20m	-8.74/8.76m	-9.12/9.14m	-9.75/9.77m	-10.12/10.14m	-10.84/10.86m	-11.20/11.22m	-11.80/11.82m	-12.24/12.26m	-12.98/13.00m	-13.24/13.26m
Cyprideis torosa (smooth)					x	xx		xx	xx	xx	xx	x	x	x	x	x																									
Leptocythere castanea						xx		xx	x	xx	xx	xx	x	x	xx	x																									
Leptocythere lacertosa						xx		xx	xx	xx	xx	xx	xx	xx	xx																										
Loxoconcha elliptica						x								x	x	x																									
Leptocythere porcellanea								x					x	x	x																										

Organic remains are recorded on a presence (x)/absence basis.
Foraminifera and ostracods are recorded: x – present (several specimens); xx – common; xxx – abundant/superabundant

agglutinating foraminifera of mid-high saltmarsh
calcareous foraminifera of low-mid saltmarsh and tidal flats
brackish ostracods of tidal flats and creeks

peat

AMS date from foraminifera/ostracods

Table 9. SHELLHAVEN (LONDON GATEWAY), 2003
BOREHOLE 7 (ARC7)

9150-8400 (cal) yrs BP at 12.40-12.42m

BRACKISH FORAMINIFERA

	0.40/0.41m	1.90/1.91m	3.40/3.41m	4.90/4.91m	6.30/6.31m	7.90/7.91m	9.40/9.41m	10.80/10.81m	12.40/12.41m	13.90/13.91m
Trochammina inflata	x		xxx	x		x			xxx	
Jadammina macrescens	x		xxx	x					x	
Haynesina germanica	x	x	x	xxx	xxx	xxx	xx	xx		
Ammonia spp. (brackish)	x	x	x	xx	xx	xx	xx	x		
Elphidium williamsoni	x			xx	x	xx	xx	x		

OUTER ESTUARINE/MARINE FORAMINIFERA

	0.40/0.41m	1.90/1.91m	3.40/3.41m	4.90/4.91m	6.30/6.31m	7.90/7.91m	9.40/9.41m	10.80/10.81m	12.40/12.41m	13.90/13.91m
Miliolinella subrotunda				x	x	x	x			
Ammonia "tepida"				x	x	x	x			
Ammonia batavus				x	x	x				
lagenids				x	x	x				
Elphidium macellum				x	x	x	x			
Cyclogyra involvens					x	x				
Quinqueloculina spp.					x	x				
Gavelinopsis praegeri						x	x			
Planorbulina mediterranensis						x				

BRACKISH OSTRACODS

	0.40/0.41m	1.90/1.91m	3.40/3.41m	4.90/4.91m	6.30/6.31m	7.90/7.91m	9.40/9.41m	10.80/10.81m	12.40/12.41m	13.90/13.91m
Leptocythere lacertosa	x	x	x	xx	xx	xx	xx	xx		
Leptocythere castanea				x	xx	x	x			
Cyprideis torosa				x	x	x	x	x		
Leptocythere porcellanea				x	x		x	x		
Cytheromorpha fuscata				x		x				
Loxoconcha elliptica				x	x	x	x			
Cytherura gibba				x	x	x				
Leptocythere psammophila				x	x	x	x	x		

OUTER ESTUARINE/MARINE OSTRACODS

	0.40/0.41m	1.90/1.91m	3.40/3.41m	4.90/4.91m	6.30/6.31m	7.90/7.91m	9.40/9.41m	10.80/10.81m	12.40/12.41m	13.90/13.91m
Pontocythere elongata				x	x	x	x			
Semicytherura nigrescens				x	x	x	x			
Hemicythere villosa				x	x	x	x			
Hirschmannia viridis				x	x	x	x			
Heterocythereis albomaculata				x	x					
Paradoxostoma spp.				x	x	x	x			
Semicytherura sella					x		x			
Leptocythere tenera					x	x				

FRESHWATER OSTRACODS

	0.40/0.41m	1.90/1.91m	3.40/3.41m	4.90/4.91m	6.30/6.31m	7.90/7.91m	9.40/9.41m	10.80/10.81m	12.40/12.41m	13.90/13.91m
freshwater spp.				x	x	x	x			

Ecology	*Brackish tidal flats with fringing saltmarsh*	*Mid-high saltmarsh*	*Brackish tidal flats and creeks, with fringing salt marsh. Open to outer estuarine and marine influences*	*Mid-high saltmarsh*	*?Freshwater, fluviatile*

onset of tidal access

Foraminifera and ostracods are recorded: x - present (a few specimens); xx – common; xxx – abundant/superabundant

agglutinating foraminifera of mid-high saltmarsh

calcareous foraminifera of low-mid saltmarsh and tidal flats

essentially marine foraminifera and ostracod species, but able to penetrate outer estuaries

brackish ostracods of tidal flats and creeks

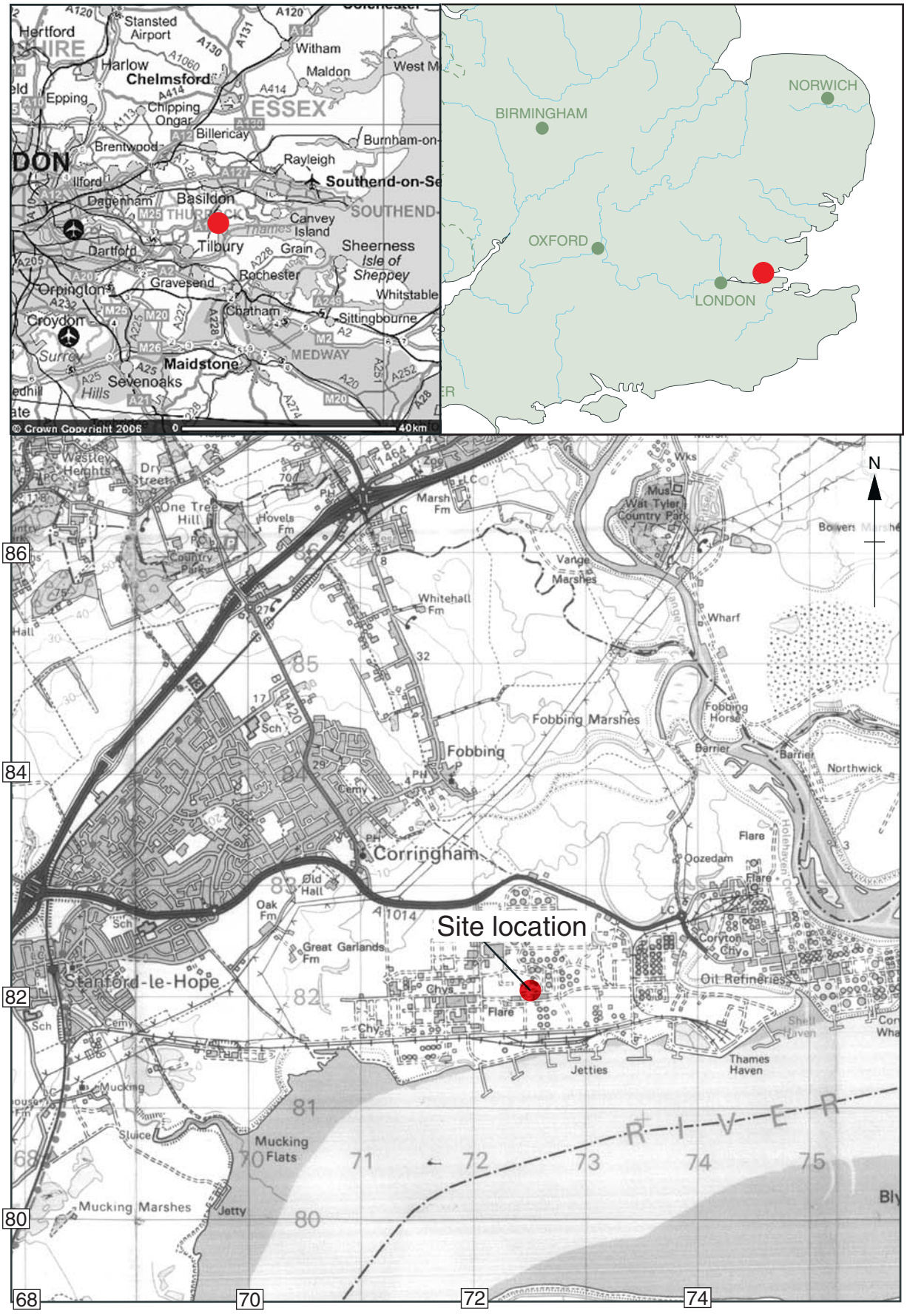
freshwater ostracods of coastal pools

Borehole No		**OA06**	**OA06**	**OA06**	**OA20**	**OA20**
Sample depth metres BGL		**6.77-6.90**	**6.90-7.00**	**11.38-11.43**	**7.45-7. 60**	**7.60-7.73**
Date		2870-2490 cal BC		5630-5510 cal BC	3630-3590 cal BC	4710-4500 cal BC
Depth of date metres BGL		6.75-6.77		11.37-11.39	7.43-7.45	7.73-7.75
Flot size ml		550	500	200	600	500
Weeds of arable, cultivated and waste ground and ruderal plants						
Chenopodium album L.	Fat-hen			2	1	1
Urtica dioica L	Common nettle	2				
Woodland/scrub plants						
Alnus glutinosa (L.) Gaertn	Alder	1				
Betula sp	Birch	1				
Buds						1
Prunus spinosa L.	Blackthorn				1	
Rubus sect 2 Glandulosus Willm and Grab. (formerly) *Rubus fruticosus* L agg)	Bramble	2				
Wet ground and Aquatic plants						
Carex cf *nigra* (L) Richards	Common sedge	2	1			
Carex cf *riparia* Curtis	Greater pond sedge		1			
Carex with utricle undifferentiated	Sedges unidentified	1				
Carex lent	Sedges with biconvex seeds			1		
Chenopodium cf *chenopodiodes* (L.) Aellen	Saltmarsh goosefoot			3		
Lycopus europaeus L.	Gipsywort					1
Oenanthe cf *aquatica* (L.) Poir	Fine-leaved water dropwort	3	1			
Potamogeton cf *pectinatus* L.	Fennel pondweed			1		
Ranunculus flammula L.	Lesser spearwort					2
Plants belonging to broad ecological categories						
Atriplex/ *Chenopodium*	Goosefoots/ oraches	1				
Ranunculus repens-type	Creeping buttercup-type					2
Matrix components are recorded on a scale of 1-5						
Amorphous plant remains		5	5	5	5	5
Monocote remains		2	4		1	
Cf *Phragmites australis (Cav.) Trin. Ex Steud* rhizomes	Common reed				2	2
Wood fragments		5	4	5	5	3
Twigs		2				

Poaceae shoot	Grass shoot	1				
Basal part of Cyperaceae or Poaceae plants	Basal part of sedges or grasses plants					1
Bryophyte fragments	Moss fragments	1				
Buds				1		1
Insect fragments		2			1	

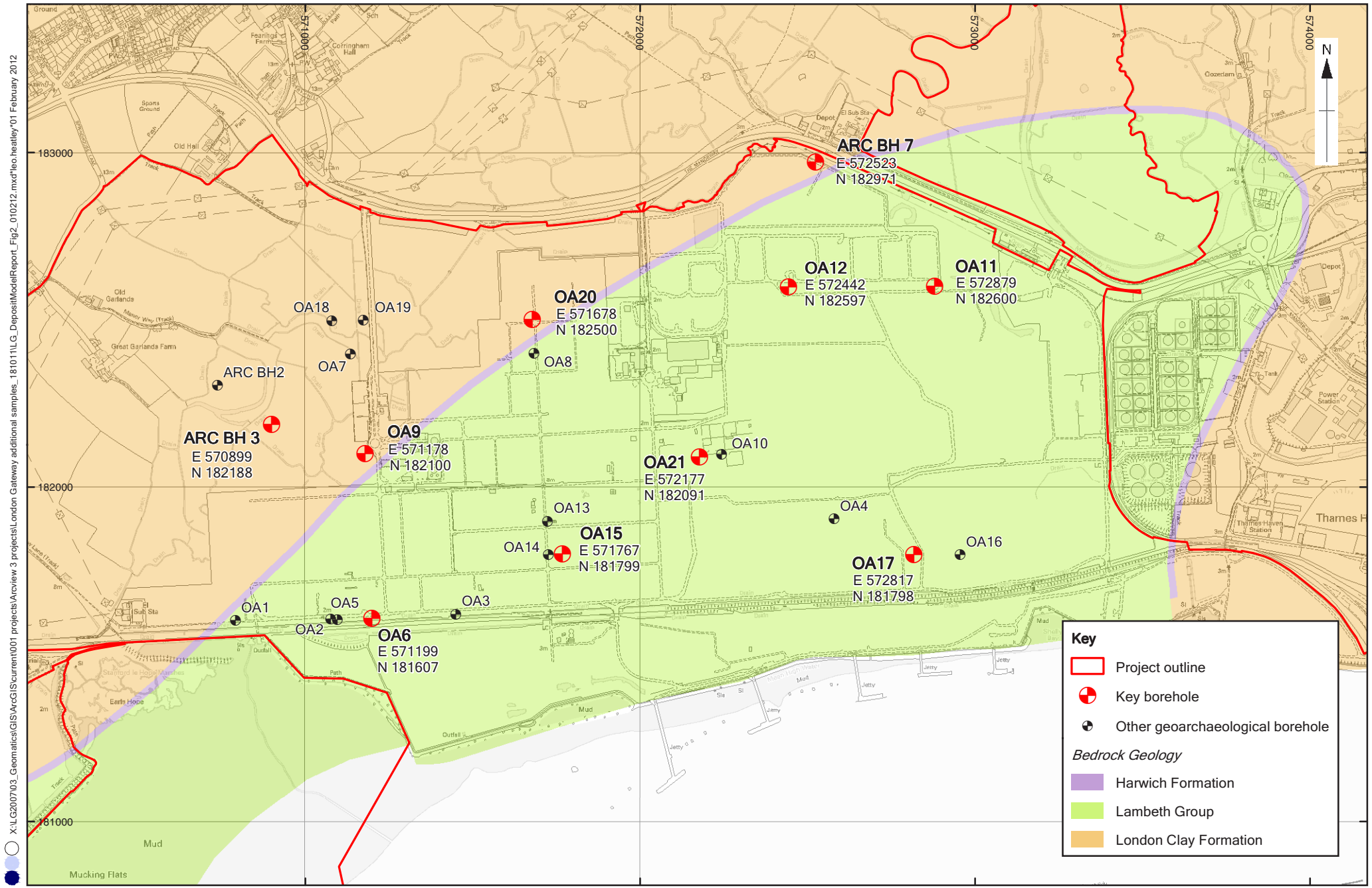
Table 10: Waterlogged plant remains from London Gateway Floodplain Boreholes, OA06 and OA20.

All seeds, buds, thorns, leaf fragments and other remains have been counted and the matrix components have been scored on a scale of 1-5,
where 1= less than 5 items and 5= more than 100 items.



Scale 1:50,000

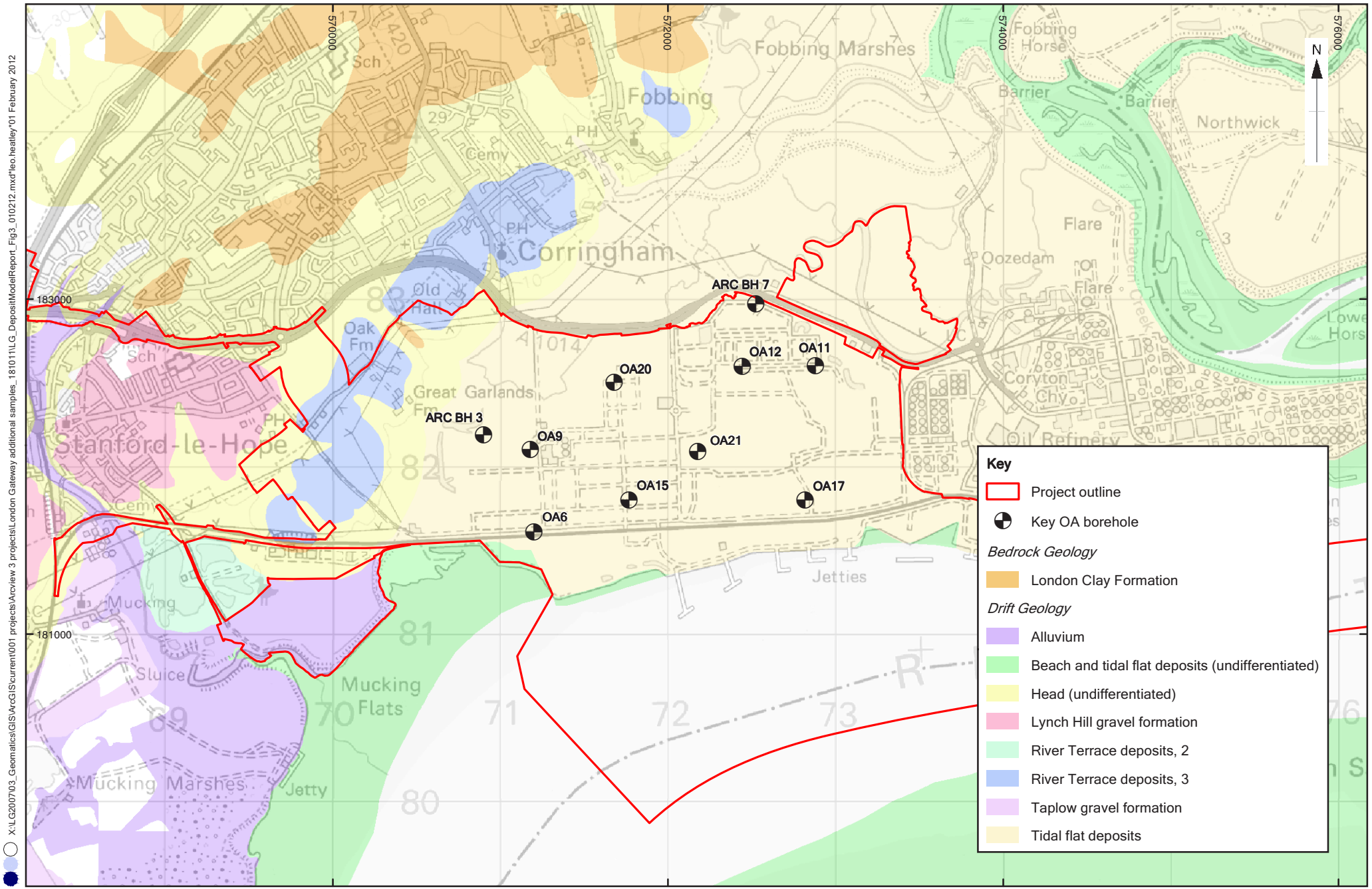
Figure 1: Site location



0 500 m

1:15,000 @ A4

Figure 2: Bedrock geology of the study area showing location of key OA boreholes.



X:\LG2007\03_Geomatics\GIS\ArcGIS\current\001 projects\Arcview 3 projects\London Gateway additional samples_181011\LG_DepositModelReport_Fig3_010212.mxd"leo.heatley"01 February 2012

QA by: MB 01.02.2011

Figure 3: Superficial geology of the study area showing location of key OA boreholes.

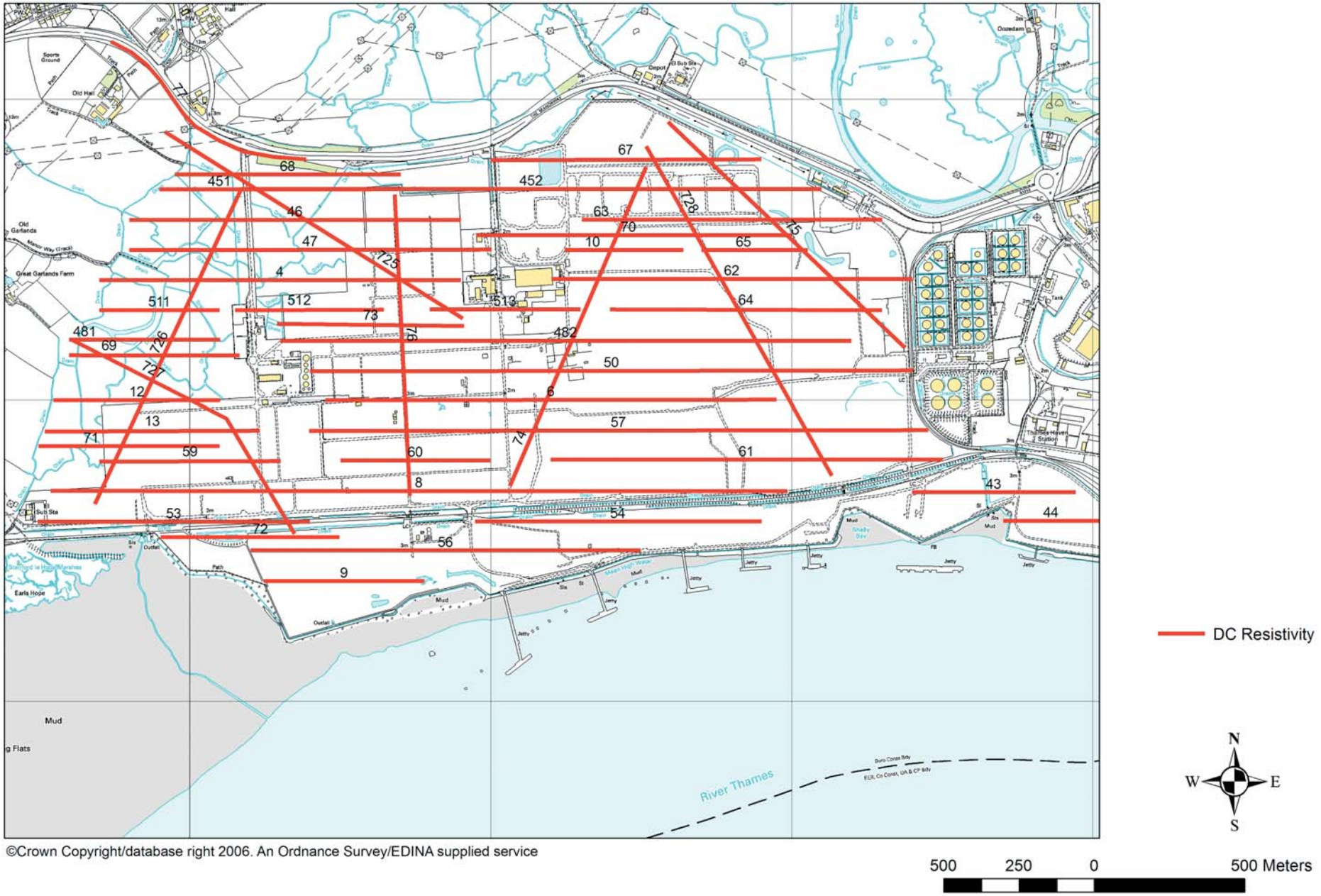


Figure 4: Distribution of geophysical survey lines across the study site.

Figure 5: Geophysical equipment in use showing distribution of cables, electrodes and measuring equipment.

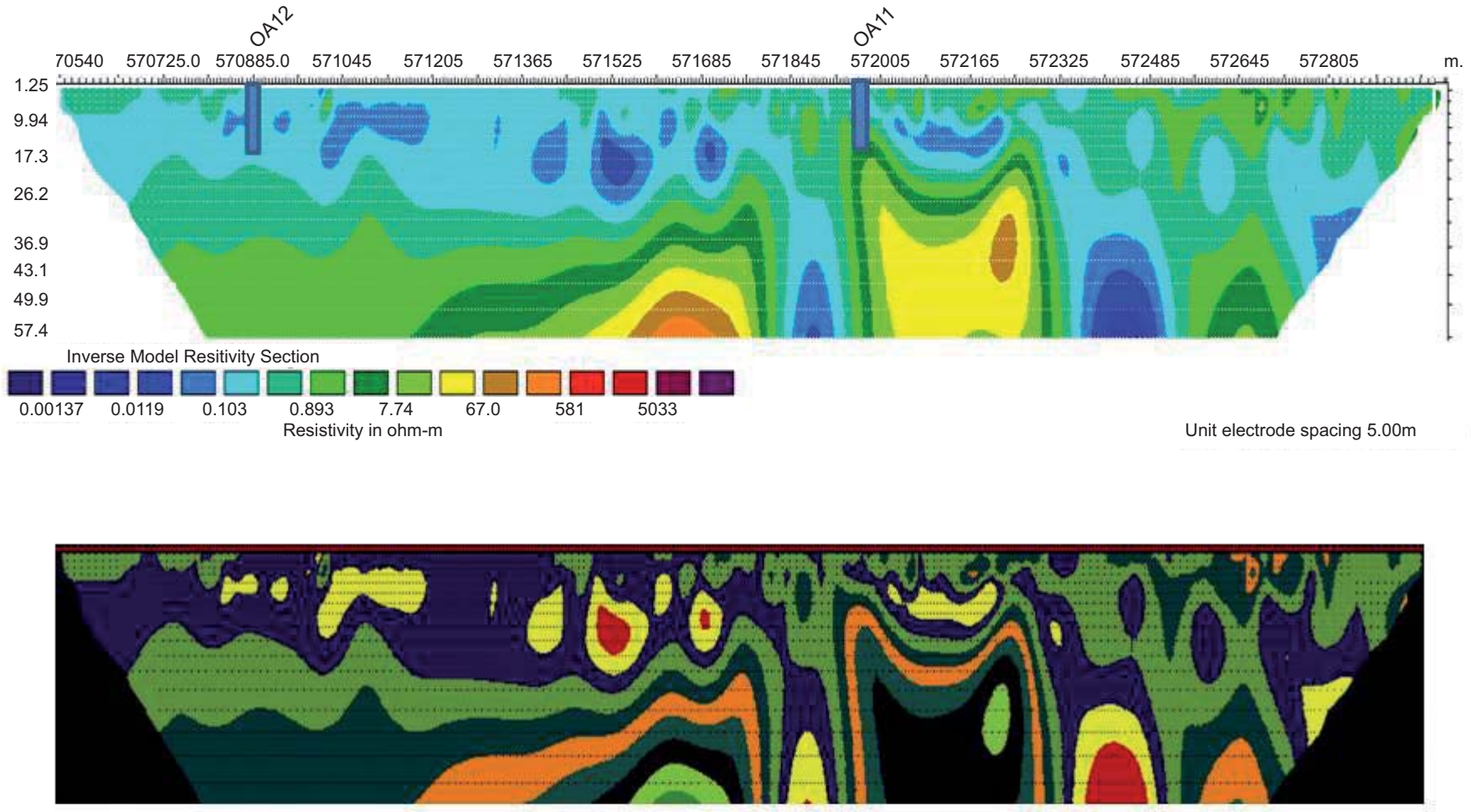


Figure 6: Resistivity profile data example. Top: apparent pseudo-section and boreholes illustrating depth to base of Holocene alluvium. Base: stratigraphy ready for processing to pick stratigraphic horizons.

Figure 7: Shell and auger drill rig in operation.

Figure 8: Piston sample extrusion.

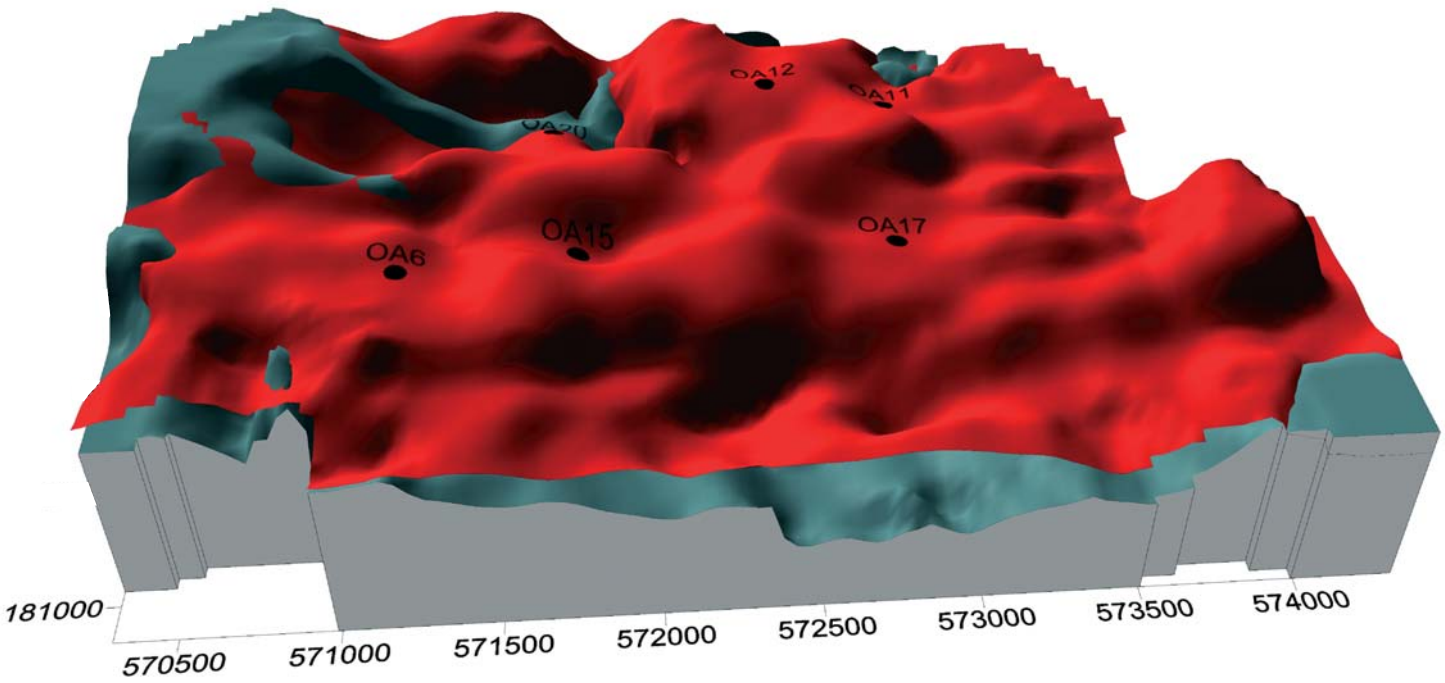


Figure 9: 3-D surface (red) for base of Holocene alluvium based on extrapolation of geophysical data overlying bedrock surface (grey). Key OA boreholes also shown.

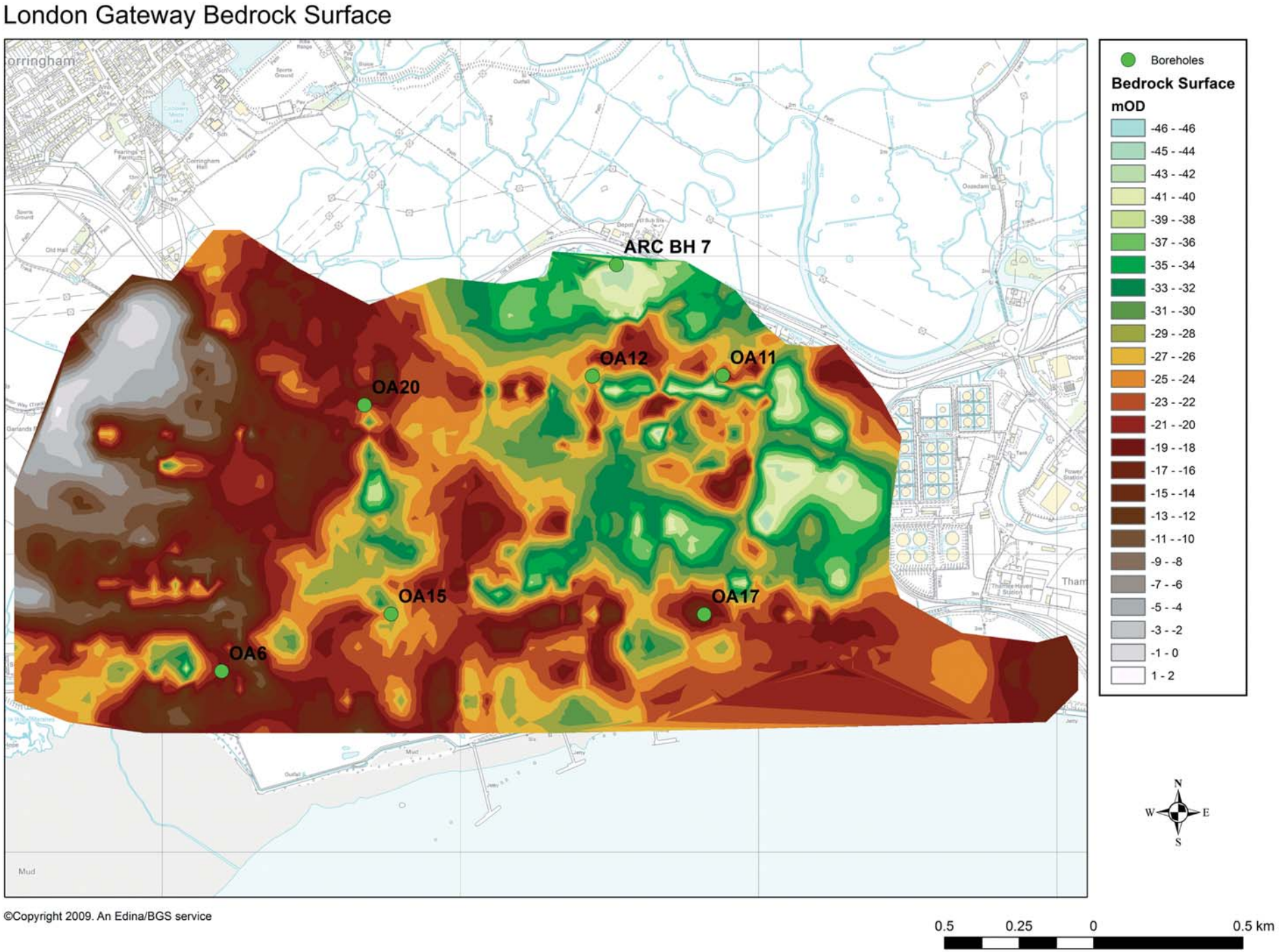


Figure 10: Bedrock topography based on integrated geophysics and borehole data.

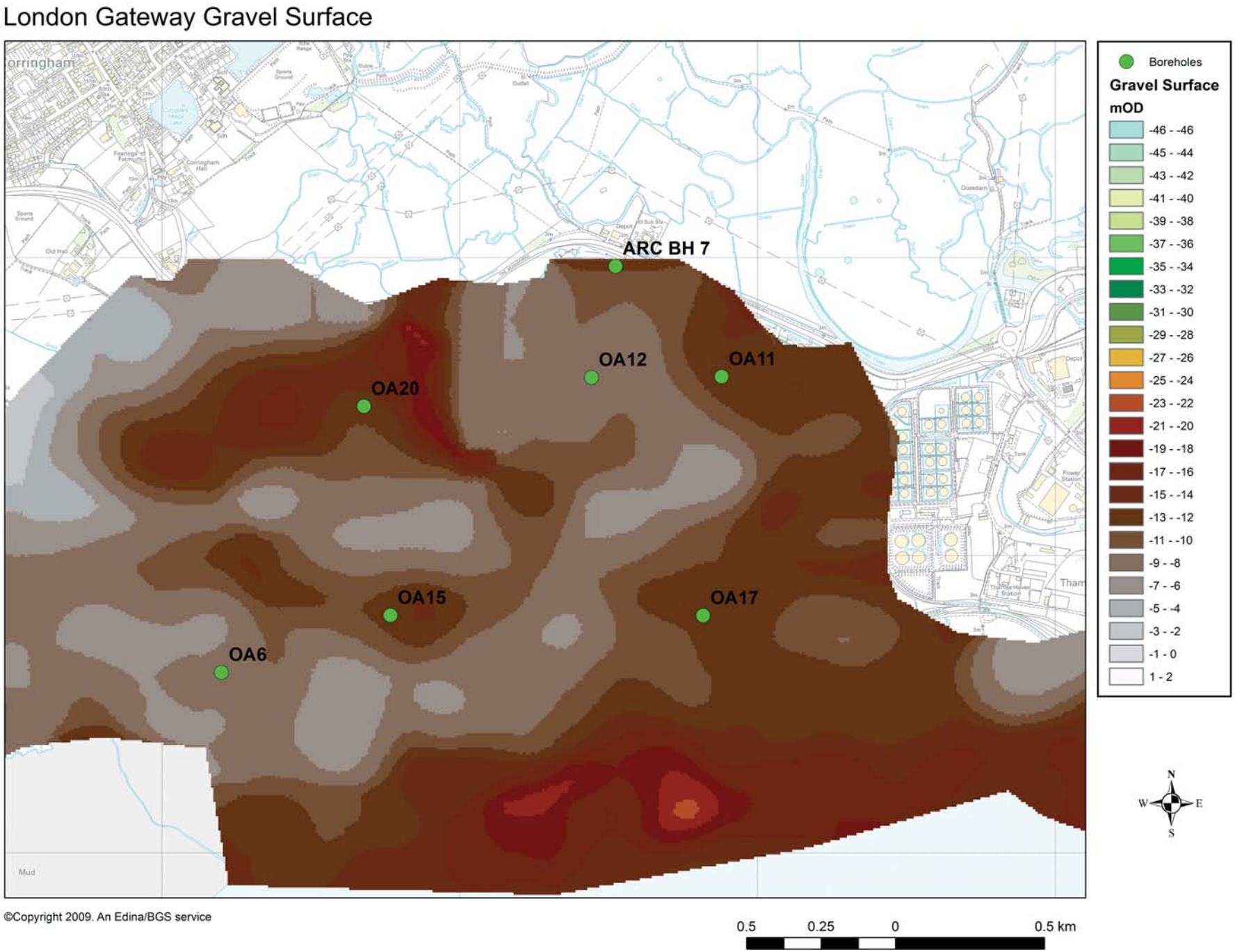


Figure 11: Gravel surface topography (base of Holocene alluvium) based on integrated geophysics and borehole data.

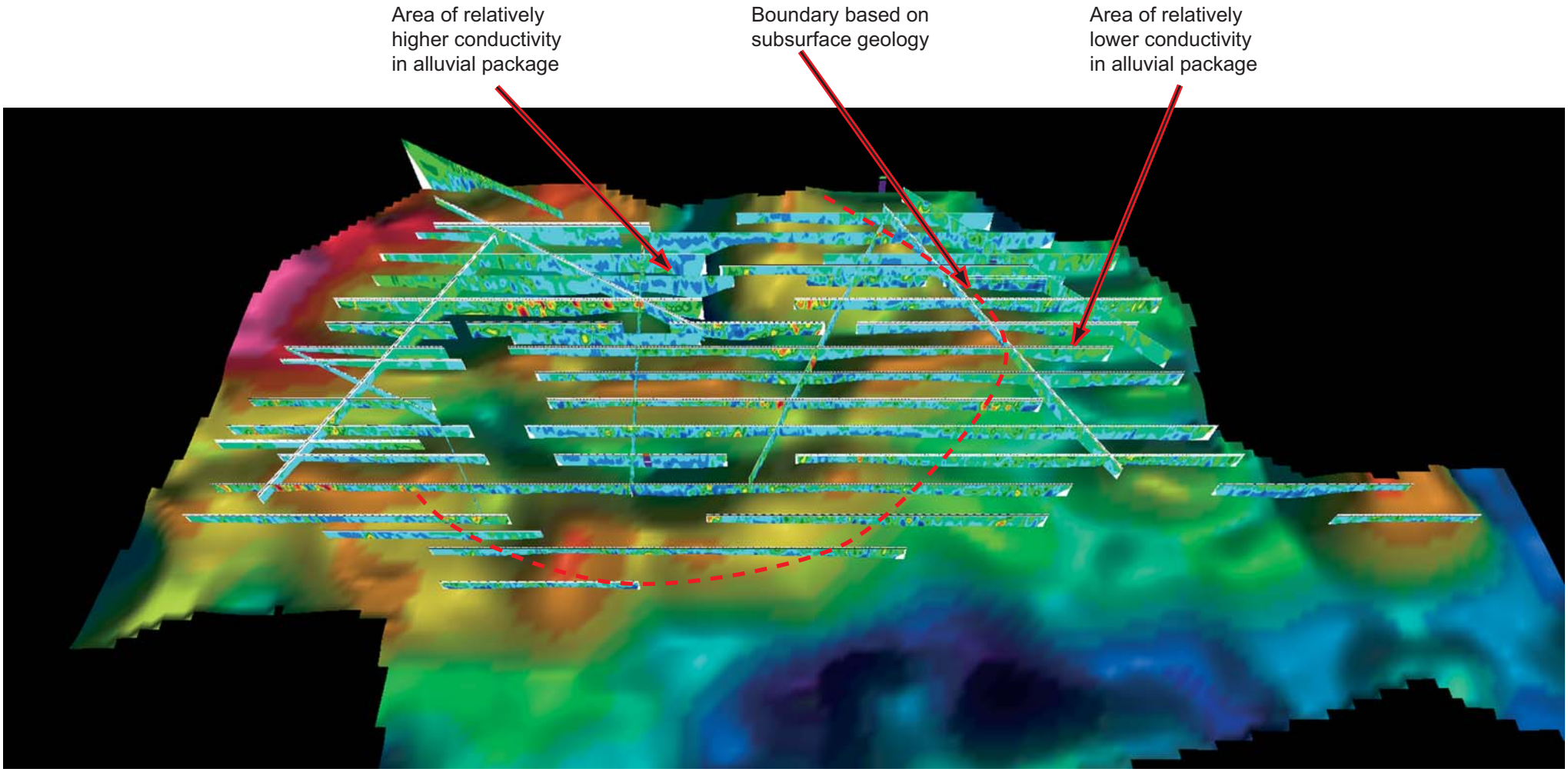


Figure 12: Modelled Holocene surface and geophysical transects. Site is divided into two zones either side of the curving arc or ridge in gravel surface topography with areas inside the arc (to north west) exhibiting higher conductivities (blue colours) and outsidethe arc (to the south and east) exhibiting lower conductivities (green colours) (see Figure 6 for coloured scale).

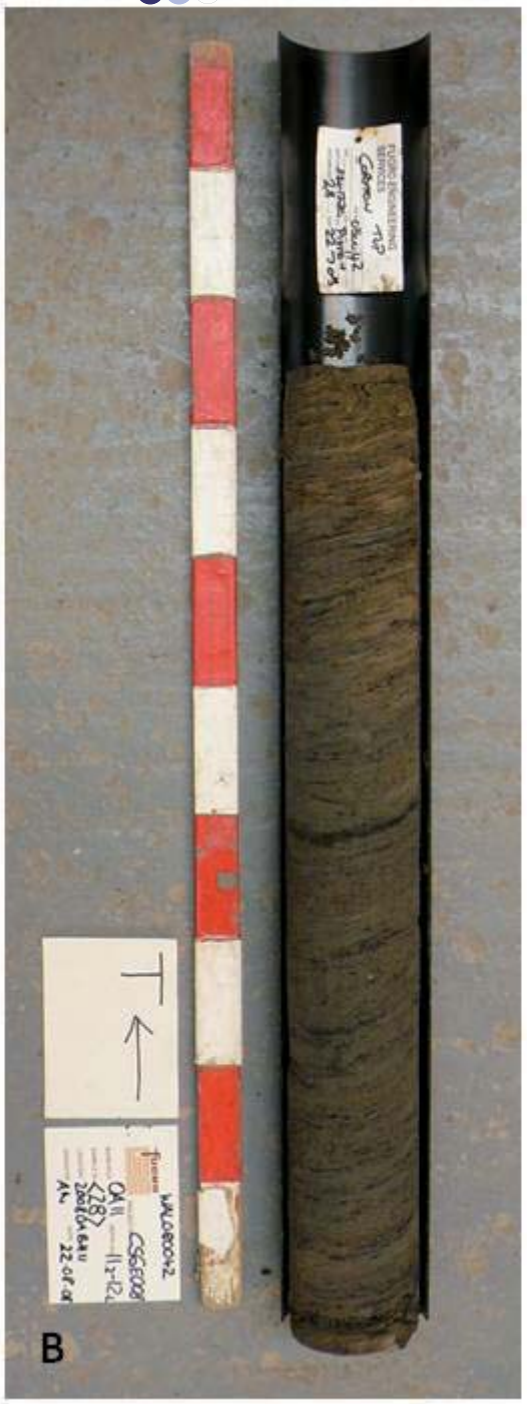


Figure 13: A: Structureless grey clay-silts.
B/C: Finely laminated clay-silts and sands.

Figure 14: Example core samples A-CA/B: Organic silts and peats. C: Sands and gravels.

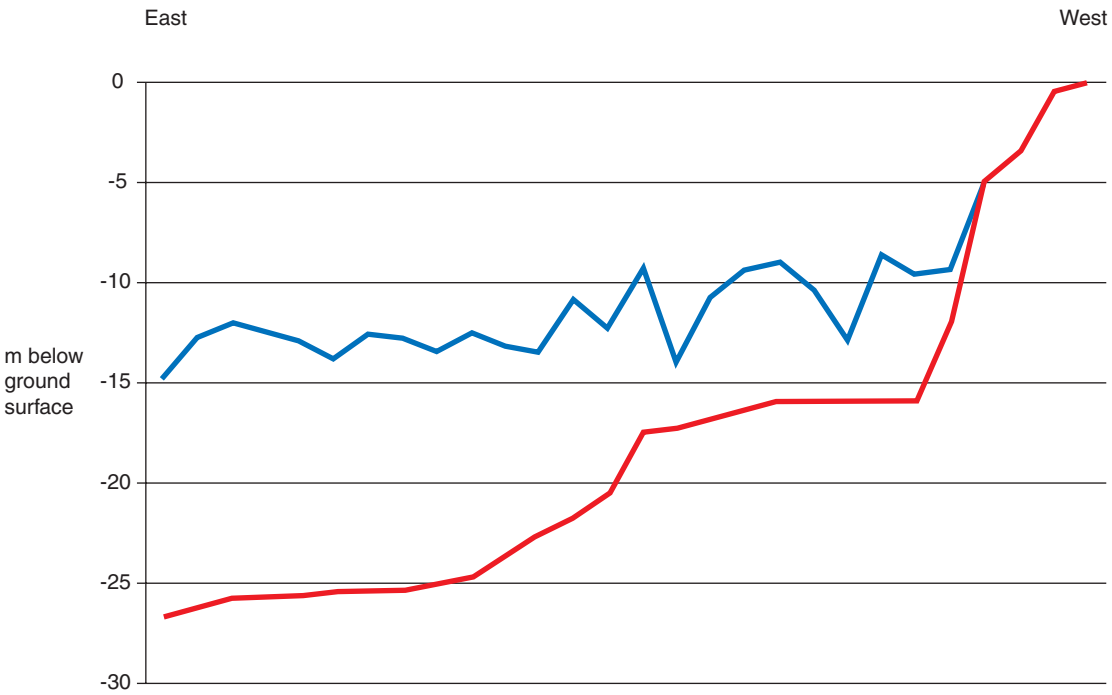
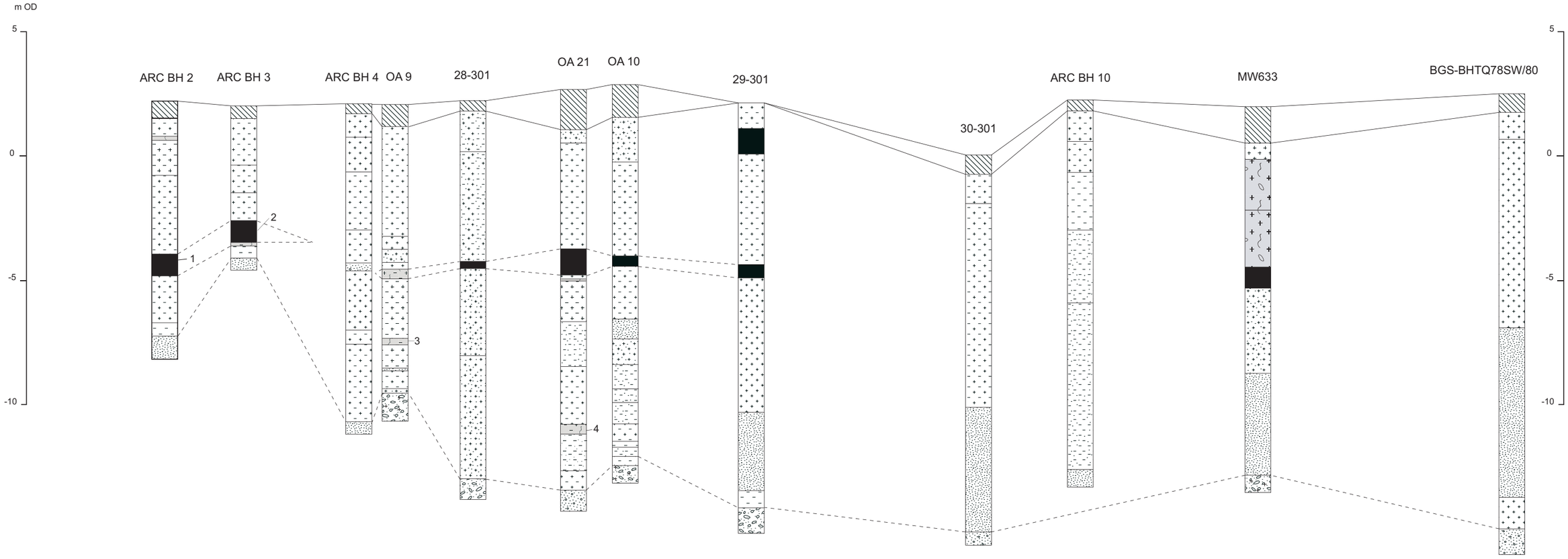


Figure 15: Gravel surface and bedrock topography profile based on data from selected boreholes along a west to east transect through site.



Key:

- Made ground
- Clay
- Silt
- Sand
- Clay and silt
- Sand and clay
- Organic silt
- Peat
- Gravel
- Clay sand and gravel
- Laminated sand and clay
- Laminated sand and silt
- Laminated clay and silt
- Gravelly organic clay

^{14}C yr BP:

1 - 5104 ± 53
2 - 4787 ± 57
3 - 8930 ± 35
4 - 8227 ± 23

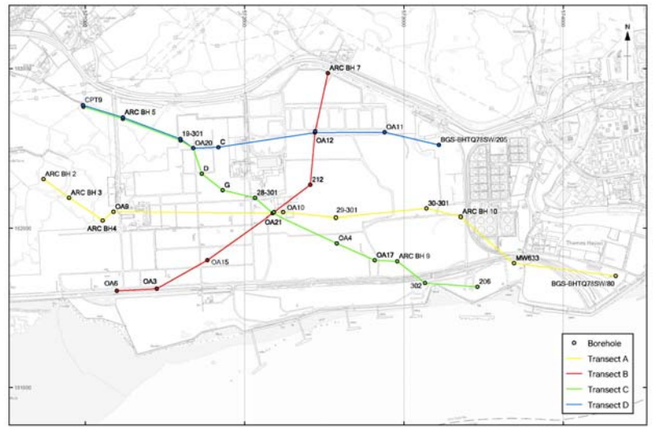
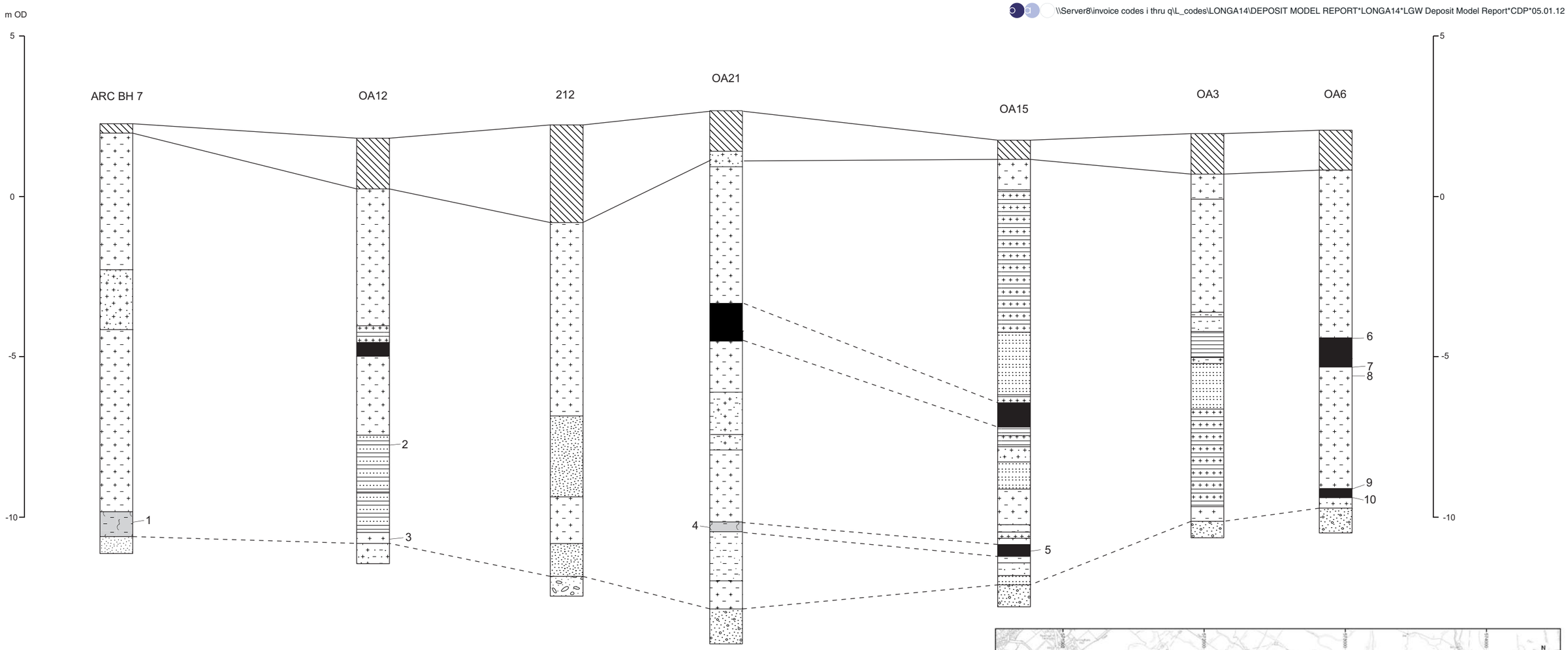


Figure 16: Borehole transect A through site.



Key:

- Made ground
- Clay
- Silt
- Sand
- Clay and silt
- Sand and clay
- Gravelly sand
- Gravel
- Organic silt
- Peat
- Clay silt and sand
- Clay sand and gravel
- Laminated sand and clay
- Laminated sand and silt
- Laminated clay and silt
- Laminated silt

^{14}C yr BP

1 - 7916 ± 137
2 - 7410 ± 35
3 - 8085 ± 55
4 - 8227 ± 23
5 - 8985 ± 35
6 - 4095 ± 35
7 - 5613 ± 21
8 - 6685 ± 50
9 - 6640 ± 35
10 - 7007 ± 23

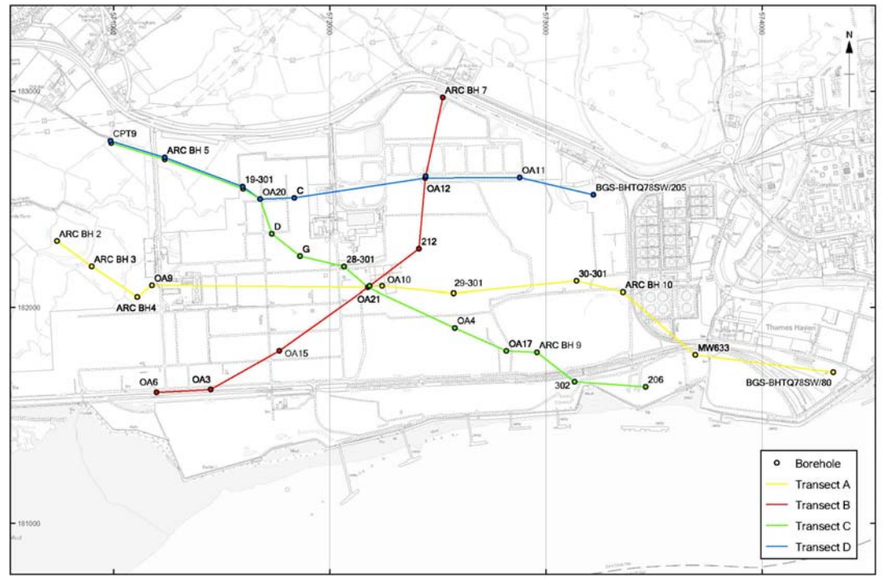
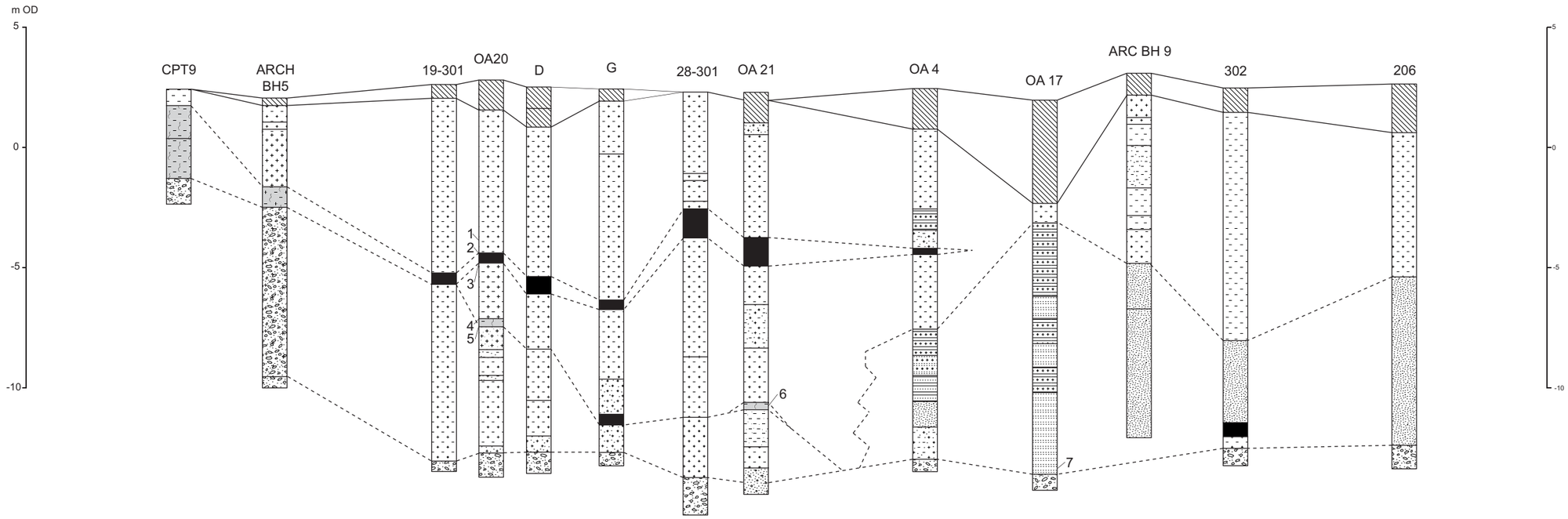


Figure 17: Borehole transect B through site.



Key:

- Made ground
- Clay
- Silt
- Sand
- Clay and silt
- Sand and clay
- Organic silt
- Peat
- Gravel
- Clay sand and gravel
- Laminated sand and clay
- Laminated sand and silt
- Laminated clay and silt
- Clay silt and sand
- Organic clay and silt

^{14}C yr BP

1 - 4490 ± 50
2 - 4675 ± 35
3 - 5755 ± 35
4 - 6505 ± 35
5 - 8526 ± 23
6 - 8227 ± 23
7 - 5685 ± 50

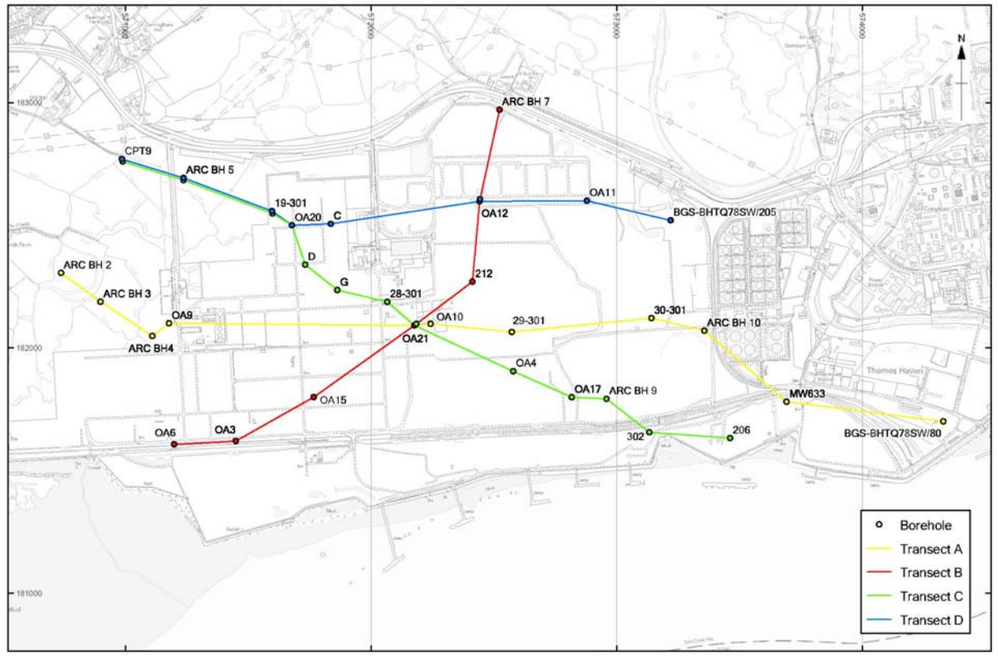
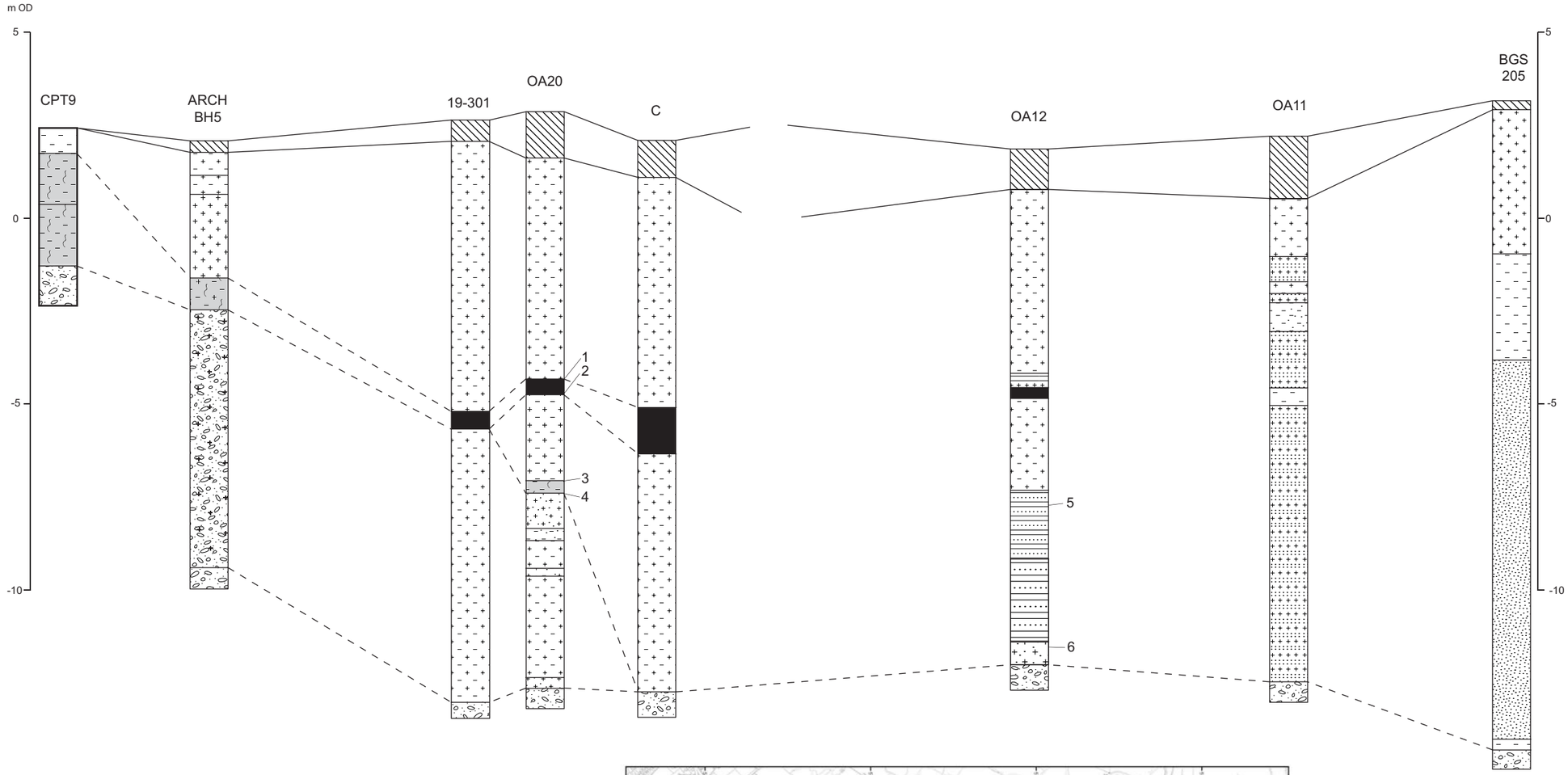


Figure 18: Borehole transect C through site.



Key:

- Made ground
- Clay
- Silt
- Sand
- Clay and silt
- Sand and clay
- Organic silt
- Peat
- Gravel
- Clay sand and gravel
- Laminated sand and clay
- Laminated sand and silt
- Laminated clay and silt
- Bedrock

^{14}C yr BP

1 - 4675 ± 35
2 - 5755 ± 35
3 - 6505 ± 35
4 - 8526 ± 23
5 - 7410 ± 35
6 - 8085 ± 55

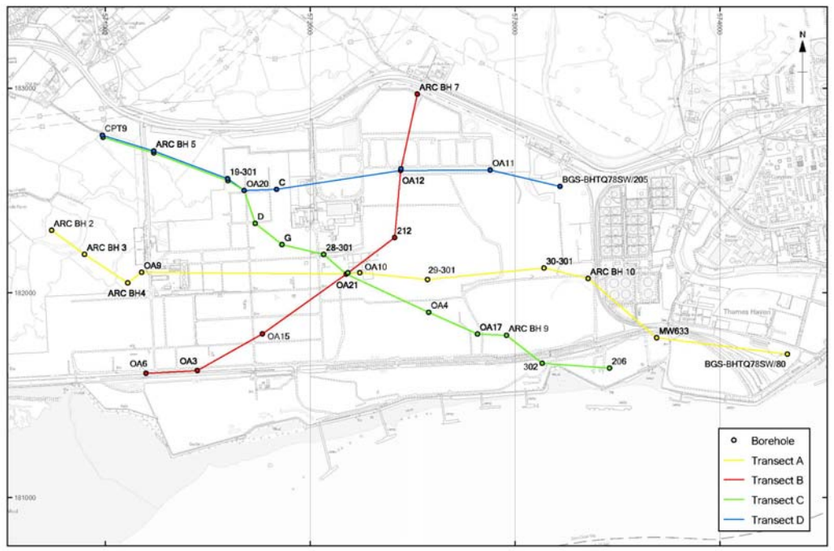


Figure 19: Borehole transect D through site.

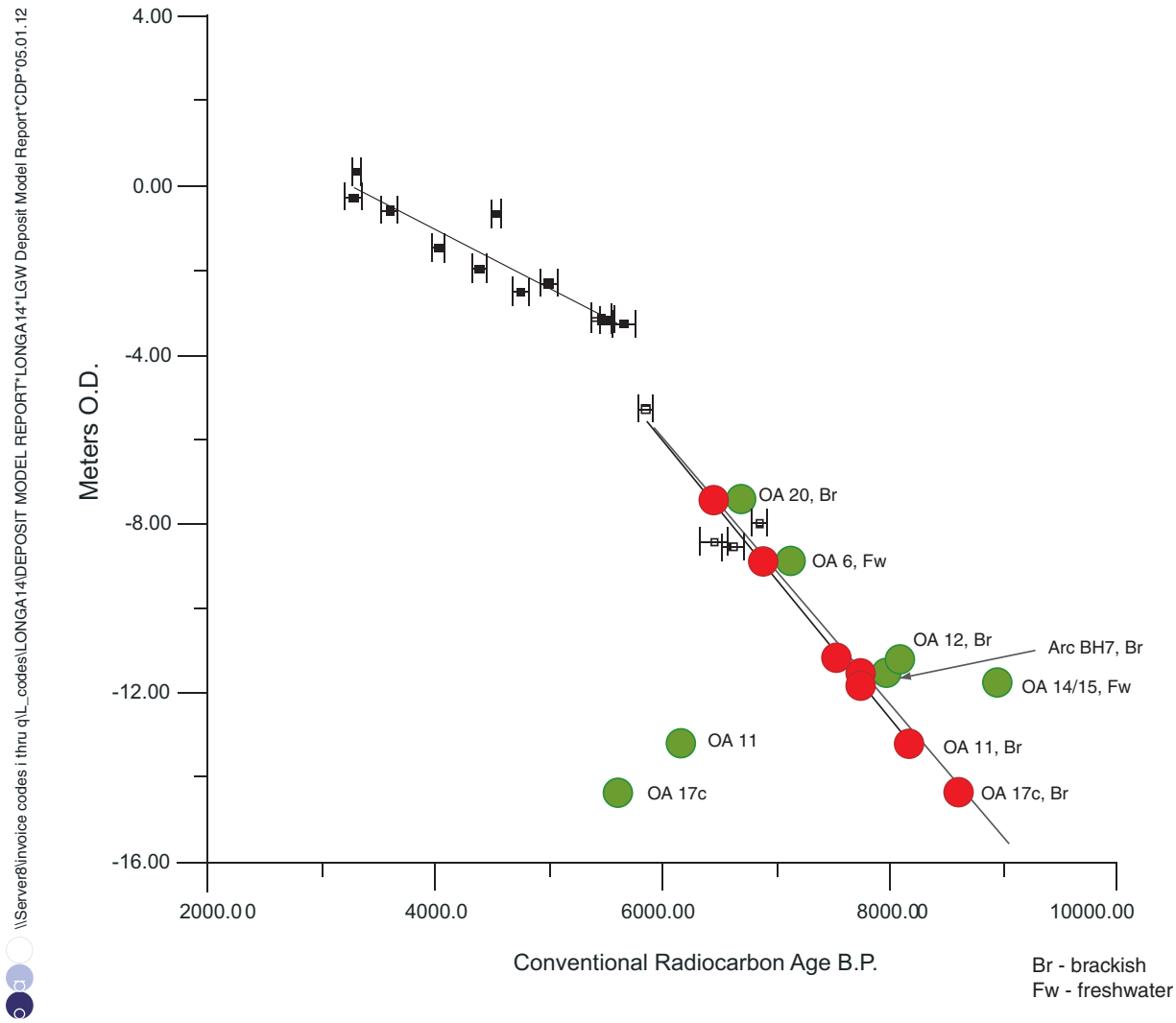


Figure 20: Radiocarbon datesModelled onset of sedimentation for lower Thames estuary based on Bates and Whittaker (2004) used to predict the timing of onset of sedimentation on the topographic template (red dotes) and the actual radiocarbon dates (green dots) from the study area.

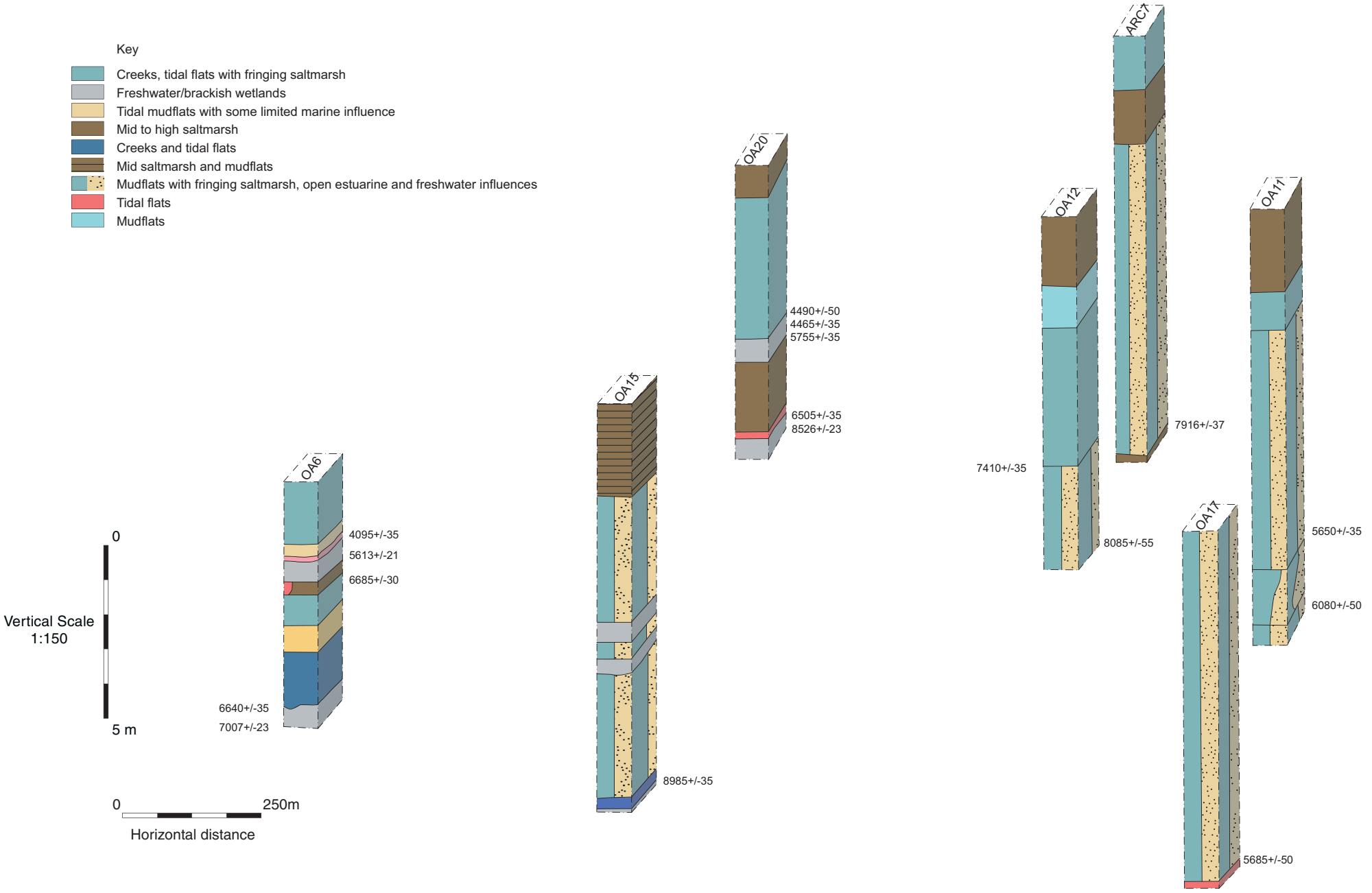


Figure 21: Summary ecological zonations for boreholes selected for microfossil investigation (dates are ^{14}C years BP).

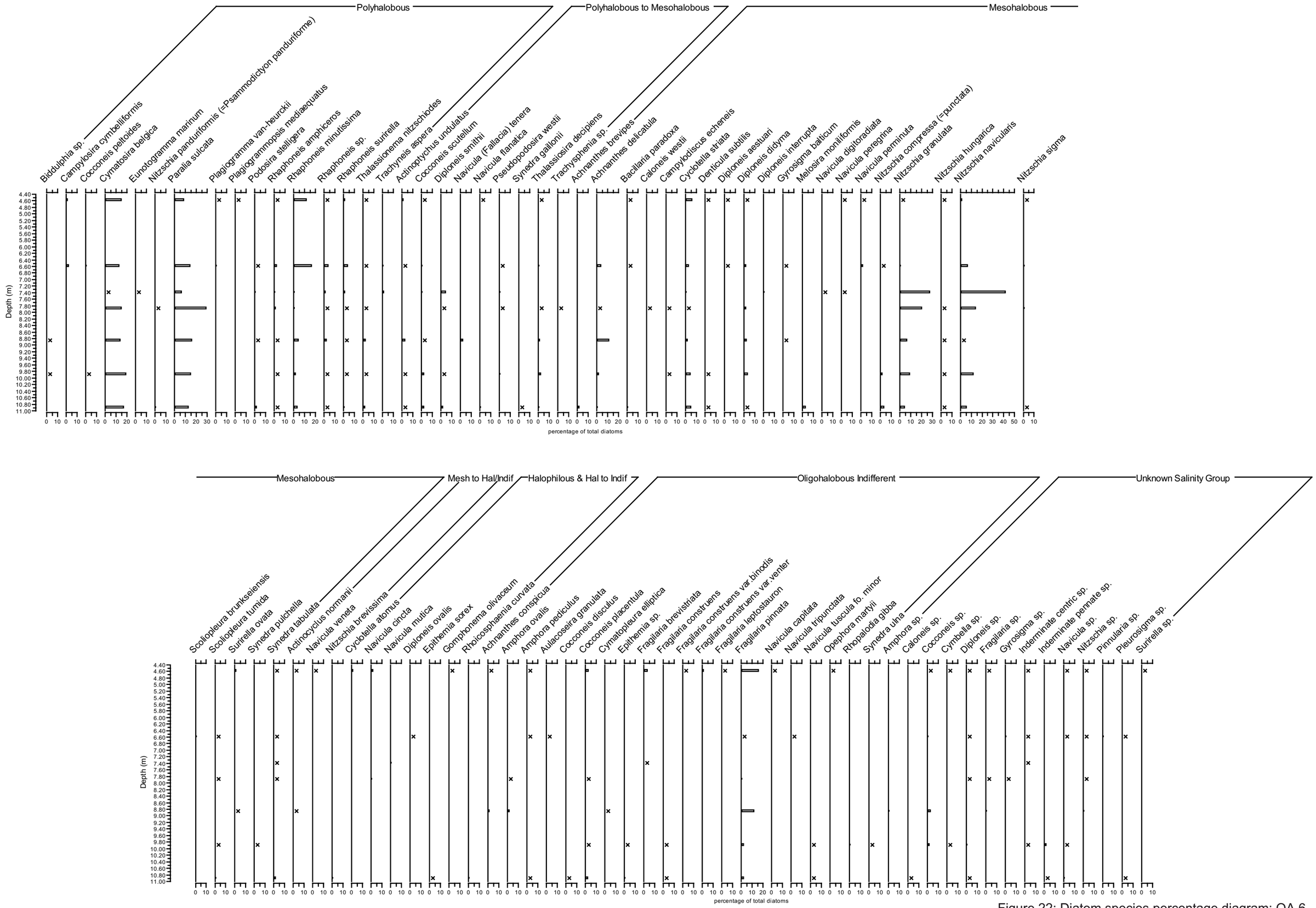


Figure 22: Diatom species percentage diagram: OA 6.

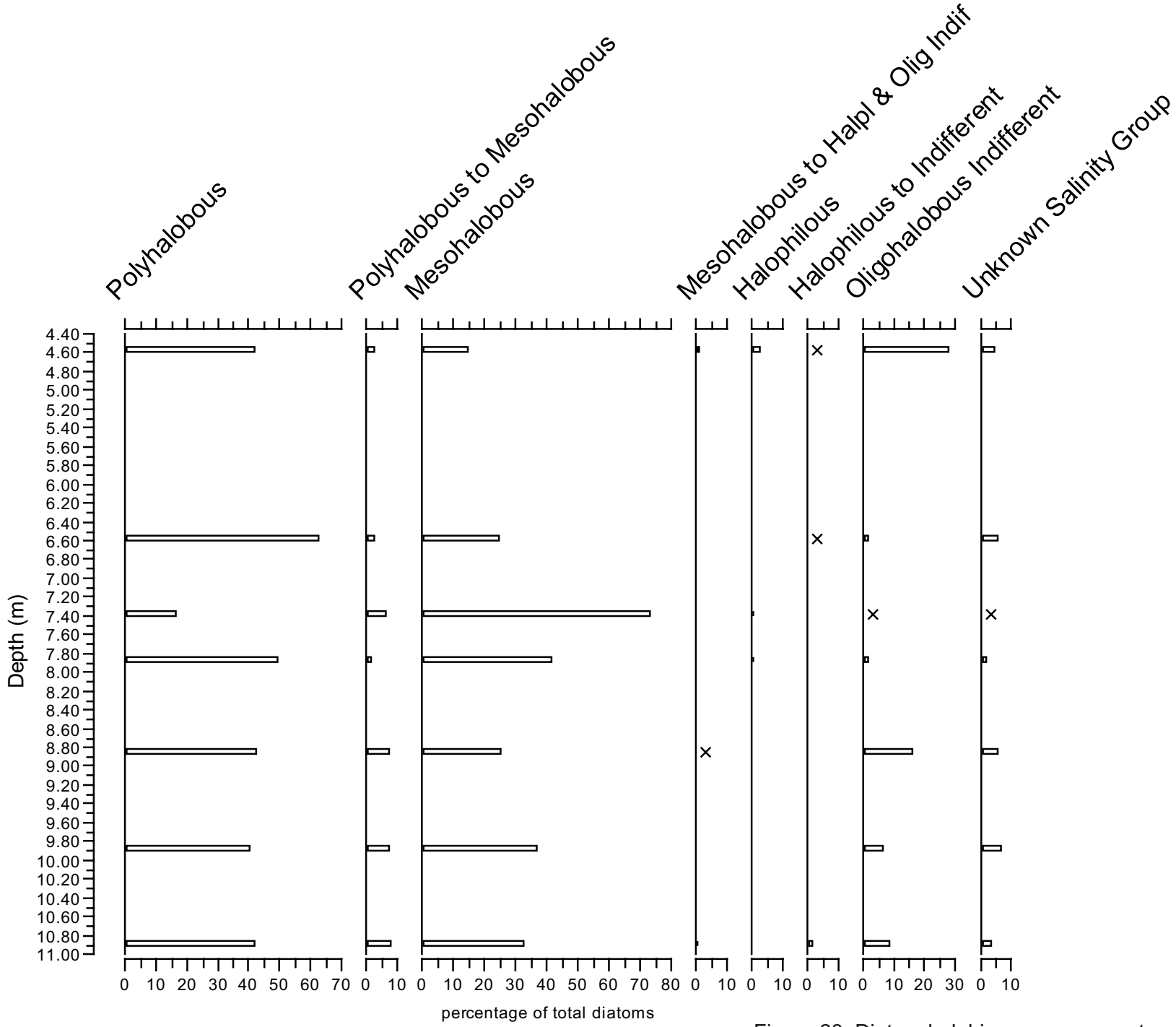
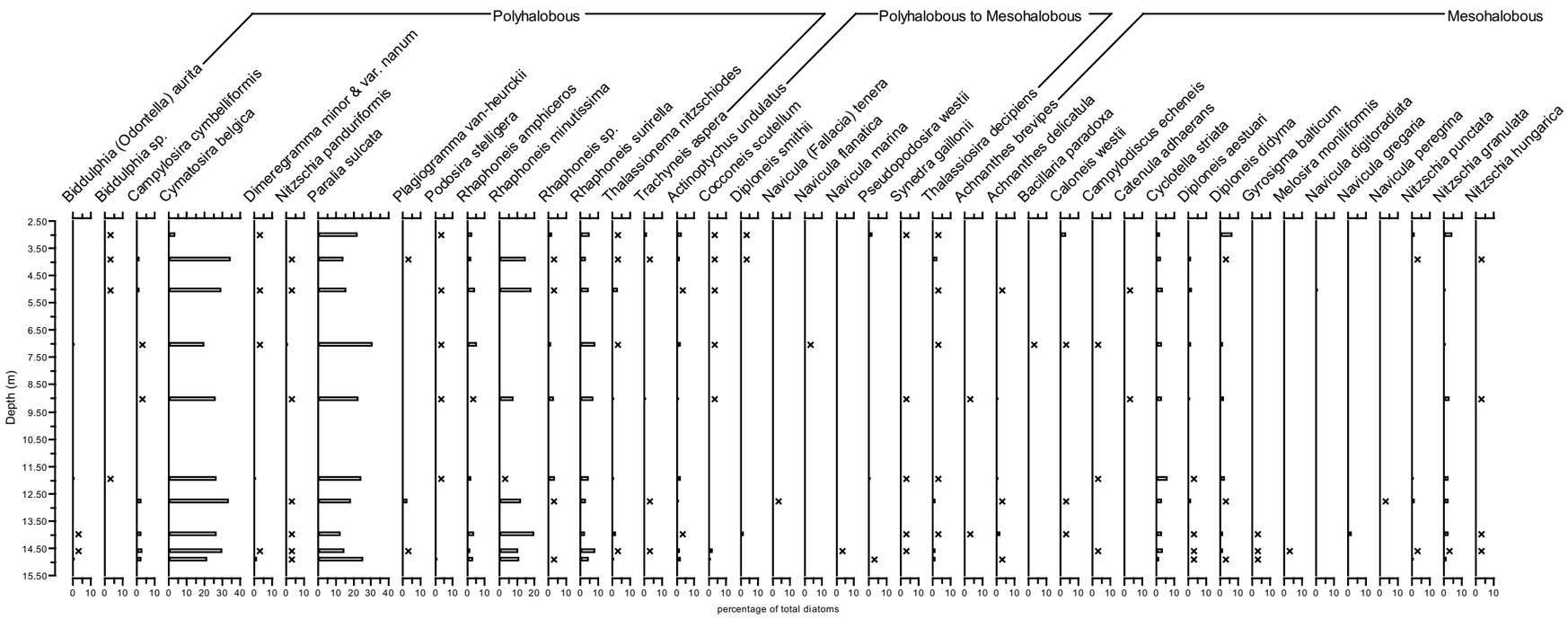


Figure 23: Diatom halobian group percentage diagram: OA 6.



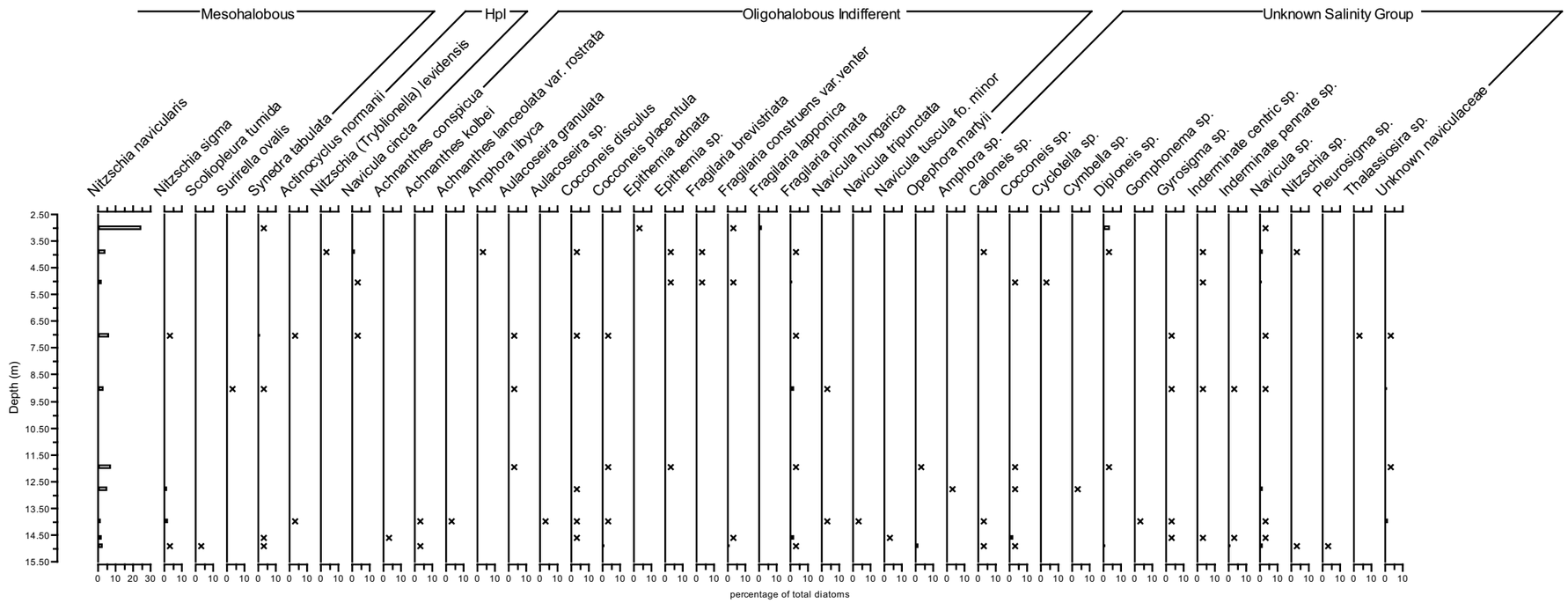


Figure 24: Diatom species percentage diagram: OA 11

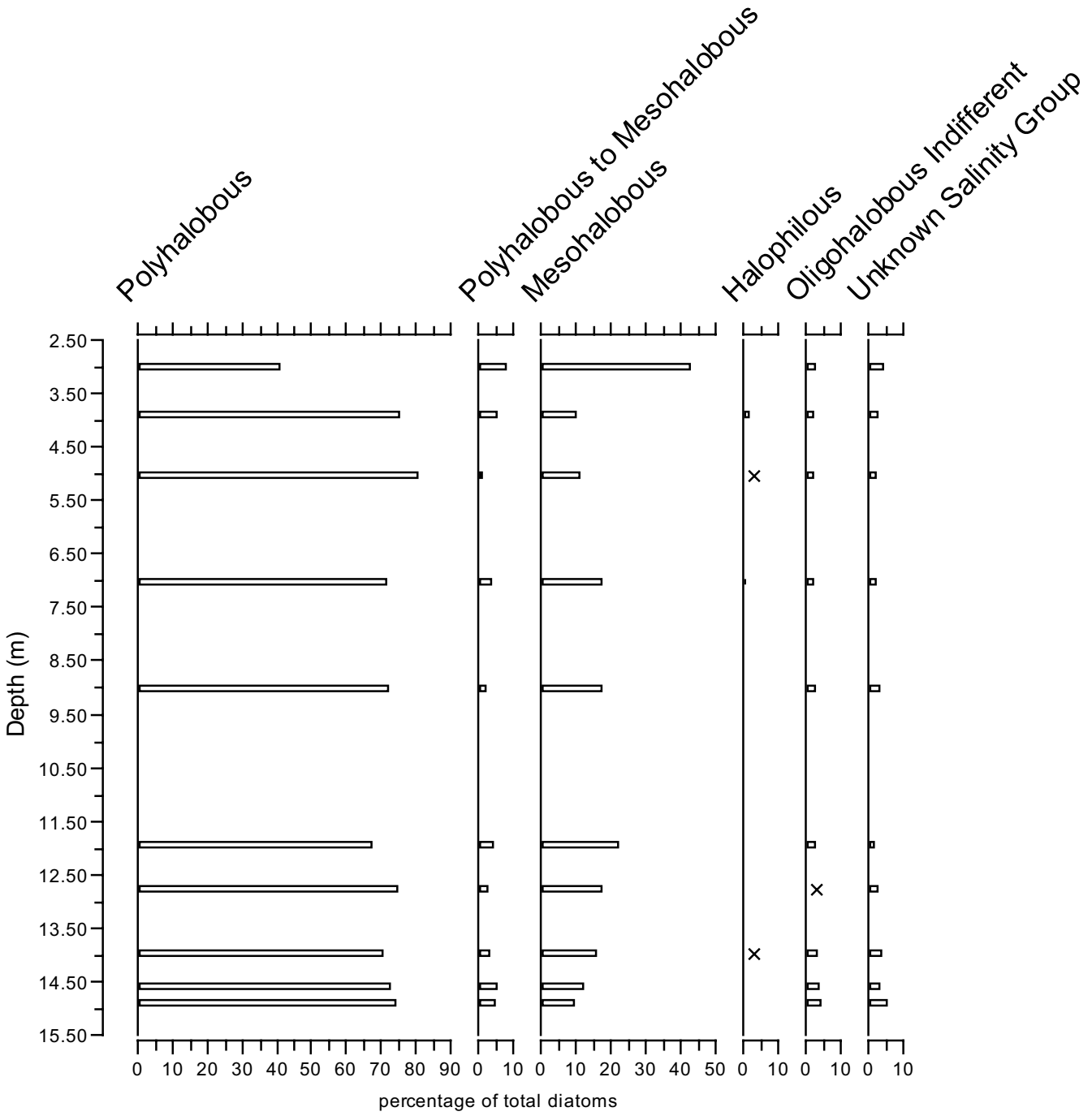


Figure 25: Diatom halobian group percentage diagram: OA 11.

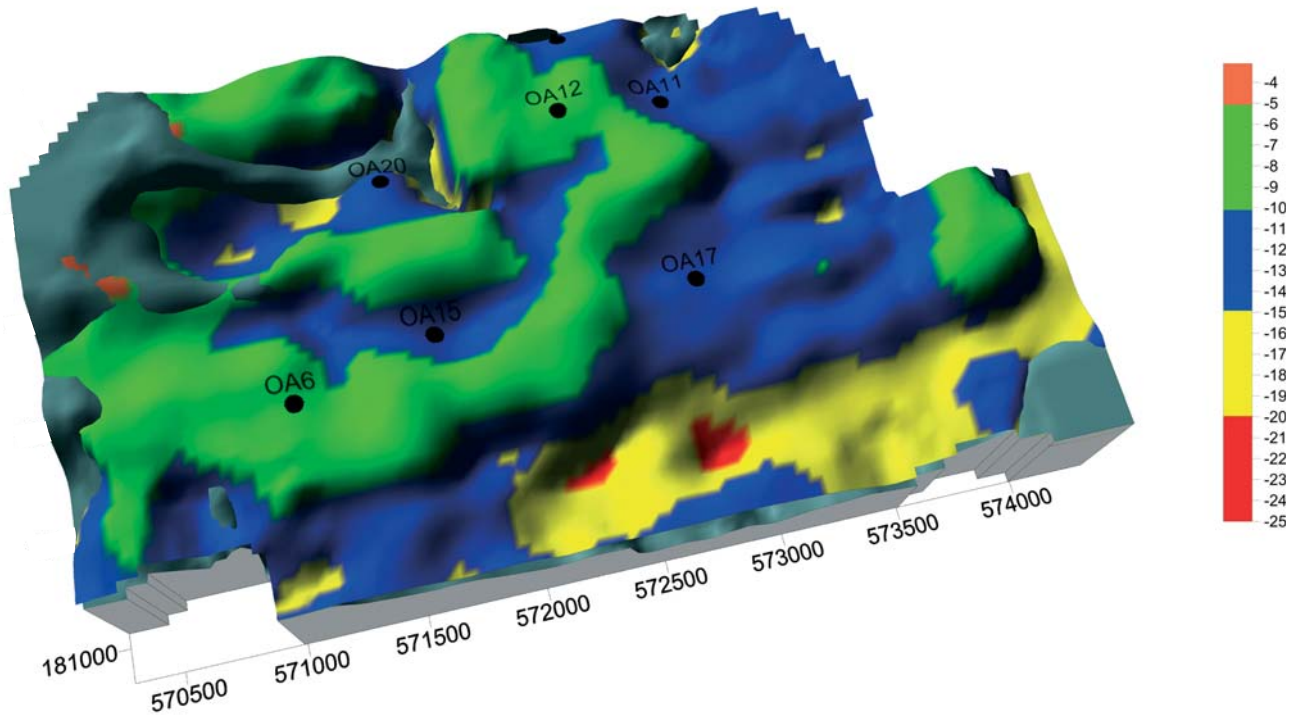


Figure 26: Simplified gravel surface superimposed on bedrock topography used for predictive modelling (see Figure 27).

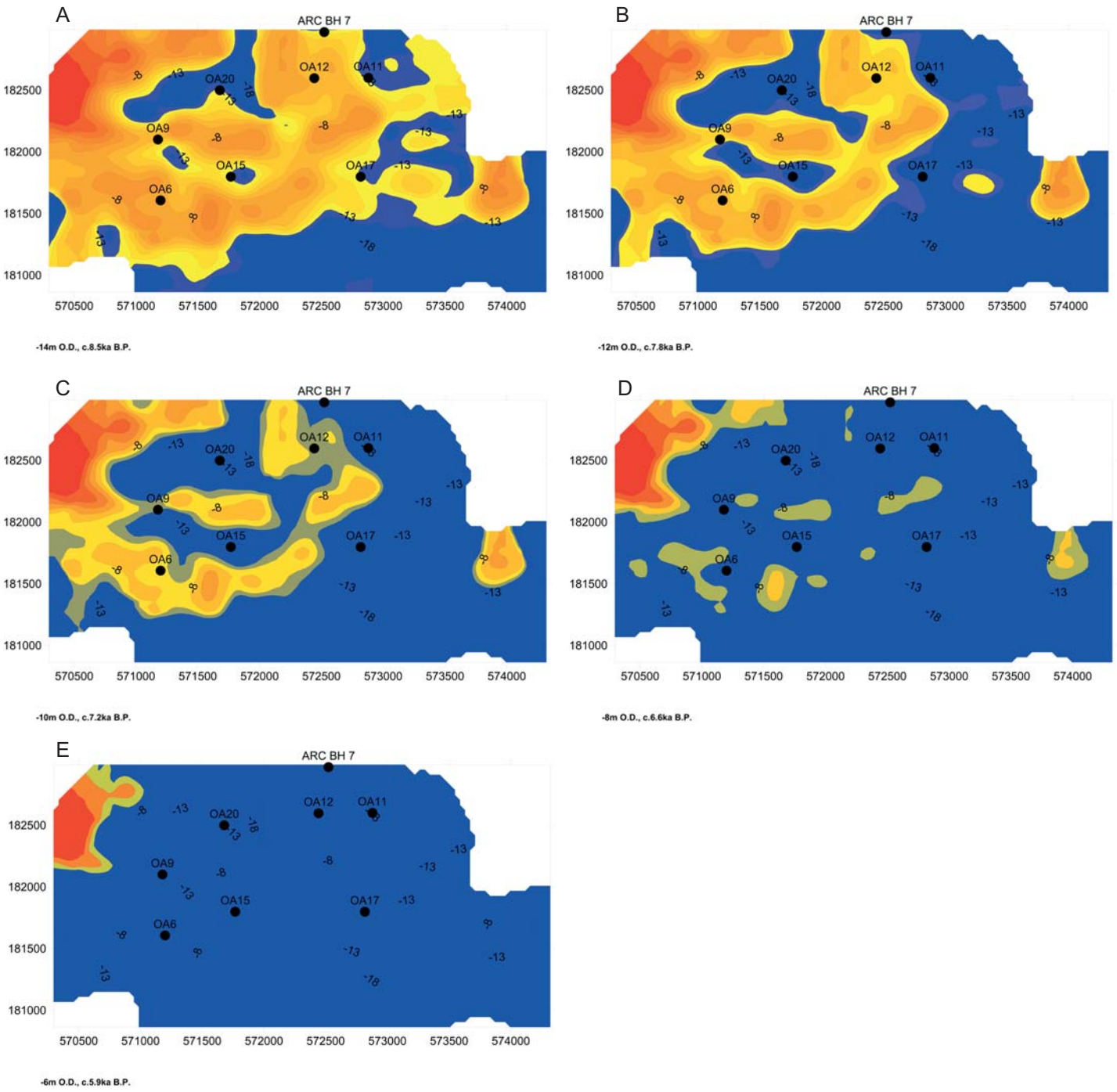


Figure 27: Modelled flooding history based on data from Bates and Whittaker (2004) using gravel surface topography.
A: -14m O.D., c.8.5ka B.P.
B: -12m O.D., c.7.8ka B.P.
C: -10m O.D., c.7.2ka B.P.
D: -8m O.D., c.6.6ka B.P.
E: -6m O.D., c.5.9ka B.P.

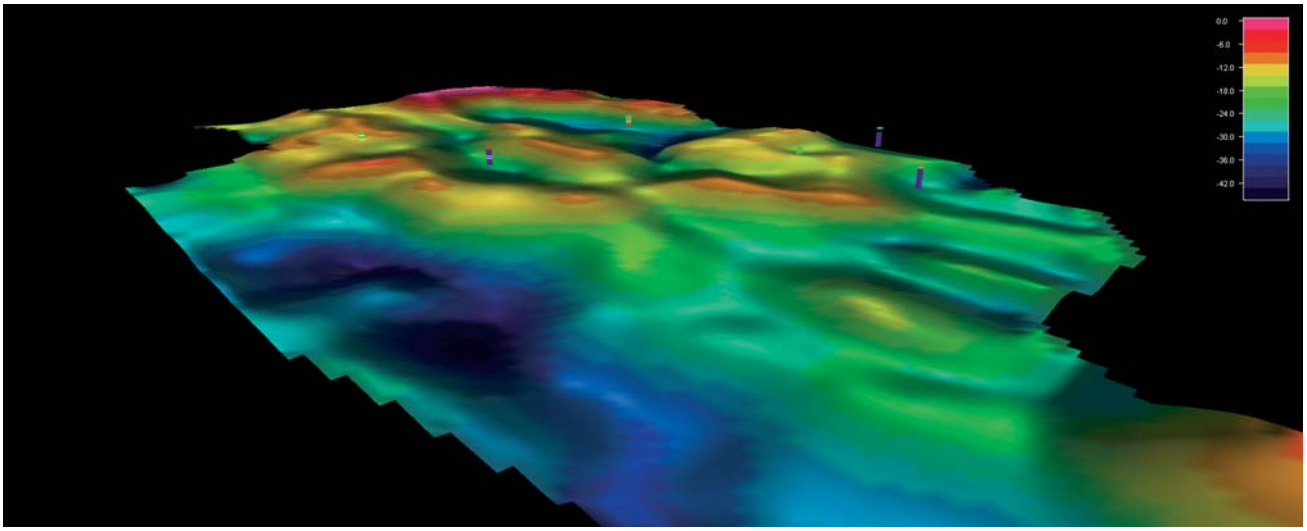


Figure 28: Gravel surface topography and boreholes used in microfossil investigation.

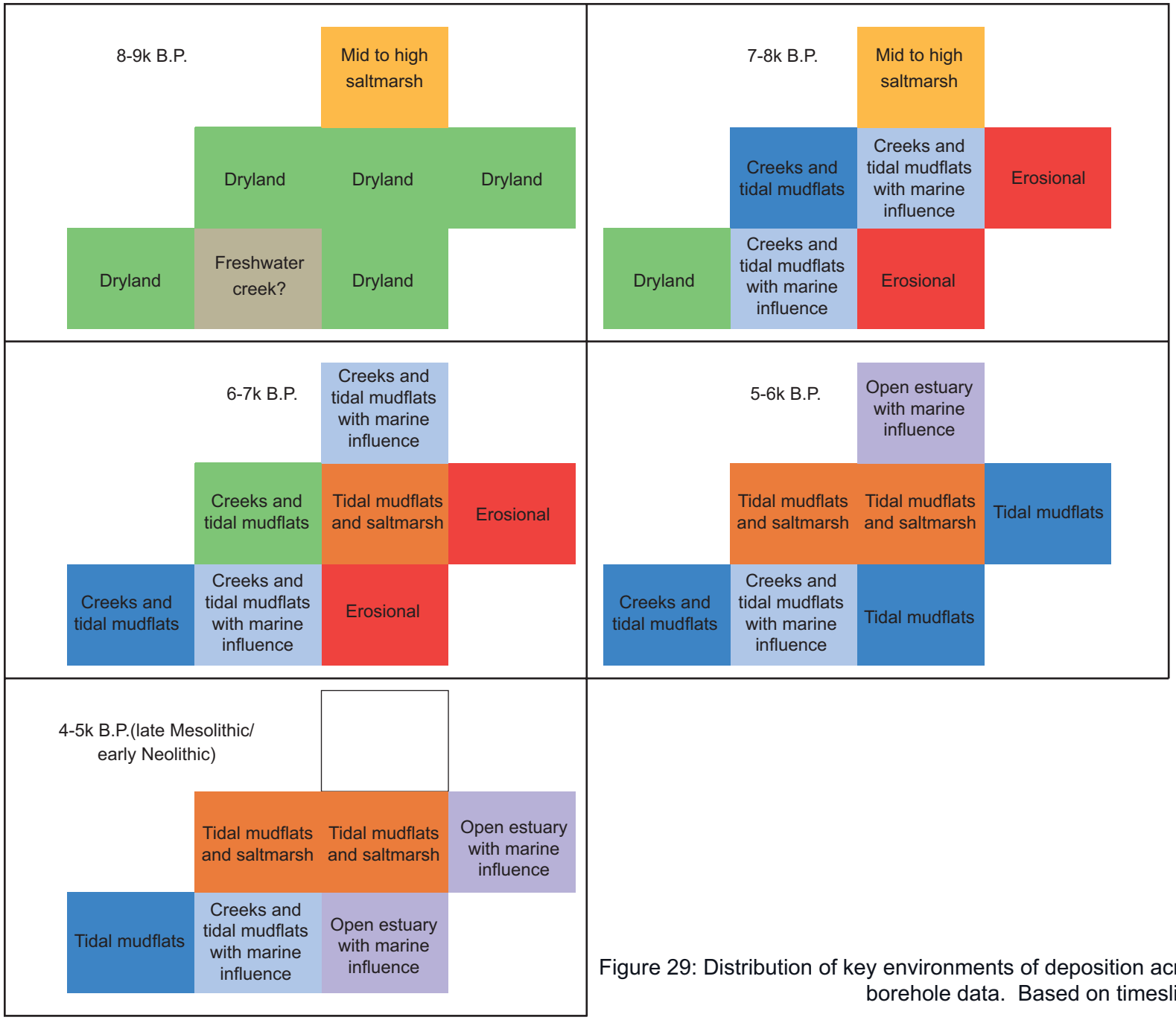


Figure 29: Distribution of key environments of deposition across the site based on borehole data. Based on timeslices used in Figure 27.

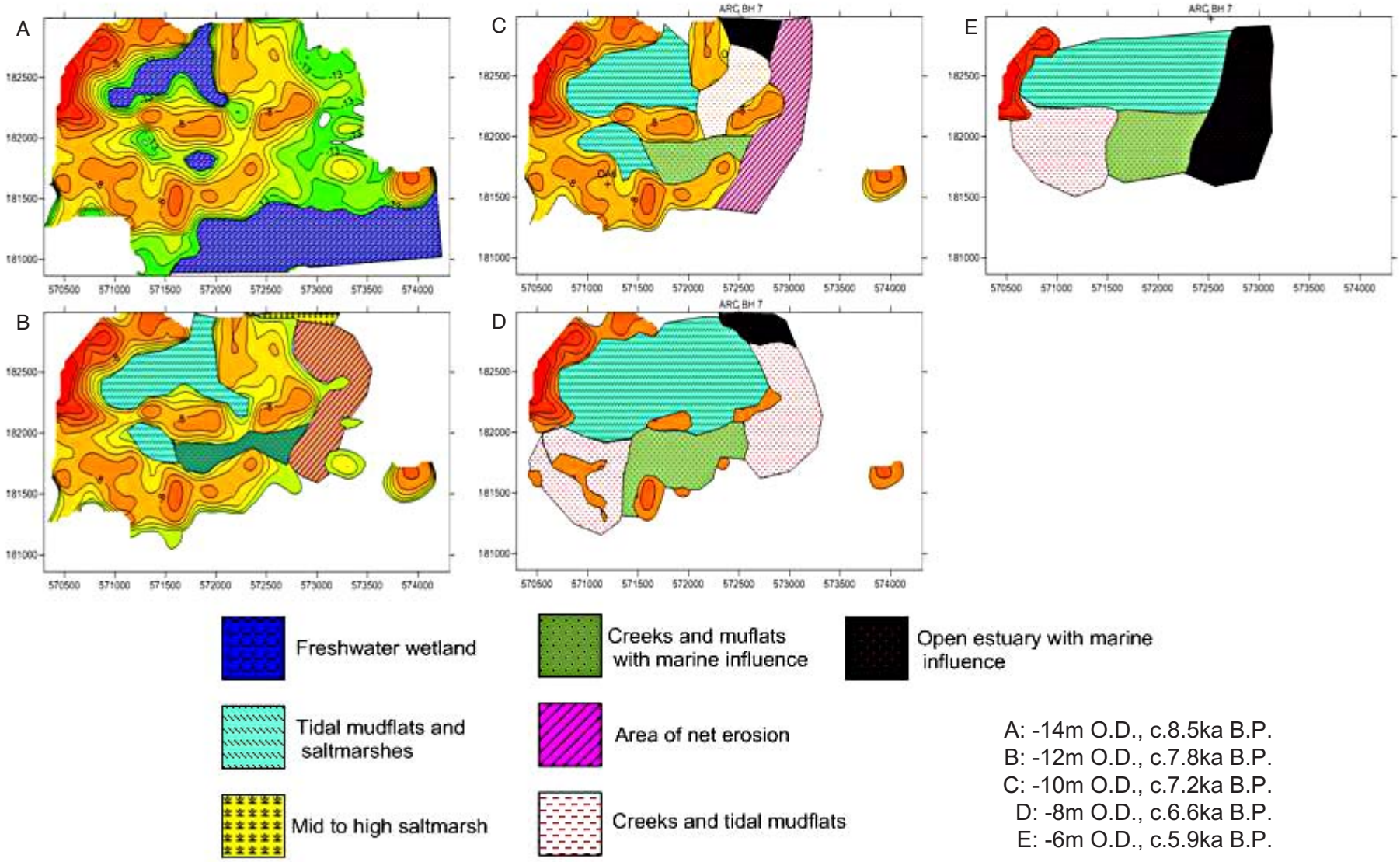


Figure 30: Time sliced palaeogeography for the study area using topographic reconstructions used in Figure 27 and calibrated microfossil data.

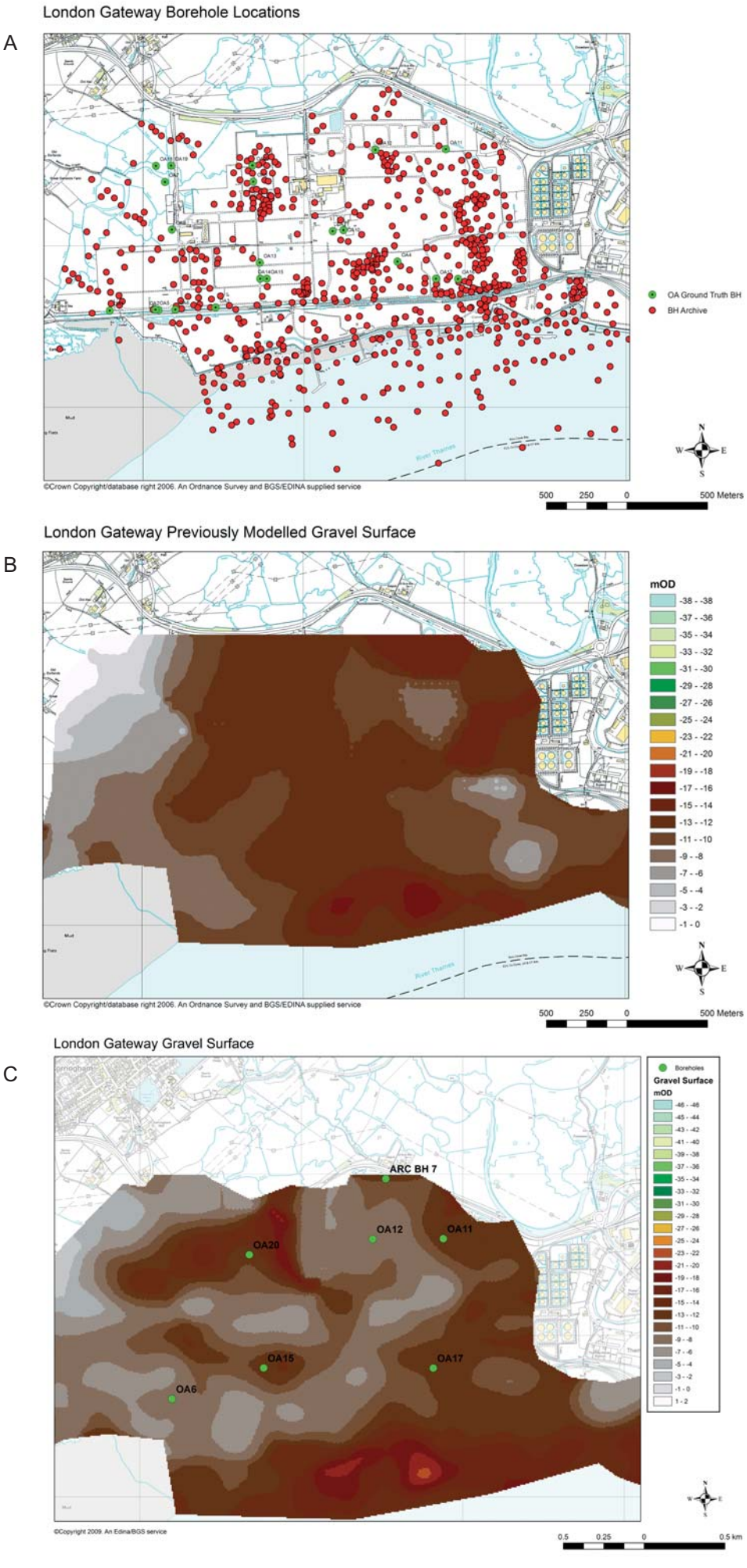
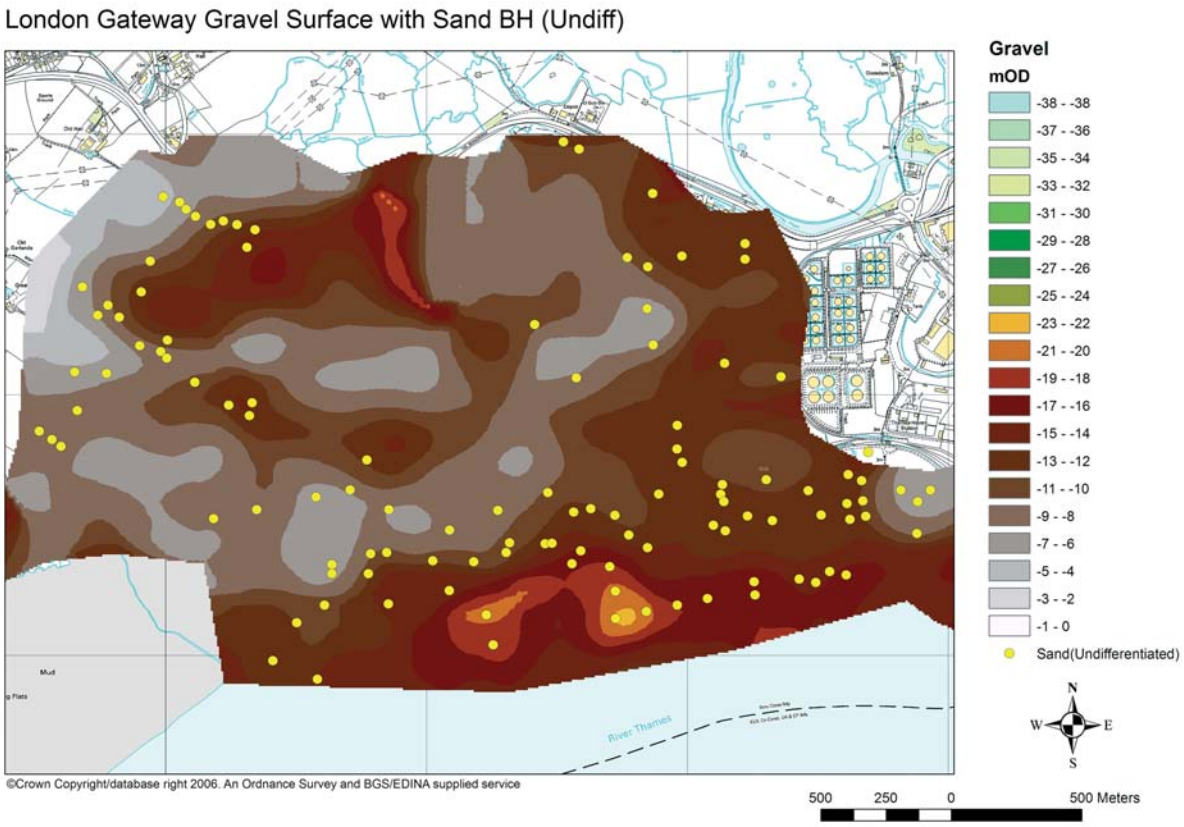


Figure 31: A: Distribution of all boreholes from study area.
B: modelled early Holocene topographic template from borehole data only.
C: modelled early Holocene topographic template from borehole and geophysical data.

A



B

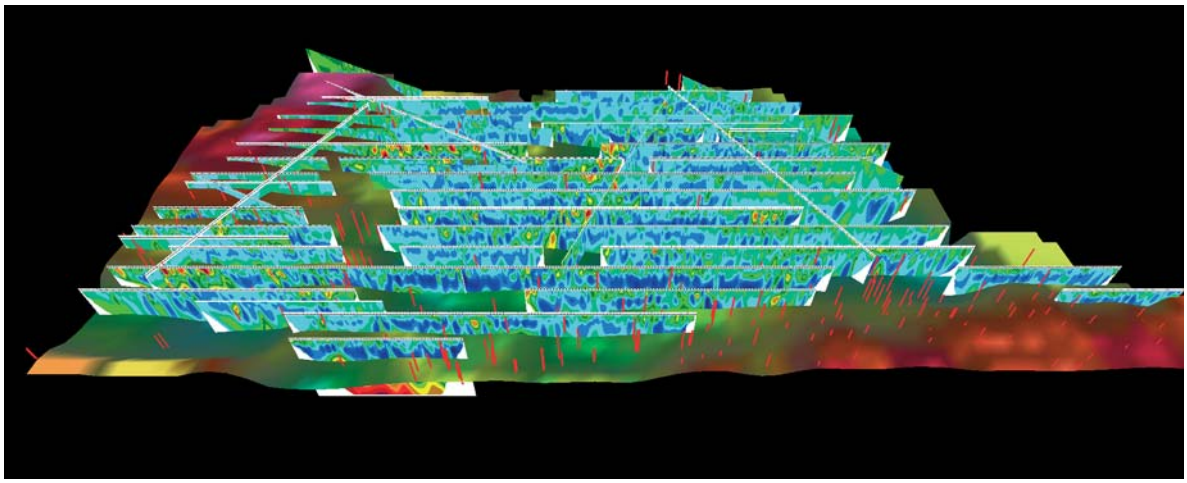


Figure 32: A: Distribution of all boreholes containing sand in study site.
B: geophysical transects showing spatial distributionof less conductive units to the east of the site for comparison with the distribution of boreholes containing sand.

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