Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley:

A Geoarchaeological Borehole Survey Report

Planning Application Number: 08/15635/FULM

National Grid Reference Number: TQ 4752 7937

AOC Project no: 30548

Site Code: ABB 09

Date: October 2009

AOC Archaeology Group

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Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley:

A Geo-archaeological Borehole Survey Report

On Behalf of:	**Mouchel** **23-29 Albion Place** **Maidstone** **Kent** **ME14 5TS**
National Grid Reference (NGR):	**TQ 4752 7937**
AOC Project No:	**30548**
Prepared by:	**Paul Harris**
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Date:	**October 2009**

This document has been prepared in accordance with AOC standard operating procedures.

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Contents

1. Introduction

1.1 This report documents the findings of a geoarchaeological borehole survey undertaken on the site of the Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (Figure 1).

1.2 The site is located c. 290m to the north-east of Abbey Wood Station, to the east of Harrow Manor Way, centred on National Grid Reference (NGR) **TQ 4752 7937**. It is bound to the north and west by Lensbury Way, to the east by an adjacent residential nursing home and to the south by the rear of properties fronting on to Overton Road. The site is rectangular in shape and 2.2 hectares in size.

1.3 The site is currently occupied by Abbey Primary School (Bexley Pupil Referral Unit) comprising the main school buildings in the centre of the site, an asphalt play ground area and the School's playing fields in the east, the staff car park and part of the school grounds (location of recently demolished nursery building and caretaker's house) in the west, and remaining area of school ground (location of recently demolished library building) in the south (Figure 2).

1.4 The proposed development scheme comprises demolition of part of the western block of the main school building and the construction of extensions upon the east, west and to the south-west of the main school building. This will include refurbishment and extension of the existing pupil referral unit and construction of single storey extensions to house a second pupil referral unit and therapy/medical unit, and a two storey administration and entrance building. External works will also be required to extend the car park in the north-west corner of the site.

1.5 All works were undertaken by professional geo-archaeologists from Quaternary Scientific (QUEST) under the management of AOC Archaeology.

2. Planning Background

2.1 The Local Planning Authority is the London Borough of Bexley. Archaeological advice to the council is provided by Mark Stevenson of the Greater London Archaeological Advisor Service (GLAAS).

2.2 Planning permission has been granted (Ref No. 08/15635/FULM) for the development proposal subject to the following condition

"No development shall take place until the applicant has secured the implementation of a programme of archaeological work in accordance with a written scheme of investigation which has been submitted by the applicant and approved in writing by the Local Planning Authority"

"REASON: To ensure that adequate archaeological records can be made in respect of the site and in the interests of the heritage of the local area."

2.3 A Desk Based Assessment was prepared for the site as the first phase of the work (AOC 2009a).

2.4 Prior to the survey taking place a Written Scheme of Investigation was produced detailing the methodology for the investigation (AOC, 2009b). It conformed to the requirements of Planning Policy Guidance: Archaeology and Planning (DoE 1990) (PPG16).

2.5 The proposed development site does not lie inside, adjacent to, or within any identified designated Conservation Areas or Sites of Archaeological Significance and does not contain any listed buildings.

3 Geology and Topography

3.1 The British Geological Survey Map, Sheet 271, indicates the proposed development site is underlain by alluvium, overlying Thanet sand formation with a bedrock of White Chalk. Geotechnical site investigations (WYG Environment, 2009) have expanded upon this by identifying a sequence of Made Ground / Topsoil overlying alluvial clay and peat deposits, underlain by River Terrace Deposits and Thanet Sand.

3.2 Until the Thamesmead development in the 1960's the site lay within the Plumstead/Erith marshland. The site is generally flat and rises towards the higher ground at Abbey Wood in the south.

4 Archaeological and Historical Background

The following is taken from the Desk-Based Assessment prepared for the site (AOC 2009).

4.1 Prehistoric (Before c.AD 43)

4.1.1 There is little Palaeolithic activity in the immediate vicinity of the site; the wider area provides some prehistoric remains. There is evidence of late Mesolithic/early Neolithic and Bronze Age activity encountered during archaeological investigations in advance of the construction of Bronze Age Way, c. 2.5km to the east of the site.

4.1.2 Within 1km of the site, Neolithic to Bronze Age peat deposits, overlain (and underlain in some cases) by alluvial clays, have been identified at a number of sites. This includes Eynsham Drive c. 380m to the northwest of the site; Abbey Wood Road c. 900m to the southeast of the site; and East Thamesmead Business Park, (c. 950m to the northeast of the site.

4.2 Roman (c.AD 43 – 410)

4.2.1 Little evidence of Roman activity has been recorded near to the site; there are a small number of records detailing Roman activity within the wider landscape however. This includes the site of a possible Roman settlement recorded during an archaeological excavation at the Woolwich Arsenal in 1856, c. 2.5km to the northwest of the site (Wigfall, 1997, P.1); a Roman settlement and cemetery at Welling, c. 3.5km to the south of the site (Garrod & Philp, 1992); a Roman burial in a lead coffin, found in 1887 within a dene hole along Kings Highway / Wickham Lane, c. 2km to the south-west of the site (Tester, 1985, P. 16) and the route of the Roman road of Watling Street (modern day A207) c. 3.5km to the south of the site.

4.3 Anglo-Saxon (c.AD 410 – 1066)

4.3.1 The manors of Plumstead, Lesnes and Erith are recorded in the Domesday Book (1086) as having already being in existence by AD 1066, whilst early medieval origins are further suggested by place name evidence of locations such as Erith (*Earyth*) and Lesnes (*Loisnes*), which derive from Old English (e.g. Anglo-Saxon) elements (Gelling, 1984).

4.3.2 The earliest evidence of early medieval activity within this area of Bexley relates to the site of the battle of *Crecganford*, which occurred in 457 AD. This is thought to have occurred in the locality of modern day Crayford, c. 6km to the southeast of the proposed development site (Tester, 1985, P.19), whilst *Earyth* (Erith) is mentioned in the 7th and 10th centuries, Bexley described in a charter of AD 814 and Plumstead is recorded in a grant of King Edgar in 960 AD.

4.3.3 There is presently no evidence to suggest significant activity near the site during this period.

4.4 Medieval (c.AD 1066 – 1485)

4.4.1 The Domesday Survey of 1086 indicates settlement activity within Plumstead, Lesnes and Erith at the beginning of the Medieval Period. The proposed development site is likely to have been located within the

manor of Lesnes, (e.g. modern day Abbey Wood and part of Thamesmead), which gave its name to the surrounding 'hundred' (administrative area during the early medieval and medieval periods).

4.4.2 The Domesday Book records Lesnes (Loisnes) as a moderately sized manor comprising sixty villagers, three small holders, two salves and three cottagers, with the land owned by Bishop Odo of Bayeaux. The land was granted to Richard De Lucy in the 12th century, who founded Lesnes Abbey in 1178 (Abbey of St. Mary & St. Thomas the Martyr), on a site c. 550m to the south of the proposed development site.

4.4.3 The Abbey was a relatively small foundation, comprising only twelve cannons and an abbott in AD 1178. However, as the landowner it was responsible for draining areas of marshland and the construction and maintenance of stretches of the river wall/embankments. Historical sources record floods during the medieval period (Wigfall, 1997) – possibly suggesting the river wall was not being maintained or was not sufficient for purpose and large floods are recorded in AD 1236 and the early 16th century (Wigfall, 1997, P. 3).

4.4.4 Lesnes Abbey continued into the early 16th century, until it was suppressed in AD 1524 by Thomas Wolsey after he obtained papal permission to close any monastery with less than eight cannons – Lesnes having 5 Cannons and an Abbott by this time (Wigfall, 1997, P.2). The Abbey's land was subdivided and sold on to private hands.

4.4.5 The ruins of Lesnes Abbay lie within 1km of the site, as do linear earthworks possibly related to the abbey to the south, and the site of a river wharf within Lesnes Abbey Wood.

4.5 Post-Medieval (c.AD 1485 - Modern)

4.5.1 Possibly as a result of general neglect and the absence of maintenance works provided by the Abbey, the river wall/embankments burst in 1537 resulting in over 2000 acres of land being 'reclaimed by the river' (Jarvis, 1983), a large percentage of which remained 'underwater' for the following c. 30 years (Wigfall, 1997, P.3).

4.5.2 Elizabeth I commissioned repairs and reclamation works in 1561 and by 1587, resulting in c. 1000 acres of marshland in Plumstead, Lesnes and Erith being drained. Further works upon the river wall were undertaken by William Burrel in 1606 (Jarvis, 1983, P.2), with further maintenance and improvements throughout the 17th and 18th centuries. More phases of land reclamation/build up over the wider locality of the marshland were undertaken during the latter half of the post-medieval period, continuing into the modern period, with demolition rubble from bombing raids during the First and Second World War being used as fill material.

4.5.3 The site does not appear to have been located within an area of development and urban expansion during the post-medieval period. Within the wider marshland area and its surrounding vicinity, one of the primary foci of development at this time was the Royal Dockyards, established at Woolwich by King Henry VIII, which grew and expanded as a naval and military centre during the 16th, 17th and 18th centuries; its name changed to 'Woolwich Arsenal' after a royal visit by King George III in 1805. Large parts of the marshland were part of the Woolwich Arsenal estate.

4.5.4 Further urban development within the marshlands remained concentrated in this area and within the settlements of Erith, Plumstead and Lesnes, though Lesnes itself appears to have remained a relatively small and rural community through to the late post-medieval period.

4.5.5 By the mid to late 19th century urban expansion was beginning to the south of the site, with the North Kent railway line located c. 280m to the south, and Abbey Wood Station constructed 1849, c. 290m to the southwest of the site. The site at this time appears to have remained undeveloped, probably agricultural, land.

4.5.6 The Plumstead/Erith Marshes remained absent of large scale development until the 1950s. Following the decision to sell off parts of the Woolwich Arsenal estate by the Ministry of Defence in 1953, and the availability of other land within the marsh, new areas of land were able to be opened up and exploited for urban expansion; needed to combat the demand for new housing, new jobs, and wide spread slum clearance in the post-war era.

4.5.7 This urban development began with the Abbey Wood Estate to the west and southwest of the proposed development site with further suburban expansion in, and around, Abbey Wood Station to the south of the site. By 1962 a plan had been drawn up for a new London County Council suburb, stretching from Woolwich Arsenal in the west to Crossness in the east (c. 1.3km to the northeast of the proposed development site). Construction of Thamesmead began in 1967 and expanded to include the area of the proposed development site, upon which a Primary School was constructed in 1972.

5 Aims of the Investigation

5.1 The aims of the geoarchaeological investigation were to:

- To establish the presence/absence of geoarchaeological remains within the site.
- To determine the extent, condition, nature, character, quality and date of any geoarchaeological remains encountered.
- To assess the ecofactual and environmental potential of any geoarchaeological remains
- To determine the extent of previous truncations of any geoarchaeological deposits.
- To enable the archaeology advisor to the London Borough of Bexley to make an informed decision on the possible requirement for further work in order to satisfy the archaeology condition.
- To make available to interested parties the results of the investigation in order to inform the mitigation strategy as part of the planning process.

5.2 The specific objectives of the geoarchaeological Investigation were to:

- Determine the presence or absence of any environmental remains to inform upon the landscape history of the site and its environs.

5.3 The final aim is to make public the results of the investigation, subject to any confidentiality restrictions.

6 Methodology

6.1 A total of five bore holes were excavated to the south, east and west of the existing Bexley Pupil Referral Unit (PRU) (Appendix A, Figure 2). An additional sixth borehole, originally planned to be excavated (AOC, 2009b) was abandoned due to the presence of reinforced concrete within the area to the north-west of the PRU.

6.2 The boreholes were excavated using a Copco Cobra 2 stroke percussion engine and Eijkelkamp gouge set for boreholes removed in sections or a Stitz piston corer for continuous boreholes. The boreholes were excavated by trained Quaternary Scientific staff.

6.3 All sampling was conducted by Quaternary Scientific. Core depths and exposed sediments were recorded by the geo-archaeologist and all samples were labelled with the site name, location, depth and orientation. The core samples were then transported to Reading University for storage and analysis.

6.4 Additional archaeological recording by AOC staff comprised the undertaking of spoil scans, the recording of the setting and scale of the ground works through digital photography, the transferral of a datum onto the site

and establishment of surface datum levels for each borehole and the survey of borehole locations using a total station (Figure 2).

6.5 All boreholes were backfilled by Quaternary Scientific at the end of the fieldwork.

7 Results

7.1 The general sequence identified in the boreholes was as follows (earliest first):

- Sand and Gravel. The upper surface was near uniform across the site (c. -5.00mOD) and represents the Pleistocene Gravel.
- Silt and Clay. These fine-grained deposits were between 0.50m and 0.90m thick and were organic-rich, representing a low energy alluvial environment.
- Peat. The peat deposits varied between 2.40m and 2.75m in thickness and represent a transition towards semi-terrestrial conditions.
- Silt and Clay. A return to alluvial conditions represented by fine-grained mineral-rich sediments.
- Made ground and topsoil.

7.2 For a full discussion of the geoarchaeological results see Appendix A.

8 Conclusions and Recommendations

8.1 No further fieldwork is recommended for the Bexley Pupil Referral Unit site.

8.2 High resolution pollen analysis in tandem with a programme of radiocarbon dating and identification of the waterlogged wood taxa should be undertaken on the sequence retrieved from Borehole 1.

8.3 The analysis will determine an appropriate method of publication. As a minimum the results will be published online through the ADS OASIS form (Appendix B) with a short summary submitted to the Greater London excavation roundup in the London Archaeologist.

8.4 On completion of all the work the site will be archived at the London Archaeological Archive Resource Centre (LAARC).

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Appendices

Appendix A – Geoarchaeological Report

BEXLEY PUPIL REFERRAL UNIT, ABBEY WOOD, LONDON BOROUGH OF BEXLEY (SITE CODE: ABB09): ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT

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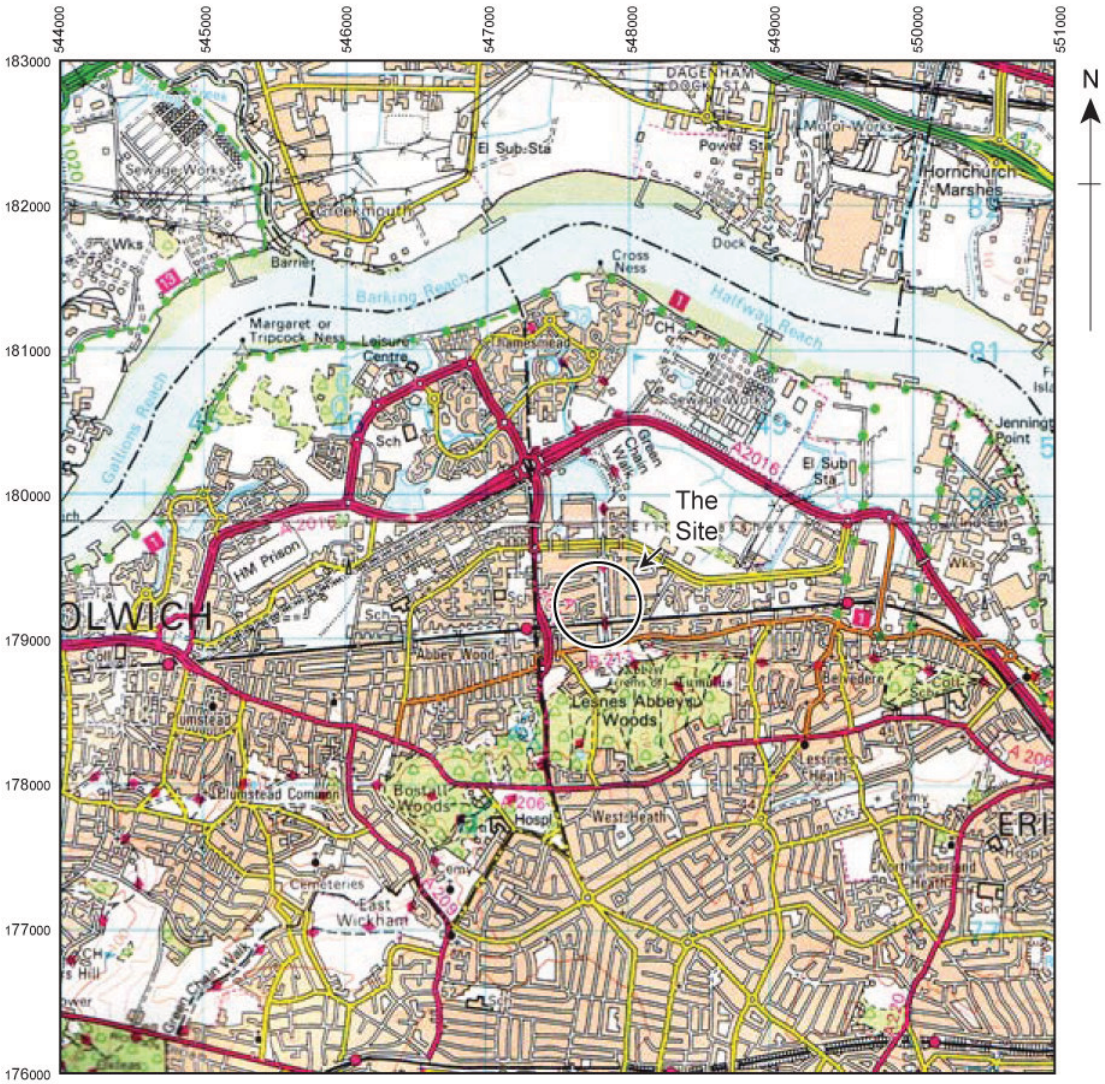
INTRODUCTION

This report summarises the findings arising out of a borehole investigation and environmental archaeological assessment undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09; National Grid Reference: TQ 4752 7937; Figures 1 and 2). Recent geo-technical work carried out by WYG Environment (WYG Environment, 2009) recorded the presence of fine-grained mineral-rich sediments and peat (up to 5.5m thick) overlying River Terrace Gravels. This report presents the results of a geoarchaeological borehole survey and laboratory-based environmental archaeological assessment.

Six boreholes were put down across the site (Figure 2). The aims of the borehole survey and laboratory-based investigation are as follows: (1) To establish the presence/absence of geoarchaeological remains within the site; (2) To determine the extent, condition, nature, quality and date of any geoarchaeological remains encountered; (3) To assess the ecofactual and environmental potential of any geoarchaeological remains; (4) To determine the extent of previous truncations of any geoarcaheological deposits (AOC, 2009), and (5) to evaluate the potential of the new sedimentary sequences for reconstructing the environmental history of the site and its environs. In order to achieve these aims, the environmental archaeological assessment consisted of:

1. Recording the lithostratigraphy to provide a preliminary reconstruction of the sedimentary history
2. Determining variations in organic matter content from one borehole sequence to supplement the lithostratigraphic descriptions

3. Assessment of the preservation and concentration of pollen grains and spores from one borehole sequence to provide a preliminary reconstruction of the vegetation history, and to detect evidence for human activities e.g. woodland clearance and cultivation
4. Assessment of the preservation and concentration of diatom frustules from the natural sequence to provide a preliminary reconstruction of the hydrological history e.g. water quality and depth
5. Assessment of the preservation and concentration of macroscopic plant and insect remains from one borehole sequence to provide a preliminary reconstruction of the vegetation history and general environmental context of the site



Based on the Ordnance Survey's 1:50 000 Landranger map of 2004 with the permission of the Controller of Her Majesty's Stationery Office, © Crown Copyright. Licence No. AL 100023757

Figure 1: Location of Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09) (reproduced from Ordnance Survey digital map data ©Crown copyright 2009. All rights reserved. License number 0100031673)

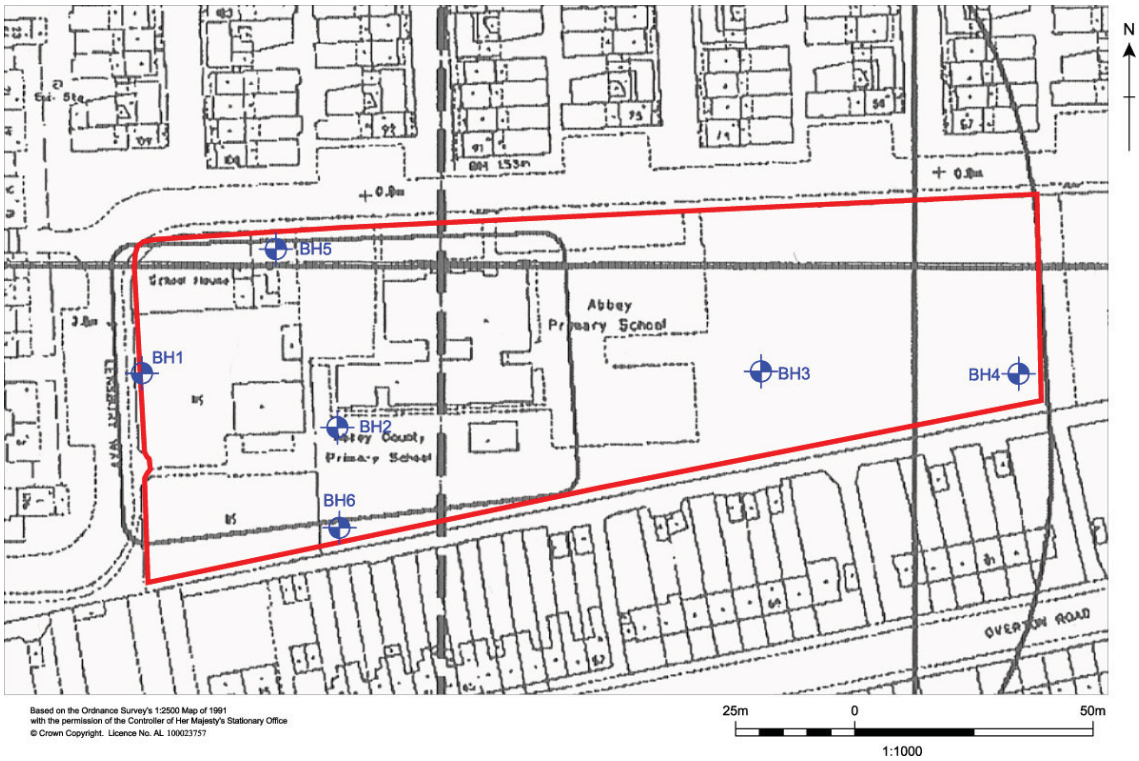


Figure 2: Location of Boreholes <BH1> to <BH6>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09) (reproduced from Ordnance Survey digital map data ©Crown copyright 2009. All rights reserved. License number 0100031673)

METHODS

Field Investigations

Six boreholes (<BH1> to <BH6>) were put down at pre-determined locations across the site (Figure 2). Borehole <BH5> was abandoned due to the presence of reinforced concrete within the upper most meter which prevented further sediments being recovered. The boreholes were taken using an Eijkelkamp window sampler and gouge set driven by an Atlas Copco TT 2-stroke percussion engine. Each borehole was put down until coarse grained unconsolidated sediments were recorded. The spatial attributes of each borehole was recorded from the ground surface by AOC Archaeology (Table 1 and Figure 2).

Table 1: Location of Boreholes <BH1> to <BH6>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Borehole number	Easting	Northing	Depth at surface (m OD)
BH1	547436.79	179376.72	0.68
BH2	547473.58	179363.79	0.92
BH3	547571.38	179383.52	0.85
BH4	547616.96	179379.72	1.06
BH5	547464.5	179403.29	0.95
BH6	547476.05	179344.99	1.03

Lithostratigraphic descriptions

All borehole core samples were retained and described in the laboratory using standard procedures for recording unconsolidated sediment and peat, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts). The procedure involved: (1) cleaning the samples with a spatula or scalpel blade and distilled water to remove surface contaminants; (2) recording the physical properties, most notably colour; (3) recording the composition e.g. gravel, fine sand, silt and clay; (4) recording the degree of peat humification, and (5) recording the unit boundaries e.g. sharp or diffuse (Tables 2 to 6; Figure 3).

Organic matter determinations

Thirty-two sub-samples were taken from borehole <BH1> for determination of the organic matter content (Table 7; Figure 4). These records were important for two reasons: (1) they identified lithostratigraphic units with a higher organic matter content that may be suitable for radiocarbon dating, and (2) they identified increases in organic matter possibly associated with more terrestrial conditions. The organic

matter content was determined by standard procedures involving: (1) drying the sub-sample at 110^0C for 12 hours to remove excess moisture; (2) placing the sub-sample in a muffle furnace at 550°C for 2 hours to remove organic matter (thermal oxidation), and (2) re-weighing the sub-sample obtain the 'loss-on-ignition' value (see Bengtsson and Enell, 1986).

Pollen assessment

Fourteen sub-samples from borehole <BH1> were extracted for an assessment of pollen content. The pollen was extracted as follows: (1) sampling a standard volume of sediment (1ml); (2) deflocculation of the sample in 1% Sodium pyrophosphate; (3) sieving of the sample to remove coarse mineral and organic fractions (>125µ); (4) acetolysis; (5) removal of finer minerogenic fraction using Sodium polytungstate (specific gravity of 2.0g/cm^3); (6) mounting of the sample in glycerol jelly. Each stage of the procedure was preceded and followed by thorough sample cleaning in filtered distilled water. Quality control is maintained by periodic checking of residues, and assembling sample batches from various depths to test for systematic laboratory effects. Pollen grains and spores were identified using the University of Reading pollen type collection and the following sources of keys and photographs: Moore *et al* (1991); Reille (1992). Plant nomenclature follows the Flora Europaea as summarised in Stace (1997). The assessment procedure consisted of scanning the prepared slides, and recording the concentration and preservation of pollen grains and spores, and the principle taxa on four transects (10% of the slide) (Table 8).

Diatom assessment

A total of thirteen diatom samples were extracted from the inorganic sediments of borehole <BH1>. The diatom extraction involved the following procedures (Battarbee *et al.,* 2001):

1. Treatment of the sub-sample (0.2g) with Hydrogen peroxide (30%) to remove organic material and Hydrochloric acid (50%) to remove remaining carbonates
2. Centrifuging the sub-sample at 1200 for 5 minutes and washing with distilled water (4 washes)
3. Removal of clay from the sub-samples in the last wash by adding a few drops of Ammonia (1%)
4. Two slides prepared, each of a different concentration of the cleaned solution, were fixed in mounting medium of suitable refractive index for diatoms (Naphrax).

The assessment procedure consisted of scanning the prepared slides, and recording the concentration of diatoms on two transects (10% of the slide) (Table 9).

Waterlogged plant macrofossil (seeds and wood) assessment

Eighteen sub-samples taken from borehole <BH1> were processed and assessed for waterlogged plant macrofossils. The sub-samples were processed by wet-sieving using 300 micron and 1mm mesh sizes. Both fractions from each sample were scanned under a stereozoom microscope at x7-45 magnifications and the plant remains were recorded. Preliminary identifications of botanical remains have been made using modern comparative material and reference atlases (Cappers *et al.* 2006, Hather 2000, Schweingruber 1990, Schoch *et al*. 2004). Nomenclature used follows Stace (2005). The quantities of waterlogged seeds and wood were recorded for each sample, with identifications of the main seed taxa (Table 10).

Insect assessment

Eighteen sub-samples taken from borehole <BH1> were processed and assessed for insect remains. The sub-samples were processed by wet-sieving using 300 micron and 1mm mesh sizes. Both fractions from each sample were scanned under a stereozoom microscope at x7-45 magnifications and the insect remains were recorded. The wet sieved samples were scanned briefly using a low power binocular microscope (x10) to record the concentration and state of preservation of insect material, and to note the main beetle (Coleoptera) and bug (Hemiptera) taxa (Table 10).

RESULTS AND INTERPRETATION OF THE LITHOSTRATIGRAPHIC ASSESSMENT

The deepest sedimentary units recorded in all boreholes comprised coarse-grained mineral-rich sediments of sand and gravel (Figure 3; Tables 2 to 6). The upper surface of these deposits is near uniform across the site, varying between -5.14m OD in borehole <BH1> and -4.65m OD in boreholes <BH2>, <BH3> and <BH4>. These sediments represent the upper and surface of the Pleistocene Gravel. Overlying these coarse-grained sediments in all boreholes was between 0.50 and 0.90m of fine-grained alluvial deposits, generally comprising silt and clay varying quantities of detrital wood, organic-rich (up to ca. 40% in borehole <BH1>; Figure 4, Table 7), sand and gravel sediments in each borehole. These deposits are most likely representative of deposition in a low energy alluvial environment.

Above the dominantly fine-grained mineral-rich deposits recorded in all boreholes was a considerable thickness of generally very well preserved highly organic-rich wood and herbaceous peat deposits (up to *ca*. 90% organic in borehole <BH1>; Table 8; Figure 4). This varied in thickness between *ca*. 2.75m in borehole <BH1> and *ca*. 2.40m thick in boreholes <BH2>, <BH3>, <BH4> and <BH6>. These deposits represent a transition towards semi-terrestrial conditions. The peat deposits were succeeded by fine-grained mineral-rich sediments of silt and clay (<10% organic-rich in borehole <BH1>) representative of inundation and a return to alluvial conditions. The sharp nature of the contact between the peat and overlying alluvium in the majority of the boreholes indicates that the environmental transitions was abrupt, most likely eroding the upper surface of the peat. In all boreholes, the fine grained alluvium was overlain by Made Ground that ranged in thickness, up to *ca*. 0.8m.

Borehole <BH1> was selected for environmental archaeological assessment, as it contained the thickest peat sequence.

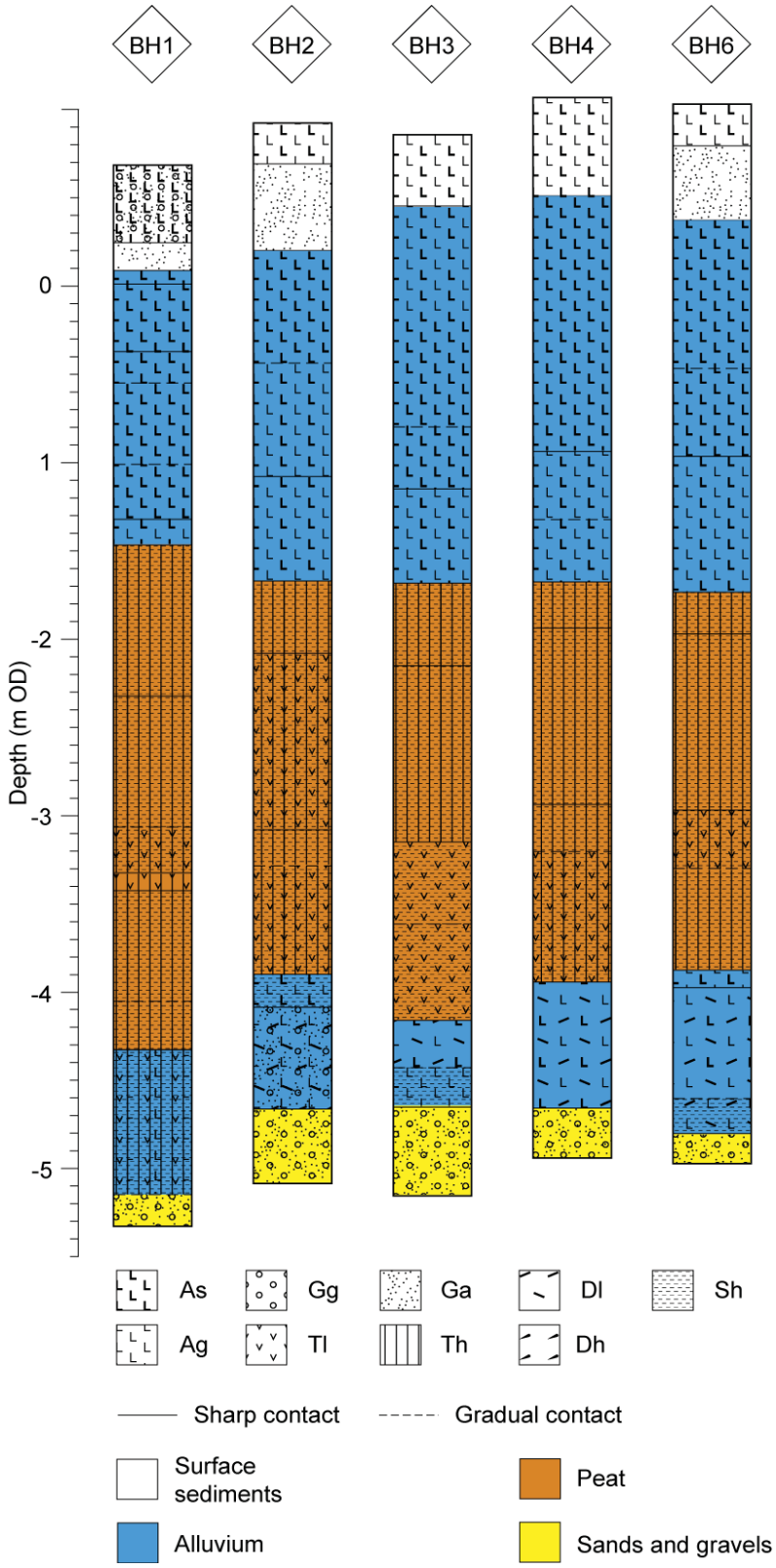


Figure 3: Transect of lithostratigraphic sequences from Boreholes <BH1> to <BH6>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Table 2: Lithostratigraphic descriptions of Borehole <BH1>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Composition
0.68 to 0.24	17	7.5YR 3/1; As2, Ga1, Gg1, concrete+, rootlets+; Very dark greyish brown sandy gravelly clay with concrete and modern rooting inclusions; Sharp contact in to:
0.24 to 0.09	16	2.5Y 6/4; Ga4; Light yellowish brown sand; Sharp contact in to:
0.09 to 0.01	15	10YR 3/2; As4, concrete+, brick+, rootlets+; Very dark greyish brown clay with concrete, brick and modern rooting inclusions; Sharp contact in to:
0.01 to -0.32	14	10YR 3/2; As4, Ga+; Very dark greyish brown clay with sand inclusions; Sharp contact into:
-0.32 to -0.37	13	2.5YR 2.5/1; Gg3 As1; Reddish black gravel with clay. Sharp contact in to:
-0.37 to -0.55	12	7.5YR 5/2; As4 Ag+; Brown slightly silty clay. Diffuse contact in to:
-0.55 to -1.01	11	10YR 4/1; As4 Ag+; Dark grey slightly silty clay. Diffuse contact in to:
-1.01 to -	10	10YR 4/2; As4 Ga+; Dark greyish brown slightly sandy clay.

1.32		
-1.32 to -1.56	9	10YR 4/1; As3 Ag1 Dh^{3}+; Humo 3; Dark grey silty clay with some detrital herbaceous material. Diffuse contact in to:
-1.56 to -2.32	8	2.5YR 2.5/1; Th^{2}2 Sh2 Tl^{2}+; Humo 3; Reddish black herbaceous peat and completely disintegrated organic material and some wood peat.
-2.32 to -3.06	7	2.5YR 2.5/1; Th^{1}2 Sh2; Humo 2; Reddish black herbaceous peat and completely disintegrated organic material. Diffuse contact in to:
-3.06 to -3.32	6	2.5YR 2.5/1; Th^{1}2 Tl^{1}1 Sh1; Humo 2; Reddish black herbaceous peat with completely disintegrated organic material and wood peat.
-3.32 to -3.42	5	10YR 3/6; Th^{1}3 Tl^{1}1; Humo 1; Dark yellowish brown herbaceous peat with wood peat. Sharp contact in to:
-3.42 to -4.05	4	2.5YR 2.5/1; Th^{2}2 Sh2; Humo 2; Reddish black herbaceous peat and completely disintegrated organic material. Diffuse contact in to:
-4.05 to -4.32	3	2.5YR 2.5/1; Sh3 Th^{3}1 Tl^{2}+; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat and some wood peat.
-4.32 to -5.14	2	10YR 3/2; Ag1 Sh1 Th^{3}1 Tl^{2}1; Humo 3; Very dark greyish brown silty herbaceous peat with wood peat and completely disintegrated organic material. Diffuse contact in to:
-5.14 to -5.32	1	10YR 3/1; Gg3 Ga1 Dh^{2}+ As+; Humo 2; Very dark grey gravel with sand and some detrital herbaceous material.

Table 3: Lithostratigraphic descriptions of Borehole <BH2>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Composition
0.92 to 0.68	13	10YR 4/1; As3 Ag1, rootlets+; Dark grey silty clay with modern rooting; Sharp contact in to:
0.68 to 0.20	12	10YR 6/4; Ga4; Light yellowish brown sand; Sharp contact in to:
0.20 to -0.08	11	10YR 5/1; As4; Grey clay; Diffuse contact in to:
-0.08 to -0.43	10	7.5YR 5/2; As4 Sh+ Ga+; Humo 4; Brown slightly sandy clay with some completely disintegrated organic material. Diffuse contact in to:
-0.43 to -1.08	9	7.5YR 4/2; As3 Ag1; Brown silty clay
-1.08 to -1.67	8	7.5YR 5/2; As3 Ag1 Sh+; Humo 4; Brown silty clay with some completely disintegrated organic material. Sharp contact in to:
-1.67 to -2.08	7	2.5YR 2.5/1; Sh3 $Th^2$1 Tl^2+; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat and some wood peat.
-2.08 to -	6	2.5YR 2.5/1; Sh2 $Th^2$1 $Tl^2$1; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat and wood peat.

3.08		
-3.08 to -3.28	5	2.5YR 3/1; Th[1]3 Sh1; Humo 2; Dark reddish grey herbaceous peat with completely disintegrated organic material. Diffuse contact in to:
-3.28 to -3.90	4	2.5YR 2.5/1; Sh2 Tl[2]1 Th[2]1; Humo 3; Reddish black completely disintegrated organic material with herbaceous and wood peat. Sharp contact in to:
-3.90 to -4.08	3	7.5YR 5/2; As2 Ag1 Sh1; Humo 3; Brown clay with silt and completely disintegrated organic material.
-4.08 to -4.65	2	Gley1 2.5/N; Ga1 Ag1 Gg1 Dl[2]1; Humo 2; Black sand, gravel, silt and detrital wood.
-4.65 to -5.08	1	10YR 3/1; Gg3 Ga1; Very dark grey sandy gravel.

Table 4: Lithostratigraphic descriptions of Borehole <BH3>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Composition
0.85 to 0.45	12	10YR 4/1; As3 Ag1, rootlets+; Dark grey silty clay with modern rooting; Sharp contact in to:
0.45 to -0.15	11	10YR 4/2; As3, Ag1, rootlets+; Dark greyish brown silty clay with modern rooting; Diffuse contact in to:
-0.15	10	10YR 4/2; As4 Ag+; Dark greyish brown slightly silty clay. Diffuse contact in to:

to -0.80		
-0.80 to -1.15	9	10YR 4/1; As4 Ag+; Dark grey slightly silty clay.
-1.15 to -1.69	8	Gley1 4/10Y; As3 Ag1 Sh+; Humo 4; Dark greenish grey silty clay with some completely disintegrated organic material. Sharp contact in to:
-1.69 to -2.15	7	2.5YR 2.5/1; Sh3 $Th^2$1; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat.
-2.15 to -3.15	6	2.5YR 2.5/1; Sh3 $Th^2$1 Tl^2+; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat and some wood peat.
-3.15 to -3.61	5	2.5YR 2.5/1; Sh3 $Tl^2$1 Th^2+; Humo 3; Reddish black completely disintegrated organic material with wood peat and some herbaceous peat. Diffuse contact in to:
-3.61 to -4.15	4	2.5YR 2.5/1; Sh2 $Tl^2$2 Th^2+; Humo 3; Reddish black completely disintegrated organic material and wood peat with some herbaceous peat.
-4.15 to -4.42	3	10YR 3/2; Ag2 As1 $Dl^2$1 Sh+; Humo 2; Very dark greyish brown clayey silt with detrital wood and some completely disintegrated organic material. Diffuse contact in to:
-4.42 to -4.65	2	2.5YR 2.5/1; Ag2 Sh2 Dl^2+; Humo 3; Reddish black silt with completely disintegrated organic material and some detrital wood. Sharp contact in to:
-4.65 to -5.15	1	2.5Y 4/2; Gg2 Ga2; Dark greyish brown sand and gravel.

Table 5: Lithostratigraphic descriptions of Borehole <BH4>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Composition
1.06 to 0.51	11	10YR 4/1; As3 Ag1, rootlets+; Dark grey silty clay with modern rooting; Sharp contact in to:
0.51 to 0.06	10	10YR 4/2 to 10YR 5/1; As4; Dark greyish brown to grey clay; Diffuse contact in to:
0.06 to -0.94	9	7.5YR 4/3; As4 Ag+; Brown clay with some silt.
-0.94 to -1.32	8	7.5YR 4/3; As3 Ag1; Brown silty clay. Diffuse contact in to:
-1.32 to -1.68	7	Gley1 4/10Y; As3 Ag1 Sh+; Humo 4; Dark greenish grey silty clay with completely disintegrated organic material. Sharp contact in to:
-1.68 to -1.94	6	2.5YR 2.5/1; Sh3 $Th^{2}1$; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat.
-1.94 to -2.94	5	2.5YR 2.5/1; Sh3 $Th^{3}1$ Tl^{2}+; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat and some wood peat.

-2.94 to -3.20	4	2.5YR 2.5/1; $Th^{2}2$ Sh2; Humo 2; Reddish black completely disintegrated organic material and herbaceous peat. Diffuse contact in to:
-3.20 to -3.94	3	2.5YR 2.5/1; Sh2 $Th^{1}1$ $Tl^{1}1$; Humo 2; Reddish black completely disintegrated organic material with herbaceous and wood peat.
-3.94 to -4.65	2	5YR 2.5/1; Ag2 As1 $Dl^{2}1$ $Dh^{2}+$; Humo 3; Black clayey silt with detrital wood and some detrital herbaceous material. Sharp contact in to:
-4.65 to -4.94	1	2.5Y 4/2; Gg2 Ga2; Dark greyish brown sand and gravel.

Table 6: Lithostratigraphic descriptions of Borehole <BH6>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	**Unit number**	**Composition**
1.03 to 0.79	14	10YR 4/1; As3 Ag1, rootlets+; Dark grey silty clay with modern rooting; Sharp contact in to:
0.79 to 0.37	13	10YR 6/4; Ga4; Light yellowish brown sand; Sharp contact in to:
0.37 to 0.03	12	10YR 4/2; As4; Dark greyish brown clay; Diffuse contact in to:

0.03 to -0.47	11	10YR 4/2; As4 Ag+; Dark greyish brown slightly silty clay. Diffuse contact in to:
-0.47 to -0.97	10	Gley1 4/10Y; As4 Ag+ Sh+; Humo 3; Dark greenish grey slightly silty clay with some completely disintegrated organic material.
-0.97 to -1.73	9	Gley1 4/10Y; As3 Ag1 Sh+ Dh^2+; Dark greenish grey silty clay with some completely disintegrated organic material and some detrital herbaceous material. . Sharp contact in to:
-1.73 to -1.97	8	2.5YR 2.5/1; Sh3 $Th^2$1; Humo 3; Reddish black completely disintegrated organic material with herbaceous peat.
-1.97 to -2.97	7	2.5YR 2.5/1; Sh2 $Th^2$2 Tl^2+; Humo 3; Reddish black completely disintegrated organic material and herbaceous peat with some wood peat.
-2.97 to -3.30	6	2.5YR 2.5/1; Sh2 $Tl^2$1 $Th^2$1; Humo 3; Reddish black completely disintegrated organic material, herbaceous peat and wood peat Diffuse contact in to:
-3.30 to -3.87	5	2.5YR 2.5/1; Sh2 $Th^2$2 Tl^2+; Reddish black completely disintegrated organic material and herbaceous peat with some wood peat. Sharp contact in to:
-3.87 to -3.97	4	7.5YR 4/3; Ag3 As1; Brown clayey silt.
-3.97 to -4.60	3	10YR 3/2; Ag2 As1 $Dl^2$1 Sh+; Humo 2; Very dark greyish brown clayey silt with detrital wood. Diffuse contact in to:
-4.60 to -	2	2.5YR 2.5/1; Sh2 Ag1 $Dl^2$1 Dh+; Humo 3; Reddish black silty completely disintegrated organic material with detrital wood and some detrital herbaceous material. Sharp contact in to:

4.80		
-4.80 to -4.97	1	2.5Y 4/2;Gg3 Ga1; Dark greyish brown sandy gravel.

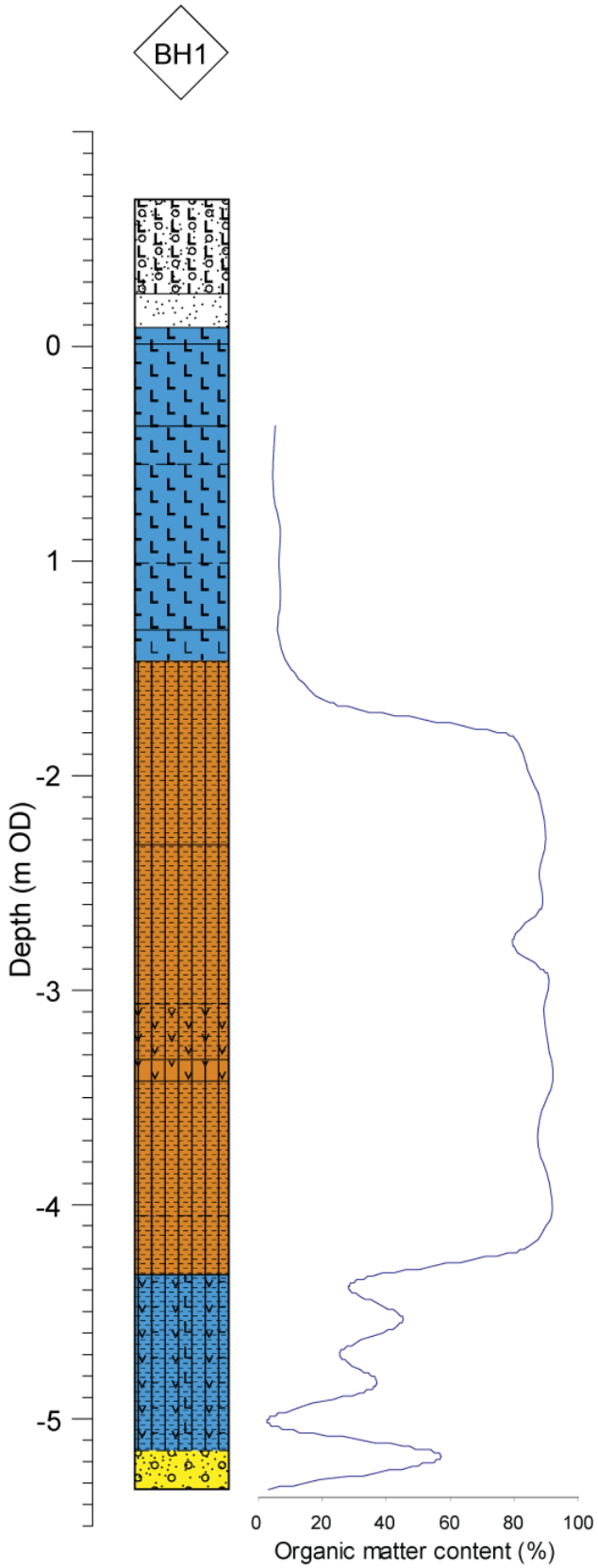


Figure 4: Organic matter content values for Borehole <BH1>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Table 7: Organic matter content values for Borehole <BH1>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Organic matter (%)
-0.35 to -0.36	12	4.31
-0.51 to -0.52	12	3.67
-0.67 to -0.68	11	3.79
-0.83 to -0.84	11	5.99
-0.99 to -1.00	11	5.51
-1.15 to -1.16	10	5.89
-1.32 to -1.33	9	5.19
-1.47 to -1.48	9	8.71
-1.63 to -1.64	8	21.59
-1.79 to -1.80	8	79.18
-1.95 to -1.96	8	83.68
-2.11 to -2.12	8	87.76
-2.27 to -2.28	8	89.37
-2.43 to -2.44	7	87.37
-2.59 to -2.60	7	88.23
-2.75 to -2.76	7	78.98
-2.91 to -2.92	7	90.21
-3.07 to -3.08	6	88.78
-3.23 to -3.24	6	90.06
-3.39 to	5	91.71

-3.40		
-3.55 to -3.56	4	87.91
-3.71 to -3.72	4	86.96
-3.87 to -3.88	4	90.58
-4.03 to -4.04	4	91.23
-4.19 to -4.20	3	82.55
-4.35 to -4.36	2	28.51
-4.51 to -4.52	2	44.55
-4.67 to -4.68	2	24.58
-4.83 to -4.84	2	35.81
-4.99 to -5.00	2	1.90
-5.15 to -5.16	1	56.64
-5.31 to -5.32	1	2.20

RESULTS OF THE POLLEN-STRATIGRAPHIC ASSESSMENT

Fourteen sub-samples were extracted from borehole <BH1> for assessment of the pollen content (Table 9). In the eleven sub-samples collected from the wood and herbaceous peat units overlying the sand and gravels (between -5.00m and -1.79m OD), the concentration of pollen was variable (very high to very low), and the preservation generally good. Microscopic charred particles were absent through this part of the sequence. The main taxa included *Alnus* (alder), Poaceae (grass family), Cyperaceae (sedge family), *Dryopteris* type (e.g. buckler fern), *Polypodium vulgare* (polypody) and occasional cf *Menyanthes trifoliata* (bog bean). This assemblage is indicative of wet woodland dominated by alder, with an understorey of grasses, sedges, aquatics and ferns. The presence of *Chenopodium* type towards the base of the peat sequence (-4.99 to -5.00m OD) may potentially represent the local growth of salt-marsh plants (e.g. *Sueada maritima* – annual seablite). The presence of a number of *Calluna vulgaris* (heather) pollen grains at -3.07 to -3.08m OD, is also of note, as the growth of heather on the peat surface may be indicative of more acidic conditions. *Quercus* (oak), *Betula* (birch), *Ulmus* (elm) and *Corylus* type (e.g. hazel) may also have grown on the wetland, but are equally likely to have formed mixed deciduous woodland on the dryland with *Tilia* (lime) and possibly *Pinus* (pine).

In the three sub-samples collected from the overlying alluvium (between -1.48m and -0.59m OD), the concentration and preservation of pollen remains was moderate to high. The main taxa included Cyperaceae (sedge family), Poaceae (grass family), *Sinapis* type (e.g. white mustard), Lactuceae (e.g. daisy family), *Aster* type (e.g. sea aster), *Chenopodium* type ((e.g. *Sueada maritima* – annual seablite) and *Alnus* (alder). This assemblage is indicative of a herb-rich community including the presence of salt marsh taxa. The presence of Dinoflagellate cysts is also indicate of a marine influence during this period. The presence of microscopic charred particles also increased during this period.

Table 8: Pollen-stratigraphic assessment of Borehole <BH1>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Concentration	Preservation	Microscopic charcoal	Main taxa	
					Latin name	Common name
-0.59 to -0.60	11	4-5	2-3	2	*Alnus* *Quercus* Cyperaceae Poaceae *Plantago* type Lactuceae *Chenopodium* type *Sinapis* type *Aster* type *Dryopteris* type Dinoflagellate cyst	Alder Oak Sedge family Grass family e.g. Ribwort plantain Daisy family e.g. Annual seablite e.g. White mustard e.g. Buckler fern
-1.15 to -1.16	10	1-2	2	2-3	Cyperaceae *Sinapis* type *Dryopteris* type Dinoflagellate cyst	Sedge family e.g. White mustard e.g. Buckler fern
-1.47 to -1.48	9	4-5	3-4	1	*Alnus* *Pinus* *Quercus* Poaceae Lactuceae Cyperaceae *Chenopodium* type *Pteridium aquilinum*	Alder Pine Oak Grass family Daisy family Sedge family e.g. Annual seablite Bracken
-1.79 to -1.80	8	2	3	0	*Alnus* *Quercus* cf *Fraxinus* Cyperaceae Dinoflagellate cyst	Alder Oak Ash Sedge family
-2.11 to -2.12	8	1	3	0	*Quercus* Cyperaceae	Oak Sedge family
-2.43 to -2.44	7	1	3	0	*Pinus* Cyperaceae	Pine Sedge family
-2.75 to -2.76	7	3	4	0	*Alnus* *Betula* *Quercus* *Ulmus* *Tilia*	Alder Birch Oak Elm Lime

					Corylus type Poaceae	e.g. Hazel Grass family
-3.07 to -3.08	6	5	5	0	*Alnus* *Quercus* *Ulmus* *Corylus* type *Hedera* *Calluna vulgaris* Cyperaceae *Polypodium vulgare*	Alder Oak Elm e.g. Hazel Ivy Heather Sedge family Polypody
-3.39 to -3.40	5	5	4	0	*Alnus* *Quercus* *Ulmus* *Betula* *Corylus* type Cyperaceae *Polypodium vulgare* *Dryopteris* type	Alder Oak Elm Birch e.g. Hazel Sedge family Polypody e.g. Buckler fern
-3.79 to -3.80	4	1	4	0	*Tilia*	Lime
-4.03 to -4.04	3	2	3-4	0	*Pinus* *Alnus* *Quercus* *Tilia* *Corylus* type cf *Menyanthes trifoliata* *Dryopteris* type *Polypodium vulgare*	Pine Alder Oak Lime e.g. Hazel Bog bean e.g. Buckler fern Polypody
-4.35 to -4.36	2	2-3	3	0	*Pinus* *Alnus* *Quercus* *Corylus* type *Dryopteris* type *Polypodium vulgare*	Pine Alder Oak e.g. Hazel e.g. Buckler fern Polypody
-4.67 to -4.68	2	2	3	0	*Pinus* *Quercus* *Betula* *Corylus* type Poaceae	Pine Oak Birch e.g. Hazel Grass family
-4.99 to -5.00	2	5	4	0	*Alnus* *Quercus* *Betula* *Ulmus* *Corylus* type Poaceae	Alder Oak Birch Elm e.g. Hazel Grass family

Key: 0 = 0 estimated grains per slide; 1 = 1 to 75; 2 = 76 to 150; 3 = 151 to 225; 4 = 226-300; 5 = 300+. Estimated number based on assessment of 10% of total number of slide transects (4 of 40 transects)

RESULTS AND INTERPRETATION OF THE DIATOM ASSESSMENT

Thirteen sub-samples from borehole <BH1> were extracted for the assessment of diatoms. There were no identifiable diatoms present on the slides from any sample (Table 10). Diatom valve breakage and silica dissolution was a common occurrence, and may have altered the diatom assemblage significantly (see Flower, 1993; Ryves *et al.*, 2001).

Table 9: Diatom-stratigraphic assessment of Borehole <BH1>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Unit number	Concentration	Preservation	Main taxa
-0.43 to -0.44	12	0	-	-
-0.59 to -0.60	11	0	-	-
-0.75 to -0.76	11	0	-	-
-0.91 to -0.92	11	0	-	-
-1.07 to -1.08	10	0	-	-
-1.23 to -1.24	10	0	-	-
-1.39 to -1.40	9	0	-	-
-1.55 to -1.56	9	0	-	-
-4.43 to -4.44	2	0	-	-
-4.59 to -4.60	2	0	-	-
-4.75 to -4.76	2	0	-	-
-4.91 to -4.92	2	0	-	-
-5.07 to -5.08	2	0	-	-

RESULTS AND INTERPRETATION OF THE WATERLOGGED PLANT MACROFOSSIL (SEEDS AND WOOD) ASSESSMENT

Eighteen 10cm sub-samples taken from the organic horizons in borehole <BH1> (between -1.56 and -5.06m OD) were processed and assessed for waterlogged plant macrofossils.

The results of the waterlogged plant macrofossil assessment (Table 10) indicate that a low to moderate quantity of wood and seeds were preserved in the the organic horizons of borehole <BH1>. Waterlogged wood was generally better preserved in the lowest metre of the organic horizons in borehole <BH1> (between -3.96 and -5.06m OD) and consisted largely of fragments of possible alder (cf. *Alnus glutinosa*) and birch (cf. *Betula pubescens*). Above -3.96m OD waterlogged wood was present in low quantities, and consisted largely of unidentifiable fragments.

The waterlogged seed preservation was generally low to moderate throughout borehole <BH1>, with the exception of two horizons between -3.76 to -4.26 and -4.76 to -4.96m OD, where preservation was good. The waterlogged seed assemblages here consisted largely of birch (*Betula* sp.) and bogbean (*Menyanthes trifoliata*) in the upper horizon (-3.76 to -4.26m OD), and Alder (*Alnus* sp.) between -4.76 and -4.96m OD. Above -3.76m OD the waterlogged seed assemblage consisted largely of sorrel (*Rumex* sp.) and unidentifiable seed fragments and fruit skins, in low to moderate quantities.

RESULTS AND INTERPRETATION OF THE INSECT ASSESSMENT

Eighteen 10cm sub-samples taken from the organic horizons in borehole <BH1> (between -1.56 and -5.06m OD) were processed and assessed for insect remains. No insect remains were found in the sub-samples from borehole <BH1> (Table 10).

Table 10: Results of the waterlogged plant macrofossil (seeds and wood) and insect assessment of Borehole <BH1>, Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley (site code: ABB09)

Depth (m OD)	Fraction	Charcoal	Charred seeds	Waterlogged Wood	Waterlogged Seeds	Insects	Main taxa	Common name
-1.56 to -1.66	>300 µm	0	0	1	0	0	Unidentifiable	
-1.56 to -1.66	>1mm	0	0	1	1	0		
-1.76 to -1.86	>300 µm	0	0	1	0	0	Unidentifiable	
-1.76 to -1.86	>1mm	0	0	1/2	1	0		
-1.96 to -2.06	>300 µm	0	0	0	1	0	cf. *Rumex* sp.	cf. Dock/sorrel
-1.96 to -2.06	>1mm	0	0	1/2	2	0		
-2.16 to -2.26	>300 µm	0	0	0	0	0	cf. *Rumex* sp.	cf. Dock/sorrel
-2.16 to -2.26	>1mm	0	0	0	1	0		
-2.36 to -2.46	>300 µm	0	0	0	0	0	Unidentifiable	
-2.36 to	>1m	0	0	1/2	0	0		

-2.46	m							
-2.56 to -2.66	>300 µm	0	0	0	0	0	cf. *Rumex* sp.	cf. Dock/sorrel
-2.56 to -2.66	>1mm	0	0	1/2	1	0		
-2.76 to -2.86	>300 µm	0	0	0	0	0	cf. *Rumex* sp.	cf. Dock/sorrel
-2.76 to -2.86	>1mm	0	0	1/2	1	0		
-2.96 to -3.06	>300 µm	0	0	0	0	0		
-2.96 to -3.06	>1mm	0	0	1	0	0		
-3.16 to -3.26	>300 µm	0	0	0	0	0	*Betula* sp.; Unknown	Birch
-3.16 to -3.26	>1mm	0	0	1/2	2	0		
-3.36 to -3.46	>300 µm	0	0	0	0	0		
-3.36 to -3.46	>1mm	0	0	0	1	0		
-3.56 to -3.66	>300 µm	0	0	0	0	0		
-3.56 to -3.66	>1mm	0	0	1	0	0		
-3.76 to -3.86	>300 µm	0	0	1	0	0	*Betula* sp.; *Menyanthes trifoliata*	Birch; bogbean
-3.76 to -3.86	>1mm	0	0	1	2	0		
-3.96 to -4.06	>300 µm	0	0	0	0	0	*Betula* sp.; *Menyanthes trifoliata*	Birch; bogbean
-3.96 to	>1m	0	0	1/2	2/3	0		

-4.06	m							
-4.16 to -4.26	>300 µm	0	0	0	1/2	0	*Menyanthes trifoliata*	Bogbean
-4.16 to -4.26	>1m m	0	0	1/2	2	0		
-4.36 to -4.46	>300 µm	0	0	0	0	0		
-4.36 to -4.46	>1m m	0	0	1/2	0	0		
-4.56 to -4.66	>300 µm	0	0	1	0	0		
-4.56 to -4.66	>1m m	0	0	2	0	0		
-4.76 to -4.86	>300 µm	0	0	0	0	0	*Alnus* sp.; *Ranunculus* sp.;	Alder; e.g. creeping buttercup
-4.76 to -4.86	>1m m	0	0	2	2	0		
-4.96 to -5.06	>300 µm	0	0	0	1/2	0	*Alnus* sp.	Alder
-4.96 to -5.06	>1m m	0	0	2	1/2	0		

Key: 0 = Estimated minimum number of specimens = 0; 1 = 1 to 25; 2 = 26 to 50; 3 = 51 to 75; 4 = 76 to 100; 5 = 101

DISCUSSION AND CONCLUSIONS

The sequence of deposition can be divided into five main stratigraphic units, in order of deposition as follows:

1. Coarse-grained mineral-rich sediments dominated by gravels and sands probably representative of the Pleistocene Shepperton Gravel were recorded at the base of the sequence. The surface elevation of these deposits was lowest in borehole <BH1> (-5.14m OD) and marginally higher in all other boreholes (ca. -4.65m OD)
2. Up to 0.9m of alluvial fine grained mineral-rich deposits overlay the Pleistocene Gravel deposits in all boreholes except borehole <BH1>
3. Wood and herbaceous peat deposits representative of a shift towards semi-terrestrial conditions were recorded overlying the alluvium in all boreholes. The peat deposits were thickest in borehole <BH1>
4. Alluvial fine grained mineral-rich deposits sharply overlay the peat deposits in all boreholes
5. Made Ground of variable thickness truncated the natural deposits in all boreholes.

The biostratigraphic record (pollen and waterlogged plant macrofossils) indicates that during the deposition of the alluvium, and in particular the organic-rich horizons the wetland was dominated by alder and birch, with an understorey of grasses, sedges and semi-aquatic taxa. On the dryland, the pollen-stratigraphic assessment indicates the presence of mixed deciduous woodland dominated by lime. Oak, birch, elm and hazel (at minimum) may have grown on both the wetland and dryland surface. No definitive indicators of anthropogenic activity (e.g. cereals) were recorded during the assessment.

RECOMMENDATIONS

The sequence recorded within borehole <BH1> has good potential for reconstructing the environmental history of the site and its environs. In particular, the preservation and concentration of pollen, whilst variable, is more than sufficient to allow reconstruction of the vegetation history in this area of the Lower Thames Valley. The presence of *Ulmus* and *Tilia* indicate the potential for investigating the elm and lime decline, whilst the lack of *Taxus* pollen is of interest, indicating the absence of yew from this part of the Lower Thames Valley. In addition, high resolution pollen analysis will identify the presence or absence of human activity in the local area.

It is therefore recommended that high resolution pollen analysis in combination with a programme of radiocarbon dating, and identification of the waterlogged wood taxa should be carried out on the captured sequence from borehole <BH1> in order to increase

knowledge and understanding of the environmental history of this part of the Lower Thames Valley.

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Appendix B – OASIS Form

OASIS ID: aocarcha1-63833

Project details

Project name	Bexley Pupil Referral Unit, Abbey Wood, Bexley
Short description of the project	Five boreholes located to the east and west of an existing Pupil Referral Unit were excavated using a percussion engine, operated by a trained geo-archaeologist. Continuous boreholing was used until natural gravels were reached, obtaining core samples of the sediments. It was discovered that there were deep deposits of alluvial clay and peat below a surface layer of made ground.
Project dates	Start: 15-09-2009 End: 18-09-2009
Previous/future work	Yes / Not known
Any associated project reference codes	30548 - Contracting Unit No.
Any associated project reference codes	ABB09 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Community Service 1 - Community Buildings
Methods & techniques	'Environmental Sampling','Vibro-core'
Development type	Large/ medium scale extensions to existing structures (e.g. church, school, hospitals, law courts, etc.)
Prompt	Direction from Local Planning Authority - PPG16

Position in the planning process	After full determination (eg. As a condition)

Project location

Country	England
Site location	GREATER LONDON BEXLEY BEXLEY Bexley, Pupil Referral Unit, Lensbury Way, Abbey Wood, Bexley
Postcode	SE2 9TA
Study area	2.20 Hectares
Site coordinates	TQ 47522 79371 51.4935009322 0.125299895739 51 29 36 N 000 07 31 E Point

Project creators

Name of Organisation	AOC Archaeology
Project brief originator	Local Planning Authority (with/without advice from County/District Archaeologist)
Project design originator	AOC Archaeology
Project director/manager	Andy Leonard
Project supervisor	Paul Harris
Type of sponsor/funding body	Developer
Name of sponsor/funding body	Mouchel

Project archives

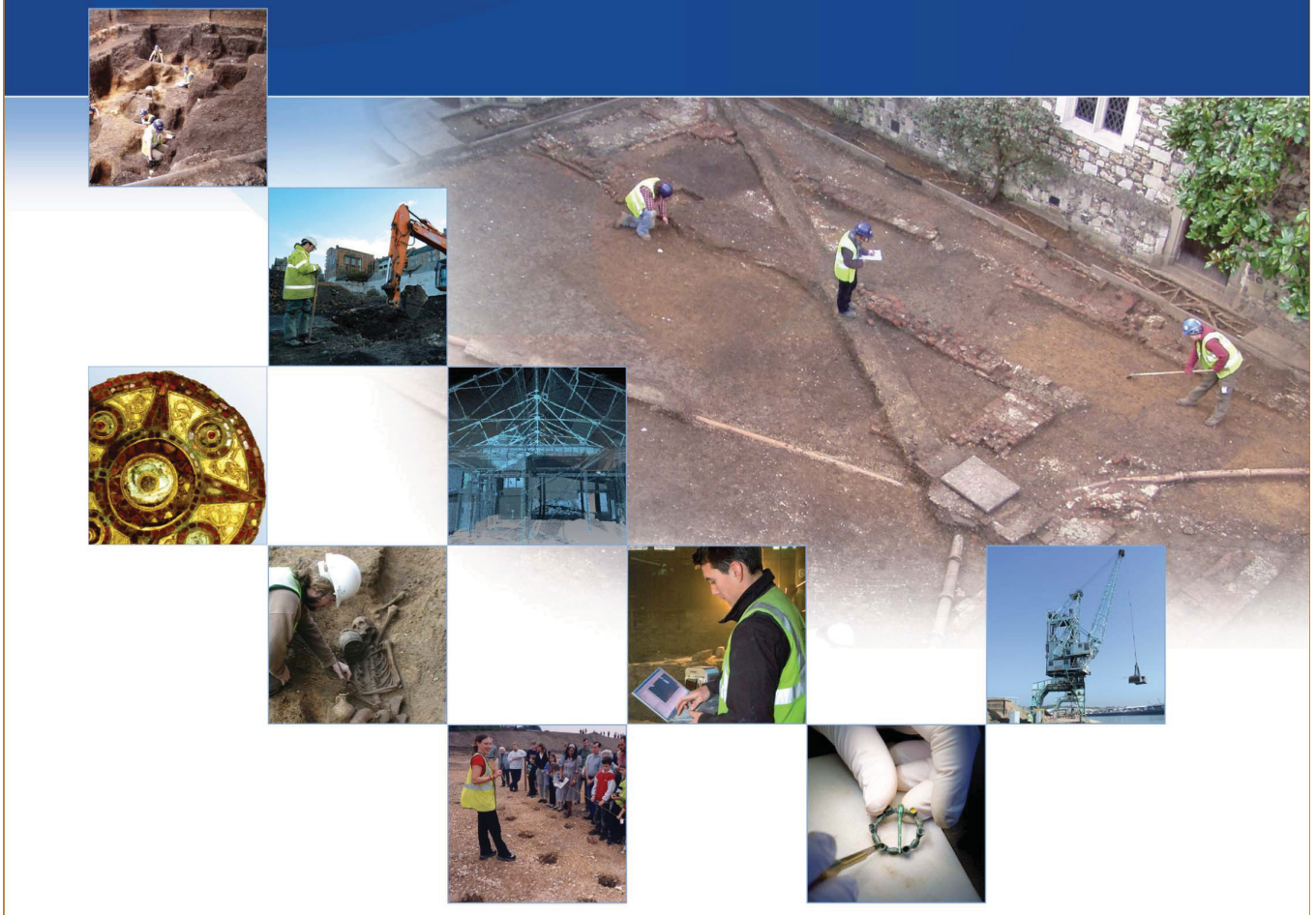
Physical Archive recipient	Museum of London
Physical Contents	'Environmental'
Digital Archive recipient	Museum of London-LAARC
Digital Media available	'Images raster / digital photography','Survey'
Paper Archive recipient	Museum of London-LAARC
Paper Media available	'Miscellaneous Material','Unpublished Text'

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Bexley Pupil Referral Unit, Abbey Wood, London Borough of Bexley; A Geo-archaeological Borehole Survey Report
Author(s)/Editor(s)	Harris, P.
Date	2009
Issuer or publisher	AOC Archaeology, Twickenham
Place of issue or publication	London

Entered by	Paul Harris (Paul.harris@aocarchaeology.com)

Entered on	20 October 2009



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