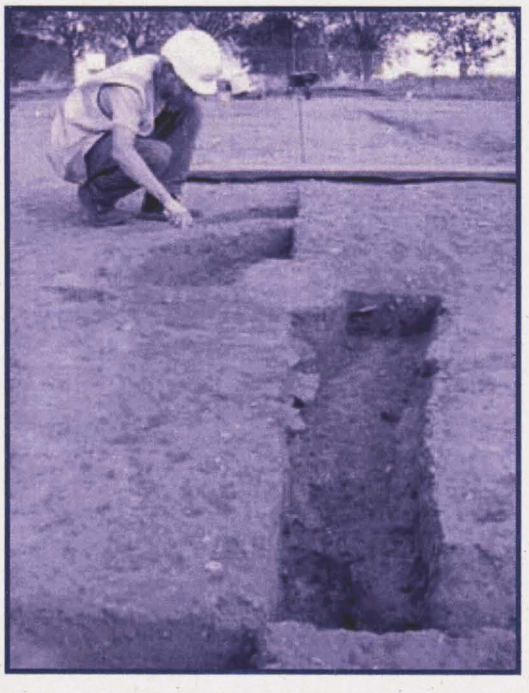

Beam Washlands
Dagenham
Greater London

Post Excavation Assessment and Updated Project Design

oxfordarchaeology

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Halcrow Group Ltd
on behalf of the Environment Agency

Beam Washlands, Dagenham, Greater London

NGR : TQ 502 836

POST-EXCAVATION ASSESSMENT AND UPDATED PROJECT DESIGN

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Oxford Archaeology

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SUMMARY

Between July 2005 and August 2006 Oxford Archaeology carried out work within the site of Beam Washlands, Dagenham, Greater London (NGR: TQ 502 836) in advance of development. The fieldwork revealed archaeological remains of dating from the late Glacial through to through to the late Roman period, as well as a small number of features belonging to the post-Roman period.

A geoarchaeological investigation, supported by radiocarbon dating, revealed a well-preserved organic/peat sequence beginning in the late glacial (late Devensian) period. Pollen evidence suggests a landscape, before the late Mesolithic, that was dominated by pine, birch and willow, with buttercup and sedges also present.

Early Mesolithic activity was represented by two concentrations of worked flint recovered from the interface between a fluvial deposit and a layer of peat that began to accumulate in the late mesolithic. Residual worked flint artefacts (including a leaf-shaped arrowhead) of Neolithic and Bronze Age date were recovered from later features. Also revealed was a burnt flint deposit by the edge of the Wantz Stream that dated to the Bronze or Iron Age.

All activity of Iron Age date was concentrated in the north-western part of the development area. This included a middle Iron Age ditch aligned WNE-ESE and a cluster of pits, one of which contained a charcoal layer, which may suggest an industrial function. Also revealed was a group of postholes of middle Iron Age date which did not form any clear pattern or structure. An improvement in environmental conditions may have prompted the earliest habitation on the site in the Iron Age.

In the early Roman period the north-western part of the site (Area 1) had a domestic and economic focus. There was a large enclosure of middle to late 1st century date, which was sub-divided internally; fencelines and postholes within the south-eastern part of the enclosure formed a possible working area. South-east of the enclosure was a possible trackway which defined the northern limit of a group of pits. Two curvilinear gullies and a possible waterhole were situated to the south-east of the pit group. In the far south east of the site (Area 2), at the edge of the promontory, was a cremation cemetery of 1st century date and a possible associated pyre site down by the edge of the Wantz stream.

In the middle Roman period the main focus of activity remained in the north-western part of the site where the pattern of land division changed and new enclosure ditches were imposed over the top of the earlier ones. The southern boundary of the earlier enclosure was reaffirmed and the area to the north of it was subdivided into two main areas by an S-shaped ditch. New spaces were created by new internal dividing ditches from which a large assemblage of domestic pottery was recovered. In the later 2nd century the main enclosure was extended to the north and the main area to the south of the S-shaped ditch was subdivided into eastern and western areas. The western area contained two wells, one succeeding the other in use. To the east of the dividing ditch, two single chambered pottery kilns of early 2nd to early 3rd century date were discovered and again one succeeded the other in use. Prolonged kiln use was suggested by successive layers of ash and debris and evidence of cleaning out. Pottery wasters were also recovered. In the far south-eastern

part of the enclosure a circle of postholes may represent a workshop or other structure associated with this activity.

By the late Roman period activity had shifted to the south of the main area of earlier enclosure and the earlier features had silted up. Two parallel ditches of 3rd to 4th century date 45 m apart were excavated. The northernmost ditch showed evidence of up to three recuts and followed the line of a relict palaeochannel. These probably functioned as drainage ditches. A cremation burial had been inserted into the upper fill of the northernmost ditch and contained much earlier pottery than that from the ditch fill, suggesting curation of the pot for ritual purposes. In the far south of the site the earliest ditch defining the promontory had silted up in this period, marking the beginnings of a substantial boundary, the use of which would extend into the post-medieval period.

Overall, the long sequence of settlement and well-preserved stratigraphy, coupled with the site's location within an intensely occupied but partially-understood landscape, ensure that the site is of importance and can contribute to priorities set out in regional research frameworks. Some of the results are of particular significance:

- *The peat and organic sequences dating from the late glacial period (late Devensian) onwards are an exceptionally rare survival. They offer enormous potential to examine changes in climate, landscape, land-use, sea-level change.*
- *Early Mesolithic flint spreads provides much-needed evidence for activity of this period in the area.*
- *The Roman pottery kilns and associated structures give insight into the organisation of small-scale pottery production, and allow questions relating to its place within a wider Thameside industry to be pursued.*
- *The early Roman cemetery presents useful evidence for rural burial practice in the East London/south Essex area.*

1 INTRODUCTION

1.1.1 This document represents an Assessment and Updated Project Design for fieldwork undertaken by Oxford Archaeology on the site of the flood alleviation scheme at Beam Washlands between July 2005 and August 2006 (see Table 1). The document has been prepared in accordance with the conditions set out in the written schemes of investigation for fieldwork (OA 2005b; 2006a), and follows a structure prescribed by English Heritage MAP 2 (1991). The document summarises the key results of the fieldwork, presents the preliminary phasing and dating evidence, and proposes methods for further research, reporting, and archive preparation with reference to regional and national research frameworks.

2 PROJECT BACKGROUND

2.1 Location and scope of work

2.1.1 The Environment Agency proposed the construction of a flood alleviation scheme at the site of the Washlands Reservoir on the Beam River to the south-west of the demolished Dagenham Hospital, Dagenham, Greater London at NGR TQ 502 836 (Fig 1).

2.1.2 For the purposes of the proposed development the site was divided into three areas of work. Area 1 encompassed the north-western part of the site, and Area 2 made up the south-eastern part of the development area. Area 3 focused on the embankment located to the south, west and east. A public footpath that leads to the north-east from the housing estate to the south-west divides areas 1 and 2 and is subsequently used as a reference point in the text (Fig. 2)

2.2 Geology and topography

2.2.1 The development site is located close to the end of a shallow SSW - NNE aligned spur *c* 200 m north of the confluence between the River Beam to the east and the Wantz Stream (one of its tributaries) to the west. This site is *c* 1 km south of the historic core of Dagenham, which developed further upstream at a suitable crossing point on the Wantz. The current course of the Beam River marks the boundary between the London Borough of Barking and Dagenham and The London Borough of Havering to the east.

2.2.2 The site is situated on a south-western side of the gravel promontory between the River Wantz and the River Beam. A break of slope that formed the edge of the Wantz flood plain ran along the western side of the site at the top of which was a gentle slope running from the highest part of the site in the north east down to the lower part in the south.

2.2.3 Area 1 was located on the western side and towards the end of the spur where the ground slopes down gently westwards. Area 2 is located on the end of the spur. The Area 3 was located just to the south of the end of the spur and adjacent to the Beam.

2.2.4 The Embankment is split into two sections that form part of the Environment Agency's flood control scheme for the Beam and Wantz watercourses. One length runs immediately adjacent to (and on the south western bank of) the Wantz and the second element runs parallel to the eastern bank of the Beam.

2.2.5 The underlying geology consists of London Clay which has been overlain by Mucking Gravels of the first terrace (BBS South Sheet, Fourth Edition Solid, 2001, BGS South Sheet, First Edition Quarternary, 1977). The site is situated on the western periphery of the River Beam floodplain, and *c* 1 km to the north of the Thames floodplain.

2.3 Archaeological and Historical Background

2.3.1 A distribution of archaeological discoveries made in the area in which Beam Washlands is located is presented in Figure 11. It is apparent that, though sites of prehistoric and Roman date are well represented, few contain the depth of sequence recorded at Beam Washlands. And the value of the findings made at Beam Washlands is further enhanced by the observation that the area immediately surrounding the site location is relatively devoid of archaeological sites, a gap that the fieldwork has therefore helped to fill.

2.3.2 A number of key discoveries in the region, highlighted here as a point of comparison, may aid understanding of the archaeology at Beam Washlands, or point the way to areas of further research.

Palaeolithic

2.3.3 Evidence from the Palaeolithic period is largely confined to isolated find spots. Palaeolithic hand axes have been found at Barking Creek, near Uphall, on Ripple Road, Gale Street, Five Elms and Beacontree Heath.

Mesolithic

2.3.4 Evidence from the Mesolithic period is also confined to find spots, mainly consisting of lithic finds from the alluvial deposits on the banks of the Thames and sealed by peat. The stratified flint concentrations at Beam Washlands potentially offer better understanding of Mesolithic activity and environment in the area.

Neolithic and Bronze Age

2.3.5 Little evidence of Neolithic and Bronze Age activity was recorded at Beam Washlands, but features of this date have been revealed in the vicinity, including a few ring ditches (GLSMR 012497; GLSMR 058298) 2-3 km to the north of the site, identified by aerial photography. The main focus of prehistoric activity nearby was in the lower Ingrebourne Valley at Rainham. This activity included an occupation site and trackway at Bridge Road, Rainham, and an early Neolithic settlement at Brookway Allotments (GLSMR 062153).

Iron Age

2.3.6 Iron Age evidence is not well represented in the immediate vicinty of Beam Washlands. Further away, an Iron Age hillfort was situated at Uphall, *c* 6 km to the west of the site, while a settlement (GLSMR 061906) was discovered at Abbey Road, Barking (MoLAS 2000). Sites are located in Rainham *c* 6-7 km east of Dagenham include a large triple-ditched enclosure/hill-fort and a middle Iron Age settlement or farmstead (GLSMR 060062, 060059). More Iron Age sites have been identified in Redbridge and Havering, including a field system and a cropmark site (GLSMR 060335) at Eastern Avenue, Ilford. An Iron Age farmstead (GLSMR 060802) was excavated at Goodmayes Hospital, Redbridge, while enclosures, ring ditches, pits and postholes were recorded at Redlands Quarry (GLSMR 06105, 6, 8, 10).

Roman

2.3.7 A concentration of Roman funerary activity was identified just across the Beam River, approximately 0.5 km to the south-east of the site. This site, at Mardyke estate comprised a cremation and inhumation cemetery and finds including a complete flagon and a quern. Another inhumation burial and cremation burial site, approximately 200 m to the east of Mardyke estate yielded more cremation burials, and a limestone coffin containing two bodies and various glass vessels. Pottery from the urned cremation burials here suggests that this site dates to the 1st century AD, although the antiquity of the work (1928) means that this date cannot be considered conclusive.

2.3.8 The Beam Washland site adds to the list of Roman-period rural settlements in the area. A site *c* 2 km to the west of the site revealed a rectilinear enclosure (possibly with a pallisade) of Late Iron Age to early Roman date (monument ID - ML 066640). A concentration of sites have been recorded on the eastern side of the Ingrebourne Valley, *c.* 2.5 km south-east of the site. These sites include at least three farmsteads (including structural evidence), field systems, trackways, wells, enclosures (including multiple ditched enclosures) and a cemetery.

Post-Roman

2.3.9 The historic settlement of Dagenham *c* 1 km to the north of the site is at a favourable crossing point on the Wantz Stream developed as a local centre during the Saxon period and is first mentioned in AD 690. Excavations have been carried out in the town and have revealed medieval and post medieval remains.

3 FIELDWORK

3.1 Introduction

3.1.1 Work that has taken place on the site of the proposed flood alleviation scheme is summarised in Table 1.

3.1.2 *Table 1*

Event	Summary	Dates
Area 1 Evaluation	6 Trenches (Tr 1-6)	May 2005

Area 1 Strip, Map and Sample Excavation	Area to north and west of path	July-August 2005
3 Geoarchaeological boreholes	Embankment	August 2005
Area 2 Evaluation	13 Trenches (Tr 9-20)	February 2006
Area 2 Geophysical Survey (Stratascan)	Magnetic and resistance surveys	December 2005
Area 2 Strip, Map and Sample Excavation	Area to south and east of path	July-August 2006
Area 3 Borehole transect (Ponds)	Far south west of area 2 - Embankment	August 2006

3.1.3 The Area 1 evaluation (which has been the subject of a separate report: OA 2005a) consisted of 6 trenches and revealed alluvial deposits overlain by a sequence of sands and gravel interleaved with clay lenses, representing a combination of bank erosion and fluvial deposition. Archaeological features were centred on Trench 2, which identified two partially revealed features dated to the Middle Iron Age. These represented ditch termini or parts of structures and produced a significant quantity of burnt clay. Trenches 2, 5 and 6 revealed ditches aligned E-W dated to the 1st-2nd Centuries AD. A ditch identified in Trench 7, also dated to the Roman period was parallel to the extant gravel bank.

3.1.4 This evaluation lead to the Area 1 'Strip, map and sample' (henceforth SMS) excavation, which is the subject of this report (as the area to the north-west of the footpath).

3.1.5 A borehole survey (3 boreholes) was undertaken in August 2005, along the edge of the Wantz Stream (the results of this are included in this report, see section 8 and Appendix 12, below).

3.1.6 Following a review of the results of the mapping and the Stage 1 sample excavation, a strategy was designed which identified the requirements of the Stage 2 excavation works, to fulfil the objectives identified in an SMA design. This was agreed between Ben Ford of Oxford Archaeology, David Divers of David Divers of the Greater London Archaeological Advisory Service, English Heritage (GLAAS), and Andy Buckley (Area 1) and John Maloney (Areas 2 and 3) of Halcrow Group Ltd.

3.1.7 The Area 2 evaluation (which has been the subject of a separate report and which also incorporated the results of a geophysical survey), was conducted during February 2006 (OA 2006b). Archaeological features were few and dispersed throughout the evaluation area. Of particular interest were several cremation burials that appeared to be of Roman date. Several ditches were also identified but not dated. A large ditch at the south-east edge of site in Trenches 12, 18 and 19 coincided with a clear break of slope in the existing topography and appeared to be of post-medieval date.

3.1.8 OA commissioned Stratascan to undertake a geophysical survey of the southern part of the site in December 2005, after the evaluation (Heard 2005). The resistivity data

appears to correspond well with a number of the archaeological features revealed by the trial trenches. However, a number of low resistance anomalies were mapped but were not identified within the trenches. While it is possible that these anomalies represent archaeological features, they may equally represent shallow modern activity just beneath topsoil, or be of geological origin. Of note is the fact that the cremation burials (that were left *in situ*) were not identified by the geophysical survey.

3.1.9 The results of the evaluation and geophysical survey of Area 2 led to the Area 2 SMS excavation, and is the subject of this report (as the area to the south-east of the footpath).

3.1.10 Alongside the Area 2 SMS excavation, fieldwork in Area 3 consisted of geological borehole work comprising a transect of 8 boreholes extending from the south-west corner of the site, along with a watching brief on the embankment (Appendix 8).

3.1.11 The Area 1 SMS, the Area 2 evaluation, SMS and watching brief (Fig. 2) and Area 3 geoarchaeological borehole work and watching brief on the ponds area (Phase 3) were undertaken in accordance with a specification for archaeological works produced by Halcrow Group Limited and written schemes of investigation (OA 2005b; 2006a). Both documents were approved, prior to the commencement of fieldwork, by David Divers of GLAAS.

3.2 SMS fieldwork methodology (Areas 1 and 2)

3.2.1 All fieldwork followed the methodology as set out in the written schemes of investigation (OA 2005b; 2006a) and work was monitored by David Divers and Andy Buckley.

3.2.2 The site area was stripped using two mechanical excavators with wide, flat, toothless buckets under strict archaeological supervision and where appropriate in spits until the first significant archaeological horizon or natural drift geology was encountered.

3.2.3 All machining was carried out carefully to ensure close control over the depth of dig to avoid truncation of archaeological features and to keep initial hand cleaning to a minimum.

3.2.4 During and within 24 hours of the completion of stripping, archaeological features were mapped using a Total Station. This plan was subsequently updated during the course of the excavation.

3.2.5 The initial works, the stage 1 sample excavation, involved:

- the investigation of the intersections of archaeological features to phase the site,
- the excavation of structural features,
- sectioning of linear features and sampling of pits and other individual features.

3.3 Area 3 watching brief on ponds

3.3.1 A rectangular trench was dug in the proposed location of pond 3 to mitigate the effects of its creation. The sides of the trench were stepped due to its depth, the area

exposed at its base being *c* 25 x 20 m. The modern topsoil (4000) overlay a minerogenic alluvial deposit (4001) which sealed a sequence of peat/humic silt deposits within a former channel of the Wantz stream. Excavation was terminated at the formation level of the pond (-1.3 m OD) without reaching the base of this sequence, although a full sequence was recovered from the cores obtained from a transect of eight boreholes dug between the Area 2 SMS area and the current channel of the stream to the south. Two possible worked flints and some burnt flint was recovered from the bank of the channel, which formed the northern edge of the trench. The northern edge of an earlier, probably Pleistocene, channel (4014) was identified cutting into the natural gravel forming the bank and the peat sequence was itself cut by a later channel (4006).

3.3.2 A watching brief was conducted during the creation of ponds 1 and 2. The ponds were dug by a mechanical excavator fitted with a toothed bucket. While a toothless bucket would have been preferable for archaeological reasons, the choice of toothed bucket was justified on the basis of depth and composition of deposits. Pond 1 was dug to a maximum depth of 3 m and pond 2 to 2 m. In both ponds the same sequence of deposits was encountered as that in the trench dug for the mitigation of pond 3, i.e. topsoil-upper alluvium-peat, and the base of the peat was not reached. No archaeological finds or features were observed.

3.4 Geoarchaeology fieldwork methodology

3.4.1 As part of the mitigation of construction impacts on areas of archaeological potential at Beam Washlands, a programme of geoarchaeological fieldwork was undertaken between 2005 and 2006. This work aimed to investigate the floodplain sediment sequence and relate it to the archaeology of the Iron Age/Roman-period site. Two phases of borehole sampling (totalling 11 boreholes) were undertaken to collect information and samples suitable for the interpretation of the depositional environment of the sediment sequence. It also aimed to identify any post-depositional processes that may have acted upon it, with the objective of reconstructing the past environment and its significance for human activity in the three areas of development impact.

3.4.2 Three boreholes (ARCBH1, ARCBH2 and ARCBH3) were located along the Wantz Stream and River Beam (Fig. 2) and eight further boreholes (OABH1-OABH8) were located in a transect in the area of the ponds (Figs 2 and 13). Eight samples were selected from the boreholes for radiocarbon dating (Fig. 14), five from ARCHBH1-3 and a further three from OABH1-8).

3.4.3 After the first phase of geoarchaeological fieldwork was completed (ARCBH1-3) an interim geoarchaeological statement (OA 2005c) was issued. This outlined the initial findings of the borehole survey, presented sediment descriptions, a preliminary deposit model for the site (based on the purposive boreholes and additional geotechnical records), as well as recommendations for further work on the palaeoenvironmental remains (pollen, diatoms, plant macro remains and insects) and a programme of radiocarbon dating.

3.4.4 An assessment of the geoarchaeological results has been included in this report (section 8), and detailed specialist environmental assessment reports for each material category can be found in Appendix 12.

4 QUANTIFICATION OF THE ARCHIVE

4.1 Stratigraphic

Record type	Eval Area 1	SMS Area 1	Eval Area 2	SMS Area 2	Area 3	Total
Context records	40	960	80	475	32	1587
Additional sheets		98		40		138
Plans A1		10		5		15
Plans A4	7	204	13	110	11	345
Sections A1		5		1	1	7
Sections A4	7	166		178	10	361
Sample registers	1	11		5	1	18
Level sheets						
Small find registers		2		3		5
Bulk find sheets	1		1	7	1	10
Environmental transfer lists	1	11		5	1	18
Black and white films	3	31	4	18	2	58
Colour films	3	31	4	18	2	48
Survey data						

4.2 Artefactual and ecofactual material

Material	Area 1 Eval	Area 1 SMS	Area 2 Eval	Area 2 SMS	Totals
Animal bone	416 (434g)				416 (434g)
Ceramic building material (CBM)	55 (2297g)			16 (925g)	71 (3222g)
Clay pipe	3 (6g)			4 (10g)	7 (16g)
Copper alloy	2 frags			120 frags	122 frags
Fired clay	2018 (79433g)			2 (28g)	2012 (79435g)
Flint, burnt unworked	527 (6011g)			3603 (31437 g)	3655 (37448g)
Flint, worked	541 (3449g)			164 (1968g)	705 (5417g)
Glass	2 (4g)			8 (101g)	10 (105g)
human bone (cremated)				13405 (3110g)	13405 (3110g)
Iron	8 frags			30 frags	38 frags
Pottery	8687 sherds (93996g)			239 sherds (2306g)	8926 sherds (99302g)
Slag	262 (2970g)			43 (144g)	305 (3114g)
Stone	119 (1487g)			1 (4g)	120 (1491g)
Wood				1 frag	1 frag

5 STRATIGRAPHIC SUMMARY

5.1 General

5.1.1 The archaeological remains related mainly to late Iron Age and Roman activity. This material provides evidence for settlement, economic and ritual activity set in a zoned landscape. A small number of features of Saxon and post-medieval date were also revealed.

5.1.2 In general terms, the site was characterised by pits, kilns, postholes and linear features. There was a limited degree of intercutting. The site experienced some truncation associated with the construction and/or demolition of the hospital and, before that, agricultural activity.

5.1.3 There was a contrast between the number of archaeological features revealed in the north-western part of the site and the south-eastern part of the site, further towards the edge of the spur. This could be due to a genuine difference in spatial distribution or due to differing levels of horizontal truncation, implying that the remains towards the edge of the spur were damaged and largely removed by previous activities on the site. However, of those remains that were revealed nearer to the edge of the promontory many were cremation burials, in some cases with almost complete burial vessels intact. Such features are often the first to be lost with any significant level of horizontal truncation on archaeological sites, and the fact that they were found here suggests that any truncation was not severe. Features seen in the north-western part of the site such as boundary ditches, pits and wells would have been deeper than the cremation burials and therefore if they had been present they would have been seen. Consequently, the distribution of features across the site is almost certainly a genuine reflection of the spatial distribution of features and activity.

5.1.4 The nature of the feature fills made stratigraphic relationships between intercutting linear features were difficult to define, and required additional excavation to confirm important stratigraphic relationships. In one instance re-machining of one area was necessary. Sufficient evidence was retrieved to allow the archaeological activity to be divided into five provisional phases.

5.1.5 The underlying geology consisted predominantly of well-draining laminated sandy gravels (2112), occasionally intermixed with silty sands. Tertiary deposits of silty clays with interleaved sandy lenses were identified along the western edge of the site where a break of slope leads down to the current course of the Wantz Stream.

5.2 Mesolithic (*c* 10,000 - 4,000 BC)

Summary

Mesolithic activity was represented by two concentrations of early Mesolithic worked flint recovered from the interface between a fluvial deposit and a layer of peat that

formed from the late Mesolithic period. Both flint deposits were situated on the lower part of the western slope of the site at the edge of the Wantz stream.

5.2.1 In the lower area of the site, a fluvial deposit of sandy silt containing Mesolithic artefacts overlaid the Tertiary deposits, these finds were concentrated where the bank appears to have been eroded (see Figs. 3 and 6). A deposit of peat that accumulated from the late Mesolithic onwards was dated by C14 dating to *c* 5635±30BP (KIA32919) in OABH4 (base of peat) and at c.3320 ±30BP in ARCBH3 (near top of peat) (Appendix 9 and Fig. 14).

5.2.2 The early Mesolithic flints were found upon a 0.24 m thick fluvial deposit of fine, light grey sandy silt (2347) (Figs 3 and 8). The assemblage, found in two distinct groups situated at the base of the bank defining the eastern edge of the Wantz Stream valley, included blades, flakes, and a core. The flint was in a fairly fresh condition with only minimal amounts of post-depositional damage. The material is likely to be undisturbed and *in situ*, and represent short-term activity by the edge of the stream. Pollen and plant evidence from the lower sequence of ARCBH1 suggests that the environment of the early Holocene - the period to which the early Mesolithic flints belong - was a largely open environment of grasses and ferns with hazel and pine woodland.

5.2.3 Following hand cleaning and artefact recovery, three 1 m by 1 m test pits were hand excavated through the silt deposit underneath the northernmost scatter to assess if there was any vertical (downward) movement of flints, but these did not yield any more artefacts.

5.3 Neolithic and Bronze Age (*c* 4,000-800 BC)

Summary

A borehole sample of the upper peat horizon in ARCBH1 was dated by C14 to the late Neolithic to early Bronze Age. Peat formation almost certainly continued beyond this date, but was subsequently removed. Residual worked flint artefacts (including a leaf shaped arrowhead) of Neolithic and Bronze Age date were recovered from later features.

5.3.1 The upper horizon of the peat unit from ARCBH1 has been radiocarbon dated to 3765±35BP (Poz-14655) which places it in the late Neolithic to early Bronze Age period. Analysis of peat sequences points to the development from the late Mesolithic of alder carr woodland and lime-dominated mixed deciduous woodland. The landscape progresively became wetter after the late Neolithic/early Bronze Age. This is suggested by a radiocarbon date of *c* 3320±30BP (KIA32918) from the upper level of the peat in ARCBH3. The peat may have been truncated by channel activity, which would have removed the latest peat deposits (see Appendix 12).

5.3.2 Worked flint artefacts of this date were recovered and indicate a limited scale of activity in the area. All these were residual from later features. A leaf shaped arrowhead was recovered from the intersection of ditches 3514 and 3516 in the far south-eastern part of the site. It was not clear which feature it had originated from, but was almost certainly residual anyway. Other pieces of worked flint recovered could only be broadly assigned to this period, and were residual within later features.

5.4 Iron Age (*c* 800 BC - AD 43)

Summary

There was limited but significant evidence attributable to this period. All activity of Iron Age date was concentrated in the north-western part of the development area. This included a middle Iron Age ditch aligned WNE-ESE, a cluster of pits, one of which contained a charcoal layer, which may suggest a currently unidentified industrial function. Also revealed was a burnt flint deposit by the edge of the Wantz Stream, and a group of postholes of middle Iron Age date which did not form any clear pattern or structure. Geoarchaeological work has indicated that at this time a change in environmental conditions occurred making the site more desirable for occupation.

5.4.1 No archaeological evidence belonging to the early Iron Age was identified. The environment was drier by the middle Iron Age (*c* 500 BC), allowing growth of woodland and development of grassland, and eventually opening up the landscape to habitation and arable farming.

5.4.2 Linear feature (2968) extended in a WNW-ESE direction for *c* 20 m (Fig. 6). To the east and west its terminals had been truncated by two early Roman ditches (3040 and 3041). The linear feature had steep sides, a flat-concave base and measured *c* 3 m wide by up to 0.8 m deep. It was located towards the southern end of the site. The final fill of this feature contained two sherds of Middle Iron Age pottery.

5.4.3 Immediately to the south of this feature was a cluster of pits, two of which contained pottery in a sandy fabric dating to the middle to late Iron Age (2174 and 2808). The majority of these pits may have been contemporaneous but were unfortunately not dated. To the south-west of this pit group were the two middle Iron Age features from the evaluation (207 and 213). Feature 213 was interesting in that its earliest fill was a layer of charcoal, perhaps suggesting an industrial function.

5.4.4 Situated 20 m south-west of features 207 and 213 was a discrete deposit of burnt flint (2308) (Fig. 6 and Plate 5). It was located at the base of the break of slope associated with the bank of the Wantz Stream at the south-western extent of the excavation at 0.9 m OD. This deposit was irregularly shaped and covered an area roughly 4 m by 4 m in plan with a maximum thickness of 0.1 m. At its eastern extent it overlay the natural gravels, while at its western extent it overlay peat deposit 2307. No pottery or

struck flint was associated with this feature, but it was located above the peat that continued to accumulate well into the Iron Age. Potentially, the feature can be interpreted as a burnt mound. However, an Iron Age date, while not unknown, is unusual for this type of feature, which is more usually assigned to the Bronze Age. In addition, a range of typically associated evidence, such as postholes and a trough-like pit, was not uncovered.

5.4.5 Situated 70 m to the north of linear 2968 was a concentration of postholes in the central eastern part of the site (Fig. 6). Two of these dated to the middle Iron Age (2250 and 2305). They were six metres apart and had an average diameter of 0.6 m and an average depth of 0.14 m. Other undated postholes in the immediate vicinity may have been contemporary with these. Taken as a whole this group formed no coherent pattern. A significant quantity of pottery was recovered from posthole 2250 (144 sherds), consisting of shell-tempered and flint-tempered middle to late Iron Age fabrics. Another posthole (2305) contained 26 sherds of shell and grog tempered ware.

5.5 Roman, Phase 1 (AD 43-130)

Summary

In this phase the site was characterised by two main functional zones. The north-western part of the site had a domestic and economic focus with a large enclosure of mid to late 1st century date with a sub-divided internal area and further divisions to the east of the main enclosure. The enclosure ditch terminals produced a large pottery assemblage including some near complete vessels. Within the south-eastern part of the interior of the enclosure were postholes forming fence lines and structures, with a possible working area to the north of this. South-east of the enclosure was a possible trackway which defined the northern limit of a group of pits. Enclosures and a waterhole south east of the occupation appears to have been utilised for farming. In the far south east of the site, at the edge of the promontory, was a cremation cemetery of 1st century date and a possible associated pyre site down by the edge of the Wantz stream.

Area 1, zone of domestic or industrial occupation

5.5.1 The earliest Roman evidence consisted of a large enclosure formed by ditch groups 2339, 2959, 2960 and 2720, established in the mid to late 1st century (Fig. 6). The enclosure consisted of a 60 m long ditch aligned N-S with a terminal at the southern end, which formed a 4 m wide entrance. The ditch continued for another 15 m before turning west and continuing for 35 m to the edge of the break in slope where it was truncated by a modern hedge line.

5.5.2 The space within the enclosure was sub-divided. Two distinct areas along its southern edge were formed by ditches 2864, 2774 and 2806. The eastern area contained 58 postholes, the probable remains of a number of structures such as fences and

buildings, possibly for animals or storage. To the north of these was a large area with possible evidence of a working area (Group 3070). A single further dividing ditch (2352) was aligned E-W to the north of this area.

5.5.3 Other areas were partly revealed east of the enclosure. These were created sometime later by short sections of ditch (2649, 2606 and 2125). No features within these areas were contemporary with these ditches.

5.5.4 Two excavated slots at the northern extent of enclosure ditch 2339 produced by far the most significant amount of pottery (124 sherds) with some near complete vessels present. These included a Hadham white-slipped flagon, a lid-seated sandy grey ware jar, shell-tempered jars, a South Gaulish samian ware platter and a stamped oxidised ware bowl. In addition, a group of fragmented kiln bricks was recovered from upper fills of 2339 (Plate 3). A dump of slag and charcoal was also recorded from this ditch.

5.5.5 The southern ditch of this enclosure was on the same alignment as a sequence of ditches (Groups 2962, 2957, 2958, 2961, 2959 and 2960) representing a significant boundary that had been renewed on a number of occasions from the late 1st to 3rd centuries.

5.5.6 Two parallel ditches (3040 and 3041) aligned E-W were situated *c* 50 m further south of the enclosure. The ditches were sinuous in form and extended westwards to the edge of the break of slope and possibly formed a 'trackway'. The 'trackway' defined the northern edge of an area of pits. These pits have dated to the Iron Age through to the 3rd century AD, although only three were specifically dated to the early Roman period.

Area 2, open ?pastoral landscape (Fig. 7)

5.5.7 Ditch 3577 extended E-W across the eastern part of the site. No finds were recovered from the single intervention excavated through this feature, but its orientation suggests that it is associated with Roman ditches recorded in the northern half of the site, beyond the footpath, and may be a continuation of trackway ditch 3040.

5.5.8 Ditch 3607 extended NW-SE for *c* 95 m, continuing further beyond the south-eastern edge of the site. At its north-western end it turned a right angle towards north-east and extended beyond the limit of the excavation, probably to form a large enclosure. A small quantity of Roman pottery was recovered from this feature (from contexts 3582 and 3600). Its north-eastern return cut a tree throw hole (3589) and near its south-eastern end it was cut by ditch 3536.

5.5.9 Ditch 3536 extended NE-SW across the eastern end of the site, where it clearly cut ditch 3607. The only find recovered was a single sherd of Roman pottery from fill 3598 where the feature cut the earlier ditch, but this could be residual. A break in the ditch just north of the intersection with 3607 is probably the result of truncation rather than representing an original entrance, as the ditch became shallow gradually, rather than ending in a definite terminal.

5.5.10 Discrete features identified in the south-eastern part of the site were a small pit (3579) and a pit or posthole (3581). Pit 3579 was initially thought to be a cremation burial due to its black fill, but on excavation no cremated bone was present and no visible charcoal was observed, although the colour of the deposit could be due to charcoal inclusions. Posthole 3581 contained a small quantity of bone, but no dating evidence was recovered from either feature.

5.5.11 Curvilinear gully (4025) enclosed an area sub-rectangular in shape and was open on the north-east side. The enclosed space measured 6.3 m NW-SE and approximately 4m NE-SW. The gully measured around 0.45m in width and 0.1 m in depth. Its fill yielded a small amount of pottery of early Roman date. Part of the area enclosed by the gully was overlain by a possible floor layer (3338) of compacted light brownish grey sandy silt with occasional stones. No finds were recovered from this layer; the same material had accumulated in the gully.

5.5.12 A roughly-circular gully (4024), a possible stockpen yielded pottery of early Roman date. Close to this, to its east, was a large pit or waterhole (3423). This feature was 3.5 m in diameter and 0.59 m in depth and also contained pottery of early Roman date. A concentration of iron panning in the base of this feature may gave developed from standing water. This feature may have been a waterhole for livestock and associated with the use of the possible stockpen and other enclosures described above.

Cremation cemetery

5.5.13 Excavation of the central part of Area 2 revealed a group of cremation graves (Fig. 7). Thirteen graves were identified, of which only four contained pottery sherds. Three contained pottery of late Iron Age to early Roman date (two of which dated to AD10-70) and one was dated more generally to the Roman period. The cremation burials are summarised in Table 2.

5.5.14 Two cremation burials were isolated from the main group and were situated in the west of the central area, close to the break of slope down to the Wantz stream. These two features contained the more closely dateable pottery (3226 and 3228), each containing fragments of 'belgic' bead rim jars. Cremation burial 3146 also contained pottery of 1st century date but was situated among the main group, indicating that the two isolated features were at least broadly contemporary with the main group of burials.

5.5.15 Several of the cremation burials yielded metal small finds which provided dating evidence as well as information relating to burial rite. Two of the cremation burials (3136 and 3138) included fragments of copper alloy sheet which may have formed parts of vessels or containers that were cremated with the dead. One of these sheet fragments (from cremation burial 3138) had a fragment of burnt human bone attached, indicating that this was indeed a cremation burial (no bone was noted on excavation). Cremation burial 3136 also contained a fragment of copper alloy curved rod and a copper alloy tack or small nail.

5.5.16 Four cremation burials (3138, 3140, 3154 and 3158) contained iron fragments from brooches of 1st century AD date. The presence of these brooches suggests that the bodies were clothed or covered when they were cremated.

5.5.17 Cremation burial 3160 contained several iron hobnails but no dateable finds to refine the probable Roman date of this burial. Cremation burial 3144 was dated broadly to the Roman period by pottery.

5.5.18 Ten of the cremation burials contained an abundance of charcoal which was assessed. The charcoal was of mixed taxa with high potential for C14 dating. Four of the cremation deposits had rare occurrences of charcoal, suggesting that the bone had been separated from the rest of the pyre remains before burial.

5.5.19 Four ditch segments (4020, 4021, 4022 and 4023) appeared to enclose the north east and south east sides of the cremation cemetery. This enclosure may have had an entrance to the south east, where two clear terminals were identified. No finds were recovered from any of the ditch fragments, but spatially the position of the main group of cremation burials within the enclosure strongly suggests that the ditch and the burials were contemporaneous.

5.5.20 Several features at the base of the slope in the far south west of the site suggested that a pyre site existed here. Three pits and a posthole were situated together and overlain by a purple-coloured scorched sand and filled with burnt stones and large amounts of charcoal. No finds were recovered, and there little evidence to place these in the Roman period, but it is possible that this group of features were the remains of a pyre site and related to the early Roman cremation cemetery on the higher ground.

5.6 Roman Phase 2 (AD 100/130-230)

Summary

In this phase the main focus of activity remained in the north western part of the site where the pattern of land division changed and new enclosure ditches were imposed over the top of the earlier system. The southern boundary of the earlier enclosure was reaffirmed and the area to the north of it was subdivided into two main areas by an S-shaped ditch. New spaces were created by new internal dividing ditches from which a large assemblage of domestic pottery was recovered. In the later 2nd century the main enclosure was extended to the north and the main area to the south of the S-shaped ditch was subdivided into eastern and western areas. The western area contained two wells, one succeeding the other in use. To the east of the dividing ditch, two single chambered pottery kilns were discovered, similarly one succeeding the other. A long period of use was suggested by successive layers of ash and debris and evidence of cleaning out. Pottery waters were also recovered. In the far south eastern part of the enclosure a circle of postholes may represent a structure associated with this industrial activity.

5.6.1 During the 2nd century the pattern of land division observed within Area 1 was significantly altered. The alignment of the southern boundary of the former enclosure remained important and was reaffirmed by replacement ditches that served as the southern boundary to the area to its north. A large S-shaped ditch (2704) delineated the principal northern and southern areas, extending for 15 m from the eastern limit of excavation, turned broadly northwards for 25 m and returned sharply west for a further 15 m.

5.6.2 Again, as with the previous enclosure other divisional ditches were placed to create a series of spaces. Ditch 2721 created a small enclosure on the eastern side of 2704. A significant quantity of mid 2nd-century pottery had been tipped against its southern side.

5.6.3 During the later 2nd century the main enclosure was extended to the north (ditch 2346) and sub-divided into two areas by N-S ditch 2859.

5.6.4 Two phases of single-chambered pottery kilns with short flues (3067 and 3068) were built, one replacing the other within one of these two sub-areas. The later kiln (3068) was built directly on top of the earlier 3067, and some of the structural elements from the first kiln were utilised for the second (Fig. 9). Pottery from the kilns dated both phases of kiln to the early 2nd to early 3rd centuries.

5.6.5 An initial firing of the first kiln (3067) left a thin lens of soot and ash on the base and sides of the structure. This preliminary firing may have provided structural stability, allowing a more substantial lining to be applied. After this event the sides of the kiln were lined, the central hub constructed and a deposit of clay placed in the base, apparently to raise the floor of the structure. The kiln then underwent a number of firings evident with the accumulation of fine ash lenses, scraped out layers and dumped waster deposits.

5.6.6 The second kiln (3068) was built directly over the first, partly utilising the original flue, with the central hub rebuilt slightly to the south-east. The back wall of the oven/firing chamber from the first kiln was utilised, and a new lining and base added. This kiln appears to have been in use for a significant time, evidenced by the accumulation of numerous laminated ash lenses, scrape-out deposits and wasters. There was also a significant accumulation of wasters within the oven structure and rake-out pit.

5.6.7 The area to the west of ditch 2859 contained two wells, with 2620 being replaced by 2117 as upcast from the southernmost well (2117) appeared to seal the fills of 2620. Both features were contemporary with the kilns and almost certainly associated with their construction and use.

5.6.8 To the south-east of the kilns was a group of postholes suggesting a round structure. Pottery from an amorphous feature in the centre, probably associated with its use, was dated from the mid 2nd to mid 3rd centuries. The structure may represent a kiln-associated workshop or storage.

5.7 Roman Phase 3 (AD 200/230-410)

Summary

By this period activity had shifted to the south of the main area of earlier the enclosure and the earlier features had silted up. Two parallel ditches of 3rd to 4th century date 45 m apart were excavated. The northernmost ditch showed evidence of up to 3 recuts and followed the line of a relict palaeochannel. These probably functioned as drainage ditches. A cremation burial had been inserted into the upper fill of this ditch and used much earlier pottery than that from the ditch fill, suggesting that the pot had been curated. In the far south of the site the earliest ditch defining the promontory had silted up in this period, marking the beginnings of a boundary, the use of which would extend into the post-medieval period.

5.7.1 Two parallel later Roman ditches (3072 and 4038) were excavated. They were 45 m apart, orientated E-W, and spanned the width of the higher terrace in the southern half of the excavation area. Ditch (3072) at the centre, was defined by a sequence of up to three recuts (Fig. 6). The ditch was some 0.5 m deep towards the east, but significantly deeper at 1.32 m at its west end. It followed a natural dip in the topography corresponding with a relict palaeochannel, which would have provided a natural boundary and obvious location for a drainage ditches.

5.7.2 Although not stratigraphically linked due to modern truncation, ditch 3072 appeared to turn north at the base of the break in slope and continue northwards parallel with the bank for 25 m before extending beyond the limit of excavation. The fills of 3072 consisted of silty clays and clay with high organic content.

5.7.3 A sequence of ditches traversed the western edge of the spur, forming a boundary still in use in the post-medieval period. A slot excavated through the ditches in the southern part of the site revealed four ditch cuts, the earliest of which (4033) contained 60 sherds of late Roman pottery in its lower fill. The ditch had fairly shallow sides and a slightly concave base. It measured 1.3 m in width and 0.45 m in depth. The earlier of the two fills (which contained the pottery) was a firm dark sandy silt. The upper fill (3127) was a loose, pale sandy silt.

5.7.4 A cremation burial (2340) had been cut into the upper fills of ditch 3072. The burial yielded three vessels, with two - a cordoned narrow necked jar and jar with worn base - containing cremated human remains. The pottery appears to be early Roman in date, and somewhat earlier than the other pottery found in the fills of the ditch. This suggests that the vessels had been retained up to two centuries before they were selected for use in the burial.

5.8 Roman (features only broadly dated)

Summary

A few sections of ditch could only be broadly dated to the Roman period by pottery finds. These features were all in the southern part of the site (Area 2).

5.8.1 A few features revealed during the excavation could only be broadly dated to the Roman period by pottery finds. These features were all located in the far south of the site. Two short sections of ditch adjacent to the western limit of excavation were included in this group.

5.8.2 Ditch 4026 was cut through the alluvium in the west of the site (3405). The ditch measured 15.2 m in length (NW-SE) and 1.1 m in width (NE-SW). It was filled by a firm dark silty clay. Excavation of the northern terminal yielded pottery sherds of mid 2nd century to late 4th century AD date.

5.8.3 Just to the east of ditch 4026, L-shaped ditch 4027 extended for 5 m NW-SE. It measured 0.7 m in width. One sherd of pottery was recovered from the south eastern terminal, which dated to the mid 1st century to early 3rd century AD.

5.9 Post-Roman

5.9.1 One feature may have been of Anglo-Saxon in date, although as only very small amounts of finds were recovered, so this is not conclusive.

5.9.2 Ditch 4028, situated in the centre of the site just south of the footpath (Fig. 5), yielded two sherds of possible early 5th century to late 6th century pottery.

5.9.3 A single post-medieval ditch (2345) was found at the northern limits of the site (Fig. 5). The break of slope to the west and south-west was defined by a ditch during this period.

5.9.4 The western and southern edges of the spur at the top of the break of slope to the Wantz Stream were defined by a ditched boundary (3125) of late Roman date that had been recut at least three times (3128, 3130 and 3313) and extended the whole NW-SE length of the site. Finds recovered from the latest of the ditches were post-medieval in date. Even though the two ditches in the middle of the sequence remain undated, the dating of the earliest and latest ditches demonstrates the continued use of this boundary from the late Roman period through to the post-medieval period (Fig. 5).

5.9.5 The only modern features were a quarry in the north-west corner of the site and a group of pits in the north of the site on the eastern side (Fig. 5). A central pit was surrounded by a further 6 pits all equidistant from that pit and each other to form a hexagon. The pits are thought to have been planting pits for an ornamental garden feature, perhaps associated with the hospital. Another group of such features was found in the southern part of the excavation area.

5.9.6 In the far south-eastern part of the site a number of features interpreted as tree planting pits associated with landscaping of he grounds of the modern hospital were recorded in plan but not excavated, as were numerous postholes containing concrete bases that probably represent fencelines.

5.10 Undated

5.10.1 A significant number of features currently remain unphased mainly due to a lack in dating material from their fills. It is likely that further analysis allow a number of these to be dated or otherwise associated with phases of activity.

6 ARTEFACTUAL SUMMARY

6.1 Introduction

6.1.1 Summaries of the artefactual evidence by category are included below. The full assessment reports can be found in Appendices.

6.2 Pottery

6.2.1 Some 8,926 sherds, weighing just over 96 kg, was recovered from the excavation. The majority of the pottery was recovered from deposits associated with the two kilns (3067 and 3068) which appear to have operated from the early 2nd century to the late 3rd Century. The material clearly constituted kiln waste, representing the final batches of fired pottery or previously dumped waste deliberately relocated to the abandoned kiln. The remaining pottery was recovered mainly from ditches, though pit deposits were also present.

6.2.2 The assemblage was dominated by locally-produced forms and fabrics. Pottery fired in the kilns included plain-rimmed and bead-rimmed dishes, ledge-rimmed and oval jars, and lids. All were available in a sandy grey ware fabric.

6.2.3 The site is one of a number of broadly contemporaneous kiln sites in the Thameside/south Essex region that produced a similar range of material.

6.2.4 A single cinerary urn, dating to between AD 10 and 70, was recovered from grave 3226. The vessel is a bead rim jar (Going 1987, G3), made in North Kent early Roman shell tempered fabric. A second vessel of similar date was recovered from grave 3228. This vessel was also a bead rim jar, made in a 'Belgic' sandy fabric. No ancillary vessels were found in either grave. Grave 3144 produced three body sherds of sandy grey ware and grave 3146 contained four sherds of North Kent early Roman shell tempered fabric, including a rim sherd from a bead rim jar. A cremation burial that had been buried in the upper fill of a drainage ditch 3072 contained pottery of 1st century date, but pottery from the ditch fill dated to the 3rd 4th century. This suggests that the pottery used for this cremation burial was an 'antique' or had been curated before burial.

6.2.5 Pottery of late Roman date was recovered from the earliest in a sequence of four boundary ditches that traversed the south western side of the spur. These included three jars/bowls in greyware fabric from context 3126, which could be dated by their form to the late 3rd to mid 4th century.

6.3 Fired clay

6.3.1 The fired clay assemblage comprised over 2000 fragments weighing some 80 kg. Nearly half of this came from the top of ditch 2339 and a further 12% was recovered from kiln group 3067. The majority of the material relates to kiln structures and furniture, and includes parts of the lining and pedestal, kiln bars and triangular bricks.

6.4 Ceramic building material

6.4.1 A quantity of ceramic building material - 71 fragments weighing 3 kg - was recovered from the excavations. Only one was of Roman date, suggesting that there were no structures utilising tile on the site. The remainder was medieval or post-medieval.

6.5 Flint

6.5.1 A total of 705 pieces of worked flint and 3655 fragments of burnt unworked flint were recovered from the evaluation and excavations at Beam Washlands. The worked flint was recovered from 56 contexts (excluding seven contexts with large amounts of sieved chips), with most contexts containing fewer than ten pieces of flint. However, context 2347 (from the Area 1 excavation) and context 3523 (from the Area 2 excavation), part of the same alluvial spread, contained 20 and 30 pieces respectively and were examined separately from the rest of the assemblage. The flint from a late alluvial spread is dated to the early Mesolithic on the basis of typological and technological characteristics. The flint from other parts of the site comprises a mixture of pieces dating into the Bronze Age and is largely residual.

6.6 Worked stone

6.6.1 Context 2719 (a posthole fill in the north of the site) produced weathered lava fragments, almost certainly from rotary querns. A single probable Millstone Grit rotary quern was also recovered from a posthole in the north of the site. This had been extensively reused as a whetstone but retains evidence of grooving on one surface.

6.6.2 An unworked flint cobble which has one polished and slightly convex face (3101) was recovered from the subsoil in the south of the site. The polish would suggest that the stone was used consistently, perhaps as a pot burnisher but it is possible that this polish was created naturally.

6.7 Slag

6.7.1 A small quantity of iron micro-slags (368 g) was identified as hammerscale (both flake and spherical) which is diagnostic of iron smithing. Most of the assemblage was retrieved from context 2181, a deposit within early Roman enclosure ditch 2339.

6.8 Metal finds

6.8.1 The metal finds comprise approximately 160 metal fragments. The finds from the excavation comprise small fragments and were almost all recovered from cremation burials. The fragments have clearly been damaged by fire from the pyre. All the

copper alloy finds except one sheet fragment came from contexts 3139 (cremation burial 3138) and 3157 (cremation burial 3136). Many small unidentified small fragments of copper alloy were recovered, almost all from context 3139 (114 frags). Two unidentified fragments were recovered from context 3157. Copper alloy sheet fragments were also found, including both small flat fragments and larger folded and probably melted fragments. Almost all the sheet fragments were from contexts 3139 (41 frags) and 3157 (35 frags). It is probable that these copper alloy sheet fragments represent parts of vessels or containers burnt with the dead and subsequently buried. One of the sheet fragments from context 3139 had a fragment of burnt bone attached (SF 3111). The only other copper alloy finds were a fragment of small nail or tack and piece of curved rod both from context 3157.

6.8.2 The iron finds were fewer in number. They include fragments from *fibulae* or safety pin brooches with sprung pins. Although the brooch fragments are small it is probable that most are from simple one-piece sprung brooches, the so-called 'Nauheim Derivatives' and date to the 1st century AD. The identified fragments were recovered from contexts 3139 (cremation 3138), 3141 (cremation 3140), 3155 (cremation 3154), 3157 and 3159 (cremation 3158). A number of hobnails were found in context 3161 (cremation 3160). The remaining finds consist of four nails or nail fragments, three fragments of wire and three unidentified fragments.

6.9 Glass

6.9.1 Eight fragments were recovered from four contexts. Those from three contexts were of 19th-century date or later. A fourth context contained a fragment of a beaker; this is currently undated.

7 ENVIRONMENTAL SUMMARY

7.1 Introduction

7.1.1 Summaries of the ecofactual evidence are presented below. Full assessment reports can be found as Appendices.

7.2 Animal bone

7.2.1 The portion of the animal bone assemblage that was examined comprised 46 refitted fragments. Fifteen could be assigned to species. Those present included cattle and horse. The assemblage was too fragmentary to be measured. Preservation was very poor and butchering marks or other pathologies could not be identified.

7.3 Human remains

7.3.1 Human remains were found in 14 contexts. All derive from Roman-period cremation burials. At this stage, the remains have been processed and sorted, but none has been

identified in terms of age or sex, or examined to determine the minimum of inividuals and funerary rite.

7.4 Charred and waterlogged plant remains

7.4.1 Out of a total of 80 environmental samples recovered from the site, 48 were selected and processed. These were assessed for potential charred and waterlogged plant remains and wood charcoal. Thirty-nine came from phased Roman contexts, largely associated with the kilns. Seven samples contained abundant charred cereal grains, cereal chaff and weed seeds. Samples from kiln 3068 contained a number of indeterminate cereal grains and glume bases, probably of the spelt wheat variety. The kilns also contained a number of charred weed seeds including Cyperaceae (sedge), Fabacaeae (pea family), *Rumex* (docks), *Polygonum* (knotgrasses), *Lamium* (dead nettles) and Galium (bedstraws). The only non-kiln feature that contained abundant CPR was waterhole 2990, which contained numerous indeterminate fragments and spelt wheat glume bases.

7.4.2 A number of the kiln samples were also rich in charcoal fragments, which will provide information on the type of wood fuel used for this activity. The species of wood used initially appears highly variable and includes abundant roundwood of possible heather.

7.4.3 The cremation deposits were sampled for charred remains and charcoal. The assessment of these samples has shown that although most of them contained charcoal of mixed taxa, four contained very little charcoal, suggesting the separation of the cremated bone from the rest of the pyre remains before burial. A feature that was situated close to the cremation burial group was very rich in oak charcoal. It was originally thought that it might have been another cremation burial, even though no bone was found on excavation. Assessment of the sample revealed no cremated bone. Therefore this was probably a posthole, with the corresponding post burnt *in situ*.

7.4.4 Other samples from the site included waterlogged remains indicating slow moving water nearby. Several of the cremation burials contained non-oak charcoal which has potential to provide information on species selection for burial rite and also the potential to provide samples for C14 dating.

8 GEOARCHAEOLOGICAL SUMMARY

8.1 Summary of stratigraphy

8.1.1 The deposit model presented in the interim geoarchaeological statement (OA 2005c) has now been updated with the data from the most recent phases of work (Fig. 13) which investigated the river valleys of the Wantz Stream and River Beam. These deposits were then investigated with two phases of targeted archaeological boreholes that explored the deepest and most complete sediment sequences. The model identified a deep sequence of alluvial and peat deposits associated with palaeochannels of the Wantz Stream.

8.1.2 Broadly the stratigraphy was relatively consistent and comprised:

- Made Ground/topsoil
- Upper Alluvium
- Peat/organic deposits.
- Lower Alluvium
- Pleistocene Gravels
- Bedrock

8.2 The embankment (ARCBH1-ARCBH3)

8.2.1 The assessment of ARCBH1 and ARCBH 2 identified an early sediment sequence associated with the Wantz Stream. This consisted of silty sand/peat/silt sequence that covered most of the early Holocene.

8.2.2 ARCHBH3 produced a sediment sequence associated with the River Beam. The sequences consisted of predominately minerogenic silty clay with increasing sand content indicating the presence of an adjacent high energy channel.

8.3 Pond transect (OABH1-OABH8) (Fig. 14)

8.3.1 The pond transect provided a cross-section of the palaeochannel sequence revealed in the deposit model just to north of the current Wantz Stream channel. The borehole transect was approximately 500 metres east of the previous boreholes that identified an early Holocene sediment sequence. The sequence consisted of a series of intercutting channels that reflected the shifting channel history of the Wantz Stream valley since the onset of the Holocene.

8.3.2 The basic stratigraphy comprised:

- 0.78m of modern disturbed ground (+0.78 to +0m OD).
- 0.68m of minerogenic silt-clay (+0.62 to – 1.3m OD)
- 4.50m of organic/peat deposits (-0.5. to –5.0m OD)
- 1.90m of minerogenic sand, silt and clay (-3.5 to – 5.4m OD)
- Fluvial gravel (-4.0 to -5.6m OD)
- Stiff clay (-6.9m OD)

8.4 Pond section 4000

8.4.1 Section 4000 was exposed during the pond excavations on the lower ground at the edge of the gravel terrace where ground levels averaged +0.495m OD. The basic stratigraphy comprised:

- 0.40m topsoil (4000)
- 0.50m silty clay (4001)
- 0.60m desiccated peat (4003)
- 0. m organic silty clay (4010 & 4011)
- 0.50m sandy silt (4013)
- Pleistocene gravel

8.5 Summary of biostratigraphy

8.5.1 A basal peat identified in ARCBH1 at -4.56 m OD that produced an unexpectedly early radiocarbon date of 12160±60BP and 12290±60BP, which places the onset of accumulation within the Late Glacial period.

8.5.2 The pollen that was preserved at the lowermost levels of this peat sequence may be considered consistent with a Late Devensian/Allerod or early Holocene date with the occurrence of birch and pine. Additional species included willow and a single alder pollen grain. A poorly preserved diatom assemblage suggested freshwater aerophile conditions, i.e. ephemeral aquatic habitats.

8.5.3 Higher in the sequence of ARCBH1 the lower peat contained a significant amount of silt, overlain by a thin layer of organic silt clay. Although undated the pollen at this level is characteristic of the early Holocene and suggests a largely open environment of grasses and ferns with hazel and pine woodland. Diatom assemblages were absent.

8.5.4 The main peat body within the sequence between -0.50 and –5.00 m OD was relatively homogenous and woody. The base of this unit is at present dated to 5820±30 BP. The pollen and plant remains were moderately preserved and indicate the development locally of alder carr woodland with lime dominated mixed deciduous woodland on the adjacent dry. The high levels of microscopic charcoal particles in the base samples may indicate low-level human disturbance of the environment. Around the middle of the main peat bed, a poorly preserved diatom assemblage is suggestive of brackish conditions.

8.5.5 A temporary shift to reed swamp conditions may have occurred at -3.0 m OD within OABH3, replacing dry woodland. Fern spores and sedge pollen are seen to increase at the expense of alder pollen within the profile. This coincides with a shift from peaty clay to an organic silty clay within the sediment sequence. However alder carr was soon re-established, with deciduous woodland also present on the dry ground. The top of the peat has been radiocarbon dated to 3765±35BP within ARCBH1 and 3320±30 BP within OABH3, which places it within the early to middle Bronze Age period. However, the upper 0.30 m of the peat was described as mixed with pockets of grey silty clay. This together with the very abrupt contact with the overlying silt clays suggests some erosion of the upper peat levels may have occurred and a hiatus in the sequence may be present at this point.

8.5.6 The overlying minerogenic deposits comprised a soft mid grey silty clay with increasing organic flecking and higher silt content approaching the lower contact with the peat. The diatom assemblages were well preserved and suggested estuarine conditions. The pollen and plant assemblages from the silt clays in ARCBH1 and ARCBH2 produced a similar signal of declining local alder carr woodland and an increase in aquatic and wet ground plants, although herbaceous taxa, mainly grasses, goosefoots and sedges do increase slightly as the proportion of ferns decrease. An increase in pollen of oak and hazel and the decrease in alder –0.82 m OD towards the top of the sequence might suggest some drying out of the alder carr-woodland, with a subsequent encroachment of oak and hazel onto the wetland.

8.5.7 The opening of the woodland within the drier ground is reflected in the top most samples of the upper silty clay deposits from OABH3, after 3320BP, with poacaea (grasses) becoming dominate and cyperaceae (sedges) secondary. This coincides with a significant increase in microscopic charcoal levels that indicate significant human activity within the locality. This evidence of woodland clearance and expansion of open ground taxa is not recorded in the ARCBH1 pollen profile, which suggests that the clearance was either very localised or that it commenced after the accumulation of the upper most sediments analysed in ARCBH1 and ARCBH2.

8.5.8 The accumulation of the upper silt clay deposits also represents a transition from brackish to freshwater conditions. The diatom assemblage consisted of a mixed assemblage of marine planktonic forms.

9 STATEMENT OF POTENTIAL

9.1 Stratigraphic

9.1.1 The records from the 'strip, map, and sample' excavations, including context records and field plans, have been digitised and subjected to assessment-level analysis. The major stratigraphic relationships required to understand the development of the site have been checked, with preliminary phasing achieved using dating derived from the pottery assessment. The stratigraphic record is considered to be reliable, and the assessment phasing forms a good basis for further analysis.

9.1.2 There is potential to achieve a greater understanding of the stratigraphic and chronological sequence than has been possible by completing the site matrix, refining ceramic spot-dates and considering other dating indicators, chiefly radiocarbon dating. In addition, better understanding can be achived by integrating the results of artefactual, geoarchaeological, and environmental analyses, further spatial analysis, and taking account of evaulation results. Currently unphased and unidentified features may also be better understood by these means.

9.2 Artefactual potential

Pottery

9.2.1 Beam Washlands is one of a number of kiln sites in the Thameside/south Essex region (Fig. 10). At least eight kilns are known at Mucking (Jones and Rodwell 1973); production began in the first century and, as at Dagenham, peaked in the 2nd and earlier 3rd century. A range of mid Roman products almost identical to that at Dagenham was encountered. First-century kilns were uncovered at West Tilbury (Drury and Rodwell 1973), while four kilns dating to the late 2nd to 4th century were excavated at Orsett (Carter 1998). Other kilns have been excavated at Grays (Rodwell 1983). The importance of studying kilns and their products cannot be overstated. They inform on technology, the endurance (or not) of traditions, the regional economy and the organisation of industry (Willis 2004, 10).

9.2.2 A comparison of form and fabric will contribute towards the question of a Thameside ceramic zone. How typologically unified was production sites in this region? The organisation of pottery production at a local, rural, level has been the subject of debate for some decades. Were potters itinerant or farmers undertaking seasonal production? Or, can a Thameside industry employing full-time professional potters be recognised? Analysis of Dagenham's pottery, in conjunction with that from comparable sites should go some way to resolving this issue.

Fired Clay

9.2.3 This is an important group of material and worthy of detailed recording and analysis. The fired clay derived directly from the kilns and will enable those structures to be more fully understood. It may also be possible to establish changes in construction and development.

9.2.4 The dominance of oven furniture, especially pedestals and triangular bricks is unusual. The close association of these two types of object suggest they both functioned in a similar manner. This is important new evidence to enable archaeologists to gain a fuller understanding at last of the function of perforated triangular bricks. The triangular bricks are also of interest in that they have been found in contexts of Roman date. They are generally regarded as being Iron Age in date, but it is possible that the type present at this site may be more commonly a Roman variety. The bricks provide important evidence for the continuity into the Roman period of native traditions in oven or kiln structures and use.

Glass

9.2.5 The glass assemblage comprises eight sherds from four contexts. There are five sherds from the indented bases of two wine bottles from context 3164 (fill of a modern linear feature). These comprise one sherd from a bottle of dark green glass, and four sherds olive green glass. There is the neck of a probable tonic bottle in pale blue glass from context 3397 (fill of post-Medieval pit 3396). This bottle was mould blown and the neck hand finished. From context 3558 (fill of a modern garden feature) there is a small frgament of clear window glass. This is thin and regular with no other diagnostic features; probably modern. Finally there is rim sherd from a small vertical walled beaker (rim diamter c 70 mm) in light green glass (sf 3131) from context 3480. The rim is fire polished. The body of the vessel has an embossed pattern set on the diagonal. Context 3480 is a fill of ditch 3497 which is currently undated.

9.2.6 The glass from contexts 316, 3397 3558 is all 19th-century or later in date, and requires no further work. The beaker sherd from context 3480 needs to be positively identified to type and date and potentially should be illustrated and published.

9.3 Environmental potential

Animal bone

9.3.1 The assemblage that remained unassessed will be recorded, with pieces dated and identified to type where possible.

Human remains

9.3.2 The majority of the deposits show medium or high potential for further analysis. Further, as a group, the remains present great potential to yield an insight into the nature of the site (i.e. whether they do really represent a cemetery population) and broader aspects relating to funerary practice.

Charred and waterlogged plant remains

9.3.3 The assessment has shown that a number of the samples assessed from Beam Washlands contained relatively rich assemblages of charred plant remains and charcoal, and that the majority of these came from the Roman kiln features and cremation burials. The cereal remains should provide information on the type of cereals being used at the site and the charcoal which should provide information on the preferred fuel wood for the heating of the kiln and for the cremation pyre. In addition, two samples that came from a well were very rich in waterlogged plant remains, which provide information on not only the immediate environment of the site, but also on the wild resources available.

9.4 Geoarcharchaeological potential

The Late Glacial and early Holocene sequence

9.4.1 Radiocarbon dating has demonstrated that the organic/peat sequences at Beam Washlands appear to have accumulated from the late glacial to Late Neolithic periods. The pollen profile was dominated by pine, birch, and willow, with buttercup and sedges present locally.

9.4.2 Detailed recording of the cores suggests that some truncation may have occurred associated with channel activity. This is represented by the sandy silt within the lower part of the profile that may have produced hiatuses within the sedimentary sequences. In addition, the palaeoenvironmental assemblages assessed from the lower levels of the peat sequence were poorly preserved. The potential of the sequences at this level to provide further significant environmental data for the late glacial and early Holocene periods is therefore somewhat limited.

9.4.3 Note should be made of the better preserved assemblage from the overlying organic silt clay that produced a pollen assemblage characteristic of the early Holocene. The pollen profile suggested an open environment of grasses and ferns with hazel and pine woodland. The dating and further palaeoenvironmental analysis of these deposits might help to place the early Mesolithic activity identified at the edge of the river valley within a more detailed environmental context.

The mid-late Holocene sequences

9.4.4 The range of dates from the wood peat most likely reflect shifting channel activity that may have truncated part of the upper peat sequence. Also, active channels could have continued to deposit peat at the channel edges while silty clay accumulated within the channel itself. Evidence for the presence of such channels were seen within the pond excavation section.

9.4.5 The overall interpretation of the pollen from the peat unit is consistent of dry woodland being eventually replaced by alder carr woodland with deciduous trees elsewhere on the drier ground. There was a brief transition to reed swamp conditions that was marked by the deposition of organic silt clay. However, it was not before long until alder carr woodland was re-established and peat again began to accumulate up until the early Bronze Age.

9.4.6 The asynchronous lime decline, usually occurring between the late Neolithic and the middle Bonze Age and usually ascribed to human activity, is difficult to recognise in the sequence.

9.4.7 Woodland clearance is represented within the upper deposits of OABH3. It was under this environmental backdrop that human disturbance of the environment can be detected from the middle Bronze Age onwards. The Iron Age and Roman activity within the site most likely occurred when the stream channel was still active.

Sea-level change

9.4.8 The potential late glacial deposits from the basal deposits of ARCBH1 indicate fresh water conditions that may reflect a lower sea-level than present. The channel would have been seasonally active, draining what was likely to have been a permanently frozen landscape.

9.4.9 There was a transition to brackish conditions that occurred with the accumulation of the main floodplain peat unit. This has been dated to the late Mesolithic period, and post-dates the evidence of the flint scatters identified at the edge of the channel. The onset of the main peat may have been caused by rising sea level in the early/mid Holocene that caused a backing up of freshwater tributaries. In ARCBH1 the upper organic silt clay appears to post-date at least the late Neolithic or early Bronze Age (i.e. the date from the top of the peat). Although as noted some truncation may have occurred at this horizon. The diatom assemblages indicate estuarine sedimentation. On the basis of elevations it is quite possible that marine incursion associated with channel activity was occurring at the location of ARCBH1 up until the early Bronze Age.

9.4.10 There was a change to freshwater conditions represented by the accumulation of silty clays within OABH3 and peats in ARCBH2 during the Bronze Age and Iron Age. The diatoms from these samples indicate a transition form brackish to freshwater conditions, with poor preservation of the brackish assemblage that might indicate that some of it was reworked. The environmental data suggests the continued dominance of local alder carr woodland within ARCBH2, although with an increasingly open aspect with an increase in fern spores and herbaceous taxa that was likely the result of

human disturbance. Grasses and sedges dominated the pollen profile from the silty clays from OABH3, with clear evidence of clearance activity and agriculture.

9.4.11 More detailed examination of the upper peat/ sediment contacts at Beam Washlands is therefore relevant to our knowledge of the changing regional and local relative sea level, and resulting changes in palaeogeography. In this sense the estuarine diatom assemblage identified from the middle of the wood peat in ARCBH1 and upper deposits of OABH3 are of interest.

9.5 Scientific dating potential

9.5.1 The fieldwork produced well-preserved stratigraphy and a clear sequence of occupation and development comprising at least six phases spanning the Mesolithic to present day. Artefactual evidence, especially pottery, has contributed to the phasing, and limited radiocarbon dating has recorded environmental change during the late Glacial and Holocene periods. Despite these factors, the dating of some key aspects of the site remains uncertain. The assessment has identified areas of research that would benefit from greater chronological resolution. A number of features produced material that is potentially suitable for scientific dating. Twelve dates are proposed in total.

9.5.2 The Roman cremation cemetery comprised 14 burials, of which four were dated by artefacts; the remainder, devoid of grave goods, were by themselves undated. Although the spatial association between the graves might suggest that all were contemporaneous, this cannot be demonstrated conclusively. Indeed, it can be argued that the graves without goods represent a separate rite and therefore could be of different date. This requires testing with a series of radiocarbon dates. These would also contribute significantly to the research aims outlined below.

9.5.3 A cremation grave (2340) cut into the fill of a later Roman ditch was of particular interest, since the ceramic cremation urn appears to date to the early Roman period. The presence of 'antique' pottery within graves is by no means unknown in Roman Britain, but the burial's location in a ditch in this case is more unusual. Radiocarbon dating will confirm the date of the burial and contribute to our understanding of burial practices at the site, the use of 'antique' pottery, and the importance of the ditch as a location of burial.

9.5.4 A charcoal sample from the pyre-site, also currently undated, should be dated in order to help determine its relationship to the cemetery and add to knowledge of funerary (as opposed to burial) practices.

9.5.5 The pottery kilns are well-dated by their products that were found within them and in other features. However, the dating of the pottery was achieved through typological parallel and comparison with regional styles. While ceramic development in south Essex and London's hinterland is reasonably well-understood, independent support for well-established ceramic chronologies is severely lacking. Obtaining radiocarbon dates for the use of the Dagenham kilns would give a better sense of its longevity (contributing to the understanding of the organisation of the pottery industry), and

provide a check on the dating achieved by the ceramics. Moreover, the published kiln group would be crucial as reference for subsequent ceramic dating in the region.

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11 APPENDICES

11.1 APPENDIX 1 - POTTERY

Assessment of the pottery *By Edward Biddulph*

Introduction
Some 8400 sherds, weighing almost 94 kg, were recovered during the excavation. This was rapidly scanned in order to assess the range and condition of forms and fabrics present, which allowed every pottery-yielding context to be dated. The pottery was recorded using Oxford Archaeology's standard recording system (Booth, nd); forms were identified with the additional use of Going's Chelmsford typology (1987) and Hawkes and Hull's Camulodunum series (1947). The pottery was examined with the occasional use of a microscope at x20 magnification and a sherd count and weight in grammes provided for each context.

Provenance
The majority of the pottery - 57% by weight - was recovered from deposits associated with the two kilns (3067 and 3068). Though fragmented - it had a mean sherd weight of 14 g - the pottery was in good condition with fresh breaks, but was often overfired and spalled. The material clearly constituted kiln waste, representing the final batches of fired pottery or previously dumped waste deliberately relocated to the abandoned kiln. Some 26% of the entire assemblage by weight was recovered from ditches. Much of this also represents kiln waste and was among the best preserved; it had a mean sherd weight of 23 g and may have included material moved directly from the kiln to ditches. Other feature types yielded much lower quantities of pottery; 7% was recovered from pits, while postholes accounted for 4% by weight. The well, tree-related features and two graves (2340 and 3226) each contained 2% of the assemblage.

Forms and fabrics
The assemblage was dominated by locally-produced forms and fabrics, much of which undoubtedly deriving from the excavated kilns. The earliest pottery, dating to the middle to late Iron Age, comprised a diverse range of fabrics, including grog-tempered (E80), flint-tempered (E60), sand-tempered (E30) and shell-tempered wares (C19). However, just 4% of the assemblage by weight belonged to this period and consequently few forms - largely restricted to bead-rimmed jars (Cam 254-type) in shell-tempered ware - were recognised. Grog and shell-tempered wares continued beyond the conquest period. Shell-tempered ledge-rimmed jars (Going G5.2) joined bead-rimmed types. Butt-beakers were available in grog-tempered ware; one vessel recovered from context 2279 was spalled and may be a waster, hinting at early Roman pottery production on site (it is possible that shell-tempered ware was also produced on site, though clear evidence of this is lacking). These 'Belgic' wares were joined by wheel-thrown reduced and oxidised sandy wares (R50, R30, R20, R10, O20), in which fabrics necked jars (eg Going G17 and G19) were reasonably common. Fine oxidised ware, both white-slipped (Q10) and orange-surfaced (O10), including North Kent and Hadham products, and Verulamium white ware (W21), both available mainly as flagons, were also present. Pottery production resumed, or continued, in the early 2nd century, as indicated by the association of ledge-rimmed (or lid-seated) jars (Going G5.5) - spalled and overfired and certain kiln products - with G19 types. The local fabric was a very sandy dark grey fabric (R20). Overall, early Roman pottery accounted for 11% of the assemblage.
The range of forms and fabrics produced on site widened after c AD 130. Ledge-rimmed jars were joined by bead-rimmed dishes (Going B2 and B4), necked jars (eg Going G24) and, most significantly, lids. This suggests that lids were made to fit the rebated rim of the G5 type (ceramic lids cannot otherwise be directly associated with the form as they have been rarely found at sites producing the G5 type). Finer sandy grey fabrics were made alongside the commoner grittier fabric. An oxidised version of the sandy ware (O20) may also have been produced here. Pottery production continued into the 3rd century, albeit at a reduced level. A bifid-rimmed jar (Going G28) added to the repertoire. Wares arriving from beyond the settlement included Hadham wares; both grey and oxidised fine ware (F56) fabrics are represented. South Gaulish samian (S20) was present mainly as residual occurrences in 2nd or 3rd century contexts; curiously, no central Gaulish samian is definitely present, though pieces may be revealed with further examination. A small amount of south Spanish amphora fabric (A11) completed the rather limited range of continental pottery. In total, mid Roman pottery accounts for 58% of the total assemblage by weight.

Pottery use declined after *c* AD 260; late Roman pottery accounts for 1% of the assemblage by weight. There is no evidence of on-site pottery production after this date, and grey wares may have arrived from other centres. Mortaria arriving from Oxfordshire and the Nene Valley and three bowl-jars (Going E5) in sandy grey ware, attest to settlement activity after AD 260. A shell-tempered necked jar (Going G27) from context 2554 hints at occupation at the site after AD 350.

Funerary Pottery

A single cinerary urn, dating to between AD10 and 70 was recovered from grave 3226. The vessel is a bead rim jar (Going G3), made in North Kent early Roman shell tempered fabric. A second vessel of similar date was recovered from grave 3228. This vessel was also a bead rim jar (Going G3), made in a 'Belgic' sandy fabric. No ancillary vessels were found in either grave. Grave 2340 contained a grey ware jar, grave 3144 produced three body sherds of sandy grey ware and grave 3146 contained four sherds of North Kent early Roman shell tempered fabric, including a rim sherd from a bead rim jar.

Table 1. Chronological summary of the pottery

Period	Weight (g)	Weight %
Middle-late Iron Age	640	<1%
Late Iron Age-early Roman	4546	5%
Early Roman	9620	10.2%
Mid-Roman	58661	62%
Late Roman	13575	14.4%
Undated within Roman period	6490	7%
Post-Roman	563	<1%
TOTAL	94095	

Potential

The kiln products and waste contribute the bulk of the ceramic assemblage and undoubtedly merit further analysis. Production mainly dated to the 2nd and early 3rd century, though production may have begun in the later 1st century. A total of 16 forms have been provisionally identified as locally-made products and are summarised below, with Going (1987) types in parentheses.

Table 2. Summary of forms provisionally identified as local kiln products

Vessel class	Forms
Dish	Straight-sided (B1), bead-rimmed (B2/B4), grooved rim (B3)
Bowl	Reeded rim (C16)
Jar	Bead-rimmed (G1), ledge-rimmed (G5.2, G5.5, G5.6), everted rim (G9), necked and cordoned (G19), oval-bodied (G24), bifid-rimmed (G28)
Beaker	Globular (H1), butt-beaker (H7)
Lid	Bead-rimmed (K4)

Beam Washlands is one of a number of kiln sites in the Thameside/south Essex region. At least eight kilns are known at Mucking (Jones and Rodwell 1973); production began in the first century and, as at Dagenham, peaked in the 2nd and earlier 3rd century. A range of mid Roman products almost identical to that at Dagenham was encountered. First-century kilns were uncovered at West Tilbury (Drury and Rodwell 1973), while four kilns dating to the late 2nd to 4th century were excavated at Orsett (Carter 1998). Other kilns have been excavated at Grays (Rodwell 1983). Relevant sites a little further north include a mid Roman kiln at Elms Farm, Heybridge, which was producing a similar range of pottery to that at Beam Washlands (Atkinson and Preston, forthcoming), and later Roman kilns at Rettendon and Chelmsford (Going 1987).

The importance of studying kilns and their products cannot be overstated. As Steven Willis, president of the Study Group for Roman Pottery, states, their study has benefits, not only by helping to date traded items occurring in site deposits, but also providing information upon technology, the endurance (or not) of traditions, while study of the location and siting of kilns raises interesting issues [of economics], the organisation of industry in the Roman period, [and] the relationship between town and country' (Willis 2004, 10).

In the light of this viewpoint, and wealth of evidence from Thameside Essex, some specific research areas may be considered. A comparison of form and fabric will contribute towards the question of a Thameside ceramic zone. How typologically unified were production sites in this region? The organisation of pottery production at a local, rural, level has been the subject of debate for some decades. The view that pottery was made by itinerant potters has held sway through much of the 1970s and 1980s (eg Rodwell 1974, 35). This has been replaced to some extent, largely on ethnographic grounds, by the model of 'farmer-potters', whose seasonal production was tied to the agricultural year (Cheer 1998, 101; Biddulph *et al*, forthcoming). Analysis of Dagenham's pottery, in conjunction with that from comparable sites should go some way to resolving this issue. Pottery-specific approaches could involve, among others:

- an examination of the Dagenham assemblage to identify kiln products, using, for example, the evidence of overfired and spalled pottery;
- a statistical analysis of assemblage composition, looking at the presence/absence and relative proportions of certain forms;
- a spatial analysis of products; how far were forms traded? Was there any overlap between different kiln sites?

- analysis of the scale and duration of production; Cheer (1998, 101) examines wastage rates of production at Orsett, and these might be compared with similar calculations for Dagenham;
- petrological analysis of ceramic samples; samples from Heybridge could be compared with thin-sections from Dagenham; did itinerant potters carry a fabric 'recipe' in their heads as they moved from settlement to settlement?

While much of the analysis will inevitably focus on the kiln-related material, other material remains worthy of consideration. The assemblage from early Roman ditch 2339 was large (2.5 kg) and included near-complete examples of traded pottery, such as London-Essex stamped ware, Hadham ware and samian ware. This group will not only inform on pottery supply in the early Roman period, but also the possibility of ritual deposition should not be ignored. The group should be fully quantified and illustrated. Pottery from graves 2340, 3144, 3146, 3226 and 3228 reveal something of rural burial practice, a neglected theme that has previously suffered from poor evidence in the region.

Methodology and tasks

To address these issues, the pottery from Beam Washlands should be fully recorded. The pottery will be recorded in accordance with the Museum of London Specialist Services (MoLSS) guidelines for the recording of Roman pottery, as is required for archive deposition within the Museum of London. Vessels will be quantified by estimated vessel equivalents (EVE) and estimated number of vessels based on rim count (ENV) to ensure a good level of compatibility with other sites. MoLSS fabric and form codes will be the primary reference for identification, although fabrics produced in the kilns will require detailed characterisation beyond those descriptions offered by MoLSS. Forms will be cross-referenced to Going's Chelmsford typology (1987) to allow better comparison with Essex sites and to inform on pottery supply and site chronology. Products should be illustrated, along with other significant groups, in particular the pottery from ditch 2339 and ceramic grave goods.

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11.2 APPENDIX 2 - CERAMIC BUILDING MATERIAL

Assessment Report on the Ceramic Building Material by *Cynthia Poole*

A very small quantity of ceramic building material was examined comprising 8 fragments weighing 652 g. The material has been fully recorded and fabrics characterized using a microscope at magnification of x15-x25.

A fragment of 20th century brick and wall tile were found in a post-medieval ditch fill (2102). Pieces of medieval and post-medieval flat roof tile were found in pit fills (2116 and 2243). The only Roman material was a single fragment of brick from a ditch fill. The virtual absence of Roman ceramic and stone building material is of interest in the implication that no masonry structures were present on the site.

11.3 APPENDIX 3 - FIRED CLAY

Fired Clay by *Cynthia Poole*

Fired clay was recovered from 37 contexts and comprised 1660 fragments weighing over 65 kgs. Nearly half of this came from a single 1st century AD context (2311) of a group of related objects dumped in the top of a ditch

and a further 12% came from an *in situ* kiln (group 3067) of 2nd-3rd century date. The assemblage was rapidly scanned to establish function with only minimal recording undertaken and fabrics were identified using x10 hand lens, supplemented with a microscope up to x25 magnification for a small number of pieces.

Virtually all the material is from contexts dated to the Roman period. Over 70% was from 1st-early 2nd century contexts and about 11% from mid 2nd to mid 3rd century contexts. The remainder is from 3rd or 4th century contexts or Roman, apart from one context of MIA-LIA date.

Fabrics
Four fabric types were identified.
Fabric A: sandy clay matrix mixed with frequent organic temper in the form of straw and also contained occasional coarse grits.
Fabric B: silty clay, sometimes laminated, mixed with sand and grits up to 10 mm size.
Fabric C: matrix of laminated silty clay (C1) or sandy clay (C2) containing moderate density of coarse angular flint grit up to 15mm size.
Fabric D: clay (sometimes laminated) with no coarse inclusions. D1 was used to designate clay containing a low density of fine sand.

The basic matrix is similar in all types and it is likely that the clay used was obtained locally and from a similar source. Geologically the site is situated on sandy gravels of the Mucking Gravels overlying London Clay. On the western edge of the site were Tertiary deposits of silty clays interleaved with sand lenses. Clearly clay was readily available for pottery production and the same material was probably being used for the structural clay. It is unclear whether sand and grits were deliberately added, but it is more likely to result from variations within the locally available clay or as a result of mixing soil or subsoil with purer clay deposits. The organic material had clearly been added as deliberate temper and this fabric type was mainly used for the kiln structure.

Forms
The fired clay has been assigned to a limited number of broad categories to consider function and use.

Kiln, Oven and Furnace Structure
Kiln wall or lining from the base of the kiln (3067) or collapsed demolished debris from its interior accounts for the majority of the 10.5kg of this structural element. It is possible some of the fragments are parts of kiln floor. Some features such as perforations or wattle impression were noted on a small number of fragments, but in general wattle impressions were absent. Kiln or oven wall or lining was found in a small number of other contexts, including a 4th century deposit and a small piece of vitrified furnace lining from a 1st century context.

Fragments of oven plates or perforated floors were found in two contexts, both discarded in ditch fills, one of 1st century date.

Kiln or Oven Furniture
This accounts for over 50kgs of the material recovered on site and can be divided into three basic types of object. Material categorised as the more general oven furniture are probably fragments of one of the more specific types.

Pedestals or bars: Rectangular pedestals with square or rectangular cross-sections from 50 to 95 mm wide were found in several different contexts. Some of the better preserved show evidence of increasing in width and / or breadth suggesting a prismatic shape. No complete objects survived and it is possible some of the smaller examples are firebars rather than pedestals, though the latter is the preferred identification.

Block pedestals: Some objects appeared to form a much wider or longer block than the rectangular or prismatic pedestals. These may have formed elongated wall like pedestals, but the possibility of them being portable/removable flooring also needs to be considered.

Triangular oven bricks ("loomweights"): These account for at least a quarter and probably more of the fired clay designated as kiln or oven furniture. These appear to be generally large, chunky varieties with one up to 100 mm wide and a side length over 155 mm, though a smaller example c.65 mm wide and with a side length of 133mm was noted. Lateral perforations across the corners were noted for most pieces assigned to this category and for small fragments were the diagnostic feature, where the overall triangular shape was not immediately apparent. In addition some fragments also exhibited an external groove laterally over the corner.

Setters: One fragment with a wedge shaped cross section has been identified as a possible kiln setter.

Utilised/Unidentified
Less than 1kg was assigned to this category. Unidentified indicates entirely amorphous fragments, whilst utilised indicates evidence of at least one surface suggesting deliberate shaping. There was some evidence to suggest several pieces in the latter category may be reassigned to oven furniture following cleaning or conservation and more detailed study. The small quantity of material assigned to this category may reflect a genuine absence, but is

more likely to reflect a subjective, subconscious attitude on the part of the excavators as to what is worth retaining. Two small undiagnostic fragments were also found in area 2 one probably derived from a hearth and another, which may be a fragment of briquetage, from a cremation.

Discussion and Statement of Potential

It became apparent at an early stage of the scan that the assemblage from area 1 is an important group of material in its own right and is worthy of detailed recording and analysis.

The fired clay derived directly from the kiln (3067) will enable that structure and its function to be more fully understood. It may also be possible to relate some of the discarded kiln furniture to the earlier phase of the structure and establish changes in its construction and development.

The dominance of oven furniture, especially pedestals and triangular bricks (more commonly referred to as loomweights) is unusual. The close association of these two types of object suggest they both functioned in a similar manner. This is important new evidence to enable archaeologists to gain a fuller understanding at last of the function of perforated triangular bricks. It was first suggested that these might be associated with ovens over ten years ago (Poole 1995, 285-6) based on evidence from Danebury, Hampshire. The group from context 2311 appears to lend support to this hypothesis and should therefore be subjected to full recording and analysis together with any analysis of *in situ* oven or kiln bases, from which they may have derived.

The triangular bricks are also of interest in that they have been found in contexts of Roman date. This form is generally regarded as being Iron Age in date, but it is possible that the type present at this site with the groove over the corners may be more commonly a Roman variety. They provide important evidence for the continuity of native traditions in oven or kiln structure and use into the Roman period. The presence of this type of oven or kiln furniture, which appears to predate the 2nd-3rd century kiln, may indicate the presence of earlier surface kilns of the type known from SE England, which start to appear in the Late Iron Age (Swan, 1984, 53-67).

Tasks

Cleaning, conservation with 7.5%PVA in IMS and repackaging should be carried out as necessary during the recording process. There is no general recommendation that any material should be discarded, though it may be decided during analysis that some of the small broken fragments of kiln lining need not all be retained.
Full recording of all fired clay: 10 days (including conservation etc.)
Research and Report writing: 8 days.
Illustration: drawing of a total of about 6 objects to be selected from the pedestals and triangular bricks. Site photograph of context 2311 *in situ*.

References

Poole, C. 1995, Study14: Loomweights versus oven bricks in Cunliffe, B. *Danebury An Iron Age Hillfort in Hampshire Volume 6* CBA Research Report 102

Swan, V. 1984, *The Pottery Kilns of Roman Britain* RCHM Supp. Ser. 5 HMSO

11.4 APPENDIX 4 - FLINT

The Flint *By Rebecca Devaney*

Introduction

A total of 166 pieces of worked flint and 3750 fragments (31570 g) of burnt unworked flint were recovered from the evaluation and excavations at Dagenham (*Table 1*). The worked flint was recovered from 56 contexts (excluding seven contexts with large amounts of sieved chips), with most contexts containing less than ten pieces of flint. However, context 2347 (from the Area 1 excavation) and context 3523 (from the Area 2 excavation), parts of the same alluvial spread, contained 20 and 30 pieces respectively and will be examined separately from the rest of the assemblage. The flint from the alluvial spread is dated to the early Mesolithic on the basis of typological and technological characteristics. The flint from the rest of the site comprises a mixture of pieces from both earlier and later prehistoric periods.

Table 1. Summary of flint by phase of work and flint category

	Phase of work			
Flint category	**Evaluation**	**Excavation 1**	**Excavation 2**	**Total**
Flake		25	74	99
Blade		9	17	26
Blade-like flake		5	10	15
Bladelet		2	1	3
Irregular waste			6	6
Chip			3	3
Opposed platform blade core		1		1
Single platform blade core		1		1
Opposed platform flake core		1		1
Single platform flake core		1	1	2
Multiplatform flake core			1	1
Unclassifiable/fragmentary core			1	1
Tested nodule	1	1	1	3
Leaf-shaped arrowhead			1	1
End scraper			1	1
Piercer			1	1
Serrated blade			1	1
Total	**1**	**46**	**119**	**166**
Sieved Chips 10-4mm		383	1	384
Sieved Chips 4-2mm			1	1
Burnt unworked count	2	1058	2690	3750
Burnt unworked weight (g)	37	8153	23380	31570

Methodology

The worked flint was catalogued according to a standard typology. Information about burning, breaks, condition, raw material and technology was recorded. In addition, cores were weighed and burnt unworked flint was quantified by count and weight. The data was entered into an MS Access database. Material recovered from environmental sieving was recorded in the same way. However, that from the first phase of excavations was only briefly scanned and, along with some genuine knapping debris, includes some natural fragments and burnt unworked material that needs to be isolated and removed during the programme of further work.

Raw material

Where identifiable, most of the raw material is gravel flint, which is generally characterised by a thin and abraded cortex. The material is likely to be locally derived, perhaps sourced from river gravel deposits.

Condition

The condition of the assemblage is fairly good. Of the worked flint (excluding sieved chips), 27% are in a fresh condition and 52% only exhibit slight post-depositional damage. Just 15% are moderately damaged and 2% are heavily damaged. The damage is most frequently seen on vulnerable unretouched edges and implies some post-depositional disturbance. The amount of surface alteration is minimal with the majority of the assemblage (81%) remaining uncorticated. Cortication of varying degrees was seen on just 13% of the assemblage and 5% are iron stained. A total of 65 pieces (39%) are broken and seven (4%) are burnt.

Technology and dating

The Early Mesolithic spread

The alluvial spread at the south of the site (context 2347 from the Area 1 excavation and context 3523 from the Area 2 excavation) contained 50 pieces of worked flint (*Table 2*). A high proportion (40%) of the unretouched debitage are blades, blade-like flakes and bladelets, which suggests that the material dates from the Mesolithic (Ford 1987:79, table 2). Technological characteristics associated with the careful, blade-based flint industries of the Mesolithic, such as dorsal blade scars, platform edge abrasion and punctiform butts, were seen on many pieces, and confirm the dating suggested by the typological analysis.

The opposed platform blade core utilises a long, narrow nodule, that has been worked along one face. Long blade removals have been taken from simple platforms at both ends of the core. The size of the blade removals suggests an early Mesolithic date. At 218 g, this is the largest core to be recovered from the site. The single platform blade core is very small (21 g), with removals from just one side of the nodule. The single platform flake core appears to be exhausted, with the possibility of no further removals, and weighs just 86 g. The platform shows signs of preparation, a characteristic often associated with Mesolithic and earlier Neolithic knapping. The presence of blade cores is consistent with the proportion of blades and the technological characteristics seen in the unretouched debitage and therefore supports the Mesolithic date. Furthermore, the opposed platform blade core suggests a finer date range of the early Mesolithic.

Table 2. Summary of flint by type from the alluvial spread (contexts 2347 and 3523)

	Phase of work and context		
	Excavation 1	Excavation 2	
Flint category	**2347**	**3523**	**Total**
Flake	7	20	27
Blade	4	4	8
Blade-like flake	4	4	8
Bladelet	2		2
Irregular waste		1	1
Chip		1	1
Opposed platform blade core	1		1
Single platform blade core	1		1
Single platform flake core	1		1
Total	**20**	**30**	**50**
Burnt unworked count		15	15
Burnt unworked weight (g)		171	171

The rest of the assemblage

The flint from all other contexts, a total of 116 pieces excluding sieved chips (*Table 3*), was thinly spread across the rest of the site, with few contexts containing more than five pieces of flint. Unretouched debitage dominates the assemblage (105 pieces). Technological characteristics such as dorsal blade scars and punctiform butts were mainly seen on blade and blade-like flakes, and suggests the presence of earlier prehistoric (Mesolithic and earlier Neolithic) flint. In contrast, characteristics more commonly associated with later prehistoric (later Neolithic and Bronze Age) knapping, such as clear points and cones of percussion, pronounced ventral ripples and hinge terminations, were mainly seen on flakes. The proportion of blades (27%) is quite high and supports the likely presence of earlier prehistoric material.

The cores were all utilised for the production of flakes. The opposed platform flake core, from context 2330, is fully utilised and weighs just 34 g. Short flake removals were taken from two opposite platforms, one of which is a naturally fractured surface. The other cores are more minimally worked and range in size from 24 g to 124 g. A total of three tested nodules were recovered. Each has a small number of flake removals taken from small nodules (27 g to 38 g) with otherwise cortical or thermal surfaces. The cores are not in themselves chronologically diagnostic, however, all are consistent with later Neolithic and Bronze Age flint working.

Just four retouched tools were recovered. The leaf-shaped arrowhead, from context 3518, measures 37 mm in length and has invasive retouch which covers most of the dorsal and ventral surfaces. Leaf-shaped arrowheads can be broadly dated to the earlier Neolithic (Green 1984:19). The end scraper, from context 3101, has minimal direct retouch on the distal end and the piercer, also from context 3101, has direct retouch on the proximal right which creates a sharp point. The serrated blade, from context 3169, has tiny serrations and edge gloss. Apart from the arrowhead, the tools are not chronologically diagnostic, but are consistent with the rest of the assemblage.

Table 3. Summary of flint by type (not including contexts 2347 and 3523)

	Phase of work			
Flint category	**Evaluation**	**Excavation 1**	**Excavation 2**	**Total**
Flake		18	54	**72**
Blade		5	13	**18**
Blade-like flake		1	6	**7**
Bladelet			1	**1**
Irregular waste			5	**5**
Chip			2	**2**
Opposed platform flake core		1		**1**
Single platform flake core			1	**1**
Multiplatform flake core			1	**1**
Unclassifiable/fragmentary core			1	**1**
Tested nodule	1	1	1	**3**
Leaf-shaped arrowhead			1	**1**
End scraper			1	**1**
Piercer			1	**1**
Serrated blade			1	**1**
Total	**1**	**26**	**89**	**116**
Sieved Chips 10-4mm		383	1	**384**
Sieved Chips 4-2mm			1	**1**
Burnt unworked count	2	1058	2675	**3735**
Burnt unworked weight (g)	37	8153	23209	**31399**

Discussion and potential

The flint from Dagenham suggests activity at the site stretching from the early Mesolithic through to the later Neolithic or Bronze Age. The early Mesolithic material from the alluvial spread (contexts 2347 and 3523) is likely to be redeposited, yet it remains in a fairly fresh condition with only minimal amounts of post-depositional damage. The material is likely to be the remains of a small scatter of flint and probably represents small scale activity in the area during the early Mesolithic. Further analysis is not recommended due to the small size of the assemblage.

The flint from the rest of the site comprises a mixture of material deriving from both earlier and later prehistoric flint industries. With more detailed context and phasing information, more specific results about this part of the assemblage, such as refined dating, will be possible, but further work in terms of metrical or technological analysis is not recommended.

Some time (0.5 days) should be spent purging the sieved material of natural and burnt unworked flint, with the remaining worked flint being incorporated into the quantifications stated above. This assessment report will form the basis of the final report, although some time (1 day) is required to modify the text and discuss the significance of the material. A small number of flints (*c.* four pieces) should be illustrated in order to characterise the assemblage.

11.5 APPENDIX 5 - METAL FINDS

METAL FINDS *By Ian Scott*

Methodology

The finds from the evaluation and excavation were identified, quantified and recorded onto a database. Many of the smaller fragments from the excavation were recovered during the sieving of soil samples. A precise count of these often tiny fragments was not made; they have been rounded up to the nearest ten. Selected items were x-rayed prior to the assessment.

Assemblage composition

Table 1 : Metal Finds

	Context and Cremation burial cut No.							
	3110 [3109]	3139 [3138]	3141 [3140]	3155 [3154]	3157 [3156]	3159 [3158]	3161 [3160]	**Totals**
Cu Alloy								
Nail					1			**1**
Rod					1			**1**
Sheet	1	41			35			**77**
Unid.		114			2			**116**
Sub-total	*1*	*155*			*39*			*195*
Iron								
Brooch Fr.		1	2	1	1	1		**6**
Hobnails							28	**28**
Nails			2			2		**4**
Wire				1	3			**4**
Unid.		2	1					**3**
Sub-total		*3*	*5*	*2*	*4*	*3*	*28*	*45*
Totals	1	158	5	2	43	3	28	**240**

The metal finds comprise approximately 247/257 metal fragments. The evaluation produced only seven metal finds comprising the bowl of a small modern spoon (context 2119) and large socketed tool blade (context 2102), four nails and a fragment of wire.

The finds from the excavation comprise small fragments (n = 240) and were almost all recovered from cremation burials. The fragments have clearly been damaged by fire. All the copper alloy finds except one sheet fragment came from contexts 3139 (cremation 3138) and 3157 (cremation 3136). Many small unidentified small fragments of copper alloy were recovered, almost all from context 3139 (n = 114). Two unidentified fragments were recovered from context 3157. Copper alloy sheet fragments were also found, including both small flat fragments and larger folded and probably melted fragments. Almost all of the sheet fragments were from contexts 3139 (n = 41) and 3157 (n = 35). It is probable that these copper alloy sheet fragments represent parts of vessels or containers burnt with the bodies and subsequently buried. One of the sheet fragments from context 3139 had a fragment of burnt bone attached (sf 3111). The only other copper alloy finds were a fragment of small nail or tack and piece of curved rod both from context 3157.

The iron finds were fewer in number. They include a number of fragments from *fibulae* or safety pin brooches with sprung pins. Although the brooch fragments are small it probable that most are from simple one-piece sprung brooches, the so-called 'Nauheim Derivatives' and date to the 1st century AD. The identified fragments were recovered from contexts 3139 (cremation 3138), 3141 (cremation 3140), 3155 (cremation 3154), 3157 and 3159 (cremation 3158). A number of hobnails were found in context 3161 (cremation 3160). The remaining finds consist of four nails or nail fragments, three fragments of wire and three unidentified fragments.

Assessment and Statement of Potential

The finds from the evaluation have no potential for further analysis and are not considered any further.

The metal finds from the excavation are not intrinsically of any great interest and in themselves have limited potential. However, the finds are from the cremation burials (contexts 3138, 3140, 3154, 3156, 3158 and 3160)

and therefore provide information about the cremation process and burial rite. In particular the presence of fragments sheet copper alloy suggest the use of some form of container or containers, and the fragments of iron brooches of 1st century provide dating evidence as well as an indication that the bodies were clothed or at least covered.

Further work

The metal finds have been recorded, and no further recording is anticipated. The finds do not require detailed publication of individual objects. The assemblages from each cremation burial, composed variously of copper alloy sheet and other fragments, of hobnails and nails and of the fragments of iron brooch, should be published in summary tabulated form. Selected brooch fragments could be illustrated by reproducing the relevant x-radiographs.

11.6 APPENDIX 6 - SLAG

SLAG *By Lynne Keys with additions by Luke Howarth*

A small quantity of iron micro-slags (368g), recovered from soil samples, was examined for this report. The material was mainly of hammerscale, both flake and spherical, which is diagnostic of iron smithing. No bulk slag was presented for examination and it is not known whether any was recovered. No site information was available.

The ordinary hot working of a piece of iron to make an object or repair it produces flake hammerscale. The small spheres are produced when an iron bloom is worked at high temperature to remove excess slag after smelting (the production of iron in a furnace from ore and a fuel), or by high temperature welding by a smith to join two pieces of iron.

Hammerscale usually remains in the immediate area of smithing activity (around the anvil and between it and the hearth) when larger (bulk) slags are cleared out so the assemblage is indicative of smithing somewhere on the site. Context 2181 which produced the greatest quantity per sample size; it may be in the immediate area of smithing or re-deposited material near the focus of the activity.

The occurrence of the burnt and partly vitrified clay and sediment in the residues of the second phase do not directly indicate metalworking. No finds of hammerscale or associated material was found. Non of the material from the second phase was magnetic. There appeared to be only limited vitirfication of material. The clay and sediment only indicate that a relatively low temperature burning event took place. Some of the thicker pieces of clay may relate to the fabric of a kiln/ furnace.

Quantification table of the slag:

	cnxt	<>	Size (mm)	identification	wt. (g)	comment
Area I	2132	2101	2 - 0.5	hammerscale	4	mostly flake but very occas. tiny spheres
	2134	2102		hammerscale	1	as above but with occas. broken flake
	2150	2152	2 - 0.5	sample	1	mainly magnetised clay and tiny grit fragments
	2181	2100	10 - 4	sample	168	mostly cinder, fired clay, fuel ash slag and very occas. large hammerscale flakes
	2181	2100	10 - 4	sample	98	mostly cinder, fired clay, fuel ash slag and very occas. large hammerscale flakes
	2181	2100	2 - 0.5	hammerscale	50	lots broken flake, frequent spheres
	2181	2100	4 - 2	hammerscale	42	flake and very occ. tiny spheres
	2219	2115	10 - 4	fuel ash slag	1	
	2227	2108	2 - 0.5	hammerscale	0	very broken flake, very occ. spheres
	2249	2111	2 - 0.5	hammerscale	0	some flake, occ. tiny spheres
	2542	2133	2 - 0.5	hammerscale	1	mostly flake but very occas. tiny spheres; one large sphere
	2542	2133	4 - 2	hammerscale	0	flake
	2554	2132	2 - 0.5	hammerscale	0	only very occasional broken flakes
	2599	2136	> 10	fuel ash slag & cinder	2	
	3103	2158		hammerscale	0	tiny amount broken flake
				total wt = 368g		
Phase II	3229	3115	>10	Burnt / vitrified clay and sediment.	122	Approx. 8 fragments are of greyish fired low grade clay (silty). Some flat smooth surfaces are visible. Inclusions of Burnt flint and burnt bone and some charcoal. The remaining fragments (~ 23) are of poorly sorted sandy sediment, with a silty matrix. The matrix is partly 'baked' fusing the sediment. Inclusions of sub-angular flint. The overall colour is dark red brown with patches of black. The blacker patches are assoc with partially vitrified material/ surfaces.
	3229	3127		Burnt + partly vitrified sediment.	7	Aprox. 5 Fragments baked poorly sorted sandy sediment. Inclusions of sub-angular flint. Some patches of fragments have varying degrees of vitirfication indicating uneven distribution of heat.

3229	3126	Burnt + partly vitrified clay.	10	Approx. 7 fragments of burnt grey brown burnt clay. Inclusions of burnt bone, burnt flint and some charcoal. One smooth surface on thick fragment (~1.5cm).
		Total wt =	**139g**	

Ford, S, 1987 Chronological and functional aspects of flint assemblages, in Lithic analysis and Later British Prehistory (eds A. Brown and M. Edmonds), BAR Brit Ser 162, 67-81, Oxford

Green, S H, 1984 Flint arrowheads: typology and interpretation, *Lithics* **5** 19-39

11.7 APPENDIX 7 - WORKED STONE

WORKED STONE *by Ruth Shaffrey*

A total of 117 pieces of stone were retained during the excavation. Of these, stone from two contexts is worked. The stone was examined with the aid of a x10 magnification hand lens.

Two contexts produced worked stone. Context 2719 produced 564g of very weathered lava fragments, almost certainly from rotary querns. A single probable Millstone Grit rotary quern was also recovered (2552, SF 2116). This had been extensively reused as a whetstone but retains evidence of grooving on one surface.

Catalogue

Context	SFNO	Descrip	Notes	Weight	Lithology
2719		Probable quern frags x 75	75 Very tiny and very weathered lava fragments with no distinguishing characteristics	564	Lava
2552	2116	Rotary quern fragment reused as secondary whetstone	large chunk of slightly coarse stone with remains of some grooving on one surface. Two other surfaces have been squared off and have been heavily used so are slightly concave and very smooth. It is not possible to ascertain any original	717	Probable Millstone Grit

The assemblage has little to add to our understanding of the site, producing only rotary quern fragments of materials commonly found in the area. It would, however, be worth including a note on these in any publication.

No further work is recommended.

11.8 APPENDIX 8 - GLASS

Glass By Ian Scott

The glass sherds from the excavation Area 2 were identified, quantified and recorded.

Assemblage composition

The glass assemblage comprises eight sherds from four contexts. There are five sherds from the indented bases of two wine bottles from context 3164 (fill of a modern linear feature). These comprise one sherd from a bottle of dark green glass, and four sherds olive green glass. There is the neck of a probable tonic bottle in pale blue glass from context 3397 (fill of post-Medieval pit 3396). This bottle was mould blown and the neck hand finished. From context 3558 (fill of a modern garden feature) there is a small frgament of clear window glass. This is thin and regular with no other diagnostic features; probably modern. Finally there is rim sherd from a small vertical walled beaker (rim diamter c 70 mm) in light green glass (sf 3131) from context 3480. The rim is fire polished. The body of the vessel has an embossed pattern set on the diagonal. Context 3480 is a fill of ditch 3497 which is currently undated.

Further work

The glass from contexts 316, 3397 3558 is all 19th-century or later in date, and requires no further work. The beaker sherd from context 3480 needs to be positively identified to type and date and potentially should be illustrated and published.

11.9 APPENDIX 9 - ANIMAL BONE

Animal bone by Lena Strid

Introduction
Quantity of material
The animal bone assemblage consisted of 46 re-fitted fragments. As the assemblage was so small, it was decided to include all contexts in the assessment. A full record of the assemblage, documented in a *Microsoft Access* database, can be found with the site archive.
Phasing
Animal bone were found in features dating from early Roman to post-medieval periods (Table 8).

Table 8. Contexts and phases for the BMV05 bone assemblage.

Context	Phases
2181	1-3
2187	1-3
2230	2
2246	1
2279	1
2293	1-3
2331	unphased
2338	1-3
2371	3
2372	1-3
2561	1
2561	1
2599	Post-medieval
2599	Post-medieval
2628	2
2641	2
2778	1
2995	2

Recovery
The animal bone was recovered through hand collection during excavation and from wet sieved bulk samples (processed using 500 µm residue mesh and 250 µm flot mesh). Fifty-four per cent of the assessed bones derive from hand-retrieved contexts, and 46% from sieved contexts. Most of the bones from the sieved contexts were rather small (5.4% of the total weight) and mainly unidentifiable to species.

Methodology
The bones were identified using a comparative skeletal reference collection, as well as published osteological books and articles. All the animal remains were counted and weighed, and where possible identified to species, element, side and zone. Ribs and vertebrae, with the exception for atlas and axis, were classified by size, 'large mammal' representing cattle, horse and deer, 'medium mammal' representing sheep/goat, pig and large dog, and 'small mammal' representing small dog, cat and hare.
The condition of the bone was graded using criteria stipulated by Lyman (1996). Grade 0 being very well-preserved bone and grade 5 indicating that the bone had suffered such structural and attritional damage as to make it unrecognisable.
For ageing, tooth wear was recorded using Grant's tooth wear stages (Grant 1982), and correlated with tooth eruption (Habermehl 1975) as well as the wear rate of the mandibular M3 (Benecke 1988, in Vretemark 1997), in order to estimate an age for the animals.

Overview of assemblage
Preservation
The preservation level for the assemblage was rather poor in most phases (Table 9). Apart from one vertebrae, all identified skeletal elements were teeth. This reflects the general poor bone preservation in the excavation area. Enamel is harder than bone, and teeth are therefore usually better preserved than bone, especially in poor soil conditions.

Table 9. Preservation level for contexts from all phases of the BMV05 assemblage.

Phase	n	0	1	2	3	4	5
1	23			4%	96%		
2	7			29%	71%		
3	1			100%			
1-3	10			10%	50%	40%	
Post-medieval	2				100%		
Unphased	3			100%			

Species
The assemblage consisted of 46 fragments, of which 15 (32.6%) could be determined to species (Table 10). The species present included cattle and horse. The assemblage was too fragmentary to be measured. Butchering marks or pathologies could not be found.
The presence of cattle and horse, and predominance of cattle in assemblages from the Roman period is to be expected. The absence of pig and sheep/goat is unusual, but as the assemblage is so small and relatively poorly preserved it is not recommended to over-interpret their absence. The two cattle teeth that could be aged both belonged to an animal or animals slaughtered between one and four years of age. While this should not be interpreted as a slaughter preference for young adult cattle, it is not unheard of for Roman cattle to be slaughtered at this age. At Portchester, the majority of the cattle were slaughtered at 3.5-5 years of age, but with both younger and older cattle present (Grant 1975, 396). In Dorchester, the cattle were mainly over three years of age (Maltby 1993, 320).

Table 10. Identified species/context for all phases of the BMV05 assemblage.

Species	Phase 1	Phase 2	Phase 3	Phase 1-3	Post-medieval	Unphased
Cattle	3	3	1		1	
Horse						3
Large mammal		1				
Unidentifiable	20	3			1	
Total fragment count	23	7	1	10	2	3
Total weight (g)	42.0	42.0	15.0	33.0	15.0	73.0

Table 11. Number of hand retrieved and sieved bones in the BMV05 assemblage, including weight and number of bones identifiable to species.

	Hand retrieved bones	Sieved bones	Total
Phase 1	18	5	23
Phase 2	1	6	7

Phase 3	1		1
Phase 1-3	2	8	10
Post-medieval		2	2
Unphased	3		3
Identifiable to species	9	6	15
Total fragment count	25	21	46
Total weight (g)	72.0	148.0	220.0

Phase 1 contained three cattle molars. Two were unidentifiable as to side and upper/lower jaw, whereas the remaining one was identifiable as a mandibular molar. The cattle were between 1-4 years old when slaughtered. Phase 2 contained three cattle molars, all unidentifiable as to side and upper/lower jaw, as well as one vertebrae from a large mammal. The teeth were too eroded to record tooth wear. The surface structure of the vertebrae suggested it had derived from a juvenile animal. Phase 3 contained one very fragmented cattle molar. No other information could be derived from it. Phase 1-3 contained two fragmentary cattle maxillary molars, one mandibular molar, and one molar of indeterminate jaw. The cattle were between 1-4 years old when slaughtered. The post-medieval phase contained one cattle maxillary molar, whereas the single unphased context contained three mandibular horse teeth. No other information could be derived from them.

Potential and recommendations

No further work is recommended. The preservation level is too poor and very little useful information can be derived from the fragments.

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11.10 APPENDIX 10 - CPR and WPR

Charred and waterlogged plant remains from Area 1 by Denise Druce

Introduction

During the excavations prior to the proposed development a number of bulk samples were taken for palaeoenvironmental investigations. Out of a total of 80 environmental samples (denoted below by the symbol '< >'), 48 were processed and assessed for their charred and waterlogged plant remains and wood charcoal potential. Activity on the site included early Mesolithic flint working, plus some evidence for Bronze Age and Iron Age occupation. However, only two of the assessed samples, <2111> (context 2249) and <2116> (context 2307) came from features positively identified as belonging to these earlier phases. Six of the samples came from undated contexts/features and include <2162> (context 2112), which represents a natural layer sealed by kiln group 3068, and <2116> (context 2307), which came from a layer of peat associated with burnt flint. The majority of the site consisted of a multi-phased Roman complex and out of the 48 assessed samples, 39 came from phased Roman features. The Roman samples came from a variety of features, including pit and ditch fills, well and waterhole fills, contexts associated with three kilns (kiln groups 3068 and 3067, and oven/hearth 2324) and a number of spit samples from cremation burial 2341.

Methodology

Bulk samples of between 0.5 and 40 litres were processed using a modified Siraf flotation machine, or were hand floated. The flots were collected onto a 250µm mesh, air-dried and examined under a binocular microscope. Any charred cereal grains, cereal chaff, weed seeds (CPR) was quantified, as were any waterlogged remains (WPR) and molluscs. The presence of any other material such as coal and clinker was also noted. The presence of modern contaminants such as roots, insect eggs, and modern seeds was also noted. The results are shown in the accompanying table (Table 17) and the remains are quantified on a scale of 1- 4 where: 1=present (up to 5 items); 2=frequent (5-25); 3=common (25-100) and 4=abundant (>100). 1-4 where 1 = <4 items, 2 = 5-25 items, 3 = 25-100 items and 4 = >100 items. The CPR and charcoal potential of each sample is also given. Any charcoal fragments within the bulk samples was quantified and provisionally identified where possible. Plant nomenclature follows Stace (1991).

Results

The single Iron Age sample, <2111> (2249) consisted of posthole fill 2250 and contained very limited indeterminate cereal grains and chaff remains. It did contain a number of uncharred seeds; however, these were very well preserved and, given the extent of modern root material, are likely to represent modern material.

Out of the 39 samples, which came from Roman contexts/features, seven contained abundant charred cereal grains, cereal chaff and weed seeds. These include <2101> (2132) and <2102> (2134), which both came from kiln group 3068. Both samples contained a number of indeterminate cereal grains and glume bases, probably of the spelt wheat variety. Both samples also contained a number of charred weed seeds including Cyperaceae (sedge), Fabacaeae (pea family), *Rumex* (docks), *Polygonum* (knotgrasses), *Lamium* (dead nettles) and Galium (bedstraws). Sample <2154> (2152), which came from kiln group 3067, contained a number of indeterminate cereal grains and wheat grains, plus a number of spelt? wheat glume bases and cereal culm nodes. This sample, however, contained limited charred weed seeds of Fabaceae and *Polygonum*. Samples <2107> (2215), <2112> (2259) and <2113> (2216) all came from contexts associated with oven/hearth 2324 and all were fairly rich in cereal grains, which included wheat, barley and possible oat in <2107> (2215). All of them also contained cereal glume bases of the spelt? wheat variety, and <2107> (2215) contained abundant charred weed seeds, including *Chrysanthemum segetum* (corn marigold), *Galium*, and *Rumex*. The only non-kiln feature that contained abundant CPR was sample <2163> (2995), which came from the fill of waterhole 2990 and contained numerous indeterminate fragments and spelt? wheat glume bases.

A number of the kiln samples were also rich in charcoal fragments, which may provide information on the type of wood fuel used for this activity. Samples <2101> (2132), <2102> (2134), and <2103> (2137), which are all from contexts associated with kiln group 3068 all contain appreciable amounts of charcoal fragments. The species of wood used appeared highly variable and included abundant round wood of possible heather. Sample <2154> (2152) from kiln group 3067, and <2112> (2259), from oven/hearth 2324 also contained abundant charcoal fragments. The only non-kiln feature to contain abundant charcoal fragments was sample <2128> (2497), which came from pit 2496.

In addition to those samples rich in CPR, three of the samples from Roman contexts contained abundant waterlogged plant remains (WPR). This included sample <2142> (2561), from tree bole fill 2560, and samples <2138> (2625) and <2139> (2628), which both came from well 2620. All of these samples contained a variety of weed seeds, including Urtica dioica (common nettle), Hyoscyamus (henbane) Rubus fruticosus (bramble), Prunus sp (cherries) and should provide information on the immediate environment of the site as well as the availability of wild food-stuff.

A total of 17 samples came from Roman ditch/pit fills, and all of them were relatively devoid of CPR, containing just a few fragments of cereal grains. Similarly, charred plant remains and charcoal fragments were also limited in the ten cremation spits.
The single post-medieval sample, <2136> (2599), came from ditch fill 2601 and contained over 100 cereal grains, which were very glassy and distorted and likely to have undergone burning at very high temperatures. However, a few barley and bread wheat grains were recognisable. The sample also contained over 100 charcoal fragments of mainly oak wood.
All of the six undated samples were relatively devoid of CPR. However, two contained sufficient charcoal fragments to warrant further analysis. This included sample <2116> (2307), from a peat layer associated with burnt flints, and sample <2159> (2475), which came from a ditch fill that also contained metallic fragments, which may represent 'industrial' waste.

Discussion
The assessment has shown that a number of the samples assessed from Dagenham contained relatively rich assemblages of charred plant remains and charcoal, and that a majority of these came from the Roman kiln features. The cereal remains should provide information on the type of cereals being used at the site and the charcoal should provide information on the preferred fuel wood for the heating of the kiln. In addition, two samples that came from a well were very rich in waterlogged plant remains, which provide information on not only the immediate environment of the site, but also on the wild resources available.

Recommendations
It is recommended that six of the assessed samples be taken to full CPR analysis and three taken to full WPR analysis. Additionally, it is recommended that seven samples be taken to full charcoal analysis. The chosen samples and associated recommendations are shown in Table 17.

Table 17. Summary of recommended samples to be taken to full analysis.

Samples to be taken to full analysis	Type of feature	Type of analysis
<2101> (2132) or <2102> (2134)	Kiln (grp 3068)	CPR & Charcoal
<2103> (2137)	Kiln (grp 3068)	Charcoal
<2154> (2152)	Kiln (grp 3067)	CPR & Charcoal
<2107> (2215)	Backfill of Kiln 2324	CPR
<2113> (2216)	Backfill of Kiln 2324	CPR
<2112> (2259)	Kiln 2324	CPR & Charcoal
<2116> (2307)	Peat layer ass. with burnt flint deposit	Charcoal
<2159> (2475)	Ditch (with industrial waste?)	Charcoal
<2128> (2497)	Pit	Charcoal
<2142> (2561)	Tree bole	WPR
<2138> (2625)	Well	WPR
<2139> (2628)	Well	WPR
<2163> (2995)	Waterhole	CPR

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Assessment of the Charred and Waterlogged Plant Remains from Area 2 by Ruth Pelling

Introduction

Excavations at Beam Washlands, Dagenham in August 2005 prior to the construction of a flood alleviation scheme included sampling for charred and waterlogged plant remains. The Area 1 works included an assessment of waterlogged plant remains from boreholes (Huckerby 2006) and charred and waterlogged plant remains from archaeological features of Bronze Age, Iron Age and Roman date (Druce 2006). The boreholes indicated the presence of alder carr woodland and increasingly wet conditions through time. The charred plant remains produced useful evidence for fuel use in the Roman kiln features as well as more general information about crop husbandry practices. The Area 2 charred samples are largely derived from Late Iron Age/Roman cremation deposits with three samples each from pit fills and layers and two samples from unspecified features (sample 3131, context 3578 and sample 3132, context 3580). Two waterlogged samples are from unspecified features (sample 3128 context 3169 and sample 3129 context 3150). It was hoped that the Area 2 samples would provide complimentary evidence, particularly concerning cremation deposits and/or pyres.

Methodology

Bulk samples of between 10 and 80 litres were processed at Oxford Archaeology using a siraf type flotation machine following standard procedures. Flots were collected onto 0.5mm mesh and allowed to air dry before being submitted to the author. Two waterlogged samples of 2 litres each were processed in the same way and kept wet. A total of 24 charred flots and two waterlogged flots were submitted for assessment. Each charred flot was first put through a stack of sieves from 2mm to 0.5mm to break them into manageable fractions, and each fraction was scanned under a binocular microscope at x10 to x20 magnifications. Any charred seeds, chaff or other quantifiable items were provisionally identified and an approximation of abundance made (where + = 1-10; ++ = 11-50; +++ = 51-100; ++++ = >100). The quantity of charcoal present was noted on a four point scale (present, common, frequent, abundant) and random pieces were fractured and examined in transverse section in order to make provisional identifications. Charcoal was identified as *Quercus* sp. (oak) or non-*Quercus* taxa. A sub-sample of 50ml was examined in the same way from each waterlogged flot. Plant nomenclature follows Clapham, Tutin and Moore (1989).

Results

Detailed assessment results for the charred flots are given in Table Two. Plant taxa and non-plant material noted in the waterlogged sub-samples is given in Table One. More detailed assessment notes are given in an Excel spreadsheet.

The bulk samples produced flots which were generally rich in charcoal but also contained large quantities of modern rootlets. Occasional non-charred seeds are thought to be intrusive modern material rather than dried out waterlogged archaeological material. In contrast to the Area 1 samples (Druce 2006) non-charcoal charred remains were extremely rare. No cereal remains were positively identified. One grain of *Avena* sp. (oats) in sample 3131 (context 3578) may represent a crop plant or a wild species. Single indeterminate large caryopses of Gramineae (grass) in cremation sample 3114 (context 3227) and layer sample 3121 (3342) may represent cereals or large seeded wild grasses. The basal culm nodes of indeterminate Gramineae in cremation samples 3110 (context 3157) and 3111 (context 3158) could derive from the burning of turf or uprooted grass. Occasional small seeded wild species were present in four samples and included small seeded Gramineae, *Medicago/Trifolium/Lotus* type (medick/clover/trefoil etc), possible *Rumex acetosella* type (sheep's sorrel) and *Chenopodium album* (fat hen).

Charcoal was frequent to abundant in 15 of the 24 bulk samples of which 10 were from cremations, 2 from pit fills, one from a layer (sample 3121) and one unspecified (sample 3131). It is possible that the pit fills and layer sample also derive from cremation deposits given the close proximity to the cremation features. Four cremation samples produced very rare charcoal (samples 3108, 3110, 3114 and 3115) perhaps indicating the separation of bone fragments from the remains of the funeral pyre. *Quercus* sp. (oak) was the dominant taxa identified but did not occur in all samples. Large pieces of possible Maloideae type (apple, pear, hawthorn etc) charcoal dominated sample 3104 (context 3145), while several samples were mixed containing both *Quercus* and non-*Quercus* type taxa. Both cremation deposits and other features produced mixed taxa.

Of the two waterlogged samples, sample 3129 (context 3550) produced frequent wood fragments and a limited range of seeds and insect parts. Seeds and other identifiable plant items included both seeds and catkins of *Alnus glutinosa* (alder), rare seeds of *Rubus* sp. (blackberry/bramble/raspberry etc) and species of slow flowing or stagnant water (*Oenanthe aquatica*, *Lycopus europaeus*) or possible wet grassland and stream side plants (*Ranunculus* sp. and *Polygonum persicaria/lapathifolium*). This range of material would be consistent with the continued presence of alder carr woodland and open, slow moving, bodies of water. Sample 3128 (context 3169) produced very rare plant material of which a seed of *Rumex* sp. and occasional seeds of *Alnus glutinosa* were the only species positively identified.

Statement of Potential

Charcoal was generally abundant in the samples, particularly cremation deposits. The identification of non-*Quercus* charcoal taxa would be of interest in tracing habits and patterns in cremation practice, particularly patterns in wood selection, both on a local and national level. It would be of particular use to compare to other published and unpublished cremation sites in south-east England where *Quercus* sp. and *Fraxinus* (ash) generally appear to be selected although not exclusively so (eg. Gale 1997; Dana Challinor *pers comm.*) The comparison of taxa from cremations and the Area 1 kilns would be of interest in terms of tracing both local flora but also patterns of fuel use and preferences. The other charred plant remains offer no potential for further analysis.

Non-*Quercus* charcoal provides the potential for radiocarbon dating for several as yet undated samples. In occasional undated samples however, the charcoal offers no or only limited or unreliable potential for dating. Of those, insufficient charcoal is present in sample 3108 (context 3149), while non-*Quercus* charcoal is rare or absent in samples 3120 (context 3341), 3105 (context 3151) and 3109 (context 3155). The potential for dating is indicated in Table Two.

The waterlogged plant remains offer limited potential for further analysis. Further analysis of the full flots may extend the species list slightly, but it is unlikely to add significantly to the data already generated by the Area 1 samples or pollen in terms of the local environment.

Recommendations

It is recommended that a selection of the 16 samples in which charcoal was frequent or abundant is selected for detailed analysis allowing a rate of one and a half samples a day. Priority should be given to those samples for which dating material is required. No additional work is required on the charred seeds or the waterlogged material.

Table 1: The waterlogged plant and insect remains noted during assessment of 50ml of the waterlogged flots

	Sample	**3129**	**3128**
	Context	**3550**	**3169**
Ranunculus acris/bulbosus/repens	Buttercup seed	+	-
Alnus glutinosa (L.) Gaertner	Alder seed	+	+
Alnus glutinosa (L.) Gaertner	Alder catkin	+	-
Oenanthe aquatica (L.) Poiret	Fine-leaved Water-Dropwort	+	-
Lycopus europaeus L.	Gipsywort	+	-
Rubus sp.	Blackberry/Bramble/Raspberry etc	+	-
Labiate, small seeded		+	-
Polygonum lapathifolium/persicaria	Red Shank, Persicaria/Pale persicaria	+	-
Rumex sp.	Dock, sorrel etc	-	+
Wood fragments		+++	++
Indeterminate leaf buds		-	+
Trichoptera indet	Caddisfly laval case	+	-
Insect fragments		+	+
Fungal spores		+	++

Table 2. Charred and waterlogged plant remains from Area 1

Context	Sample	Phase	Fill of	Feature and description	Sample vol. (litres)	Flot description	Plant remains	Potential
2107	2106	Roman LC1-EC2	?	Ditch fill- kiln rake-out?	40	120 ml. Charcoal (4) few >2mm, coal (2), sand (4), modern roots (4), earthworm egg cases (2), insect remains (2)	CPR: Cerealia indent (1), weed seeds (1) incl. *Galium, Polygonum aviculare;* WPR (2) *Chenopod album, Polygonum aviculare*	No
2112	2162	?	Underneath kiln grp 3067	Natural layer	10	<5 ml. Charcoal (1), modern roots (1), sand & gravel (4)	CPR: Cerealia indent (1)	No
2132	2101	Roman MC1	Kiln grp 3068	Fill of kiln	40	300 ml. Charcoal (4) >2mm, mostly diffuse porous round wood (heather?), modern roots (3)	CPR: Cerealia indet (2), chaff (3) incl. glume bases, culm nodes, Weed seeds (2) incl. Cyperaceae, *Rumex, Polygonum, Chenopodium,* Fabaceae	**Moderate CPR Good Charcoal**
2134	2102	Roman EC2-MC3	Kiln grp 3068	Fill of kiln	40	300 ml. Charcoal (4) >2mm incl. Oak & round wood, Coal (2), sand & gravel (4)	CPR: Cerealia indet. (2), chaff (3) incl. Glume bases, culm nodes, weed seeds (3) incl. *Lamium,* Cyperaceae, *Galium,* Fabaceae	**Moderate CPR Good Charcoal**
2137	2103	Roman MC2-MC3	Kiln grp 3068	Fill of kiln	40	100 ml. Charcoal (4) >2mm diffuse porous & oak, modern roots (3), insect remains (1), earthworm egg cases (2), metallic globules (1)	CPR: Cerealia indent (2), chaff (2) incl. glume base, weed seeds (1) incl. *Galium;* WPR (1) *Chenopod album, Polygonum aviculare*	**Good Charcoal**
2152	2154	Roman MC2-LC2	Kiln grp 3067	Fill of kiln	20	250 ml. Charcoal (4) >2mm, mixed with round wood, modern roots (4)	CPR: Cerealia indent, wheat (3), chaff (3) incl. culm node, glume bases, weed seeds (1) incl. Fabaceaeá, Polygonum; WPR (2) *Galium, Chenopod album, Rumex acetosa, Sambucus nigra*	**Moderate CPR Good Charcoal**
2155	2156	Roman	Kiln grp 3067	Fill of kiln	10	<5 ml. Charcoal (2), modern roots	CPR: Cerealia indent (1), weed seeds (1) incl. *Galium*	No
2181	2100	Roman LC1-LC4	2209	Ditch fill	40	200 ml. Charcoal (4) >2mm, mostly oak, some diffuse porous; modern roots (3), earthworm eggs (2)	CPR: Cerealia indet. (1), weed seeds (1); WPR (2) Fabaceae, *Polygonum*	No

Table 2. Charred and waterlogged plant remains from Area 1

Context	Sample	Phase	Fill of	Feature and description	Sample vol. (litres)	Flot description	Plant remains	Potential
2215	2107	Roman EC2-LC4	2324	Backfill of Kiln 2214	40	100 ml. Charcoal (4) few >2mm, modern roots (4),	CPR: Cerealia indent, wheat, oat, barley (4), chaff (4) incl. glume bases , weed seeds (3) incl. *Chrysanthemum segetum, Galium, Rumex acetosella;* WPR (1) *Persicaria lapathifolia*	Good CPR
2216	2113	Roman MC2-MC3	2324	Backfill of kiln	10	20 ml. Charcoal (3/4) >2mm, diffuse porous, modern roots (3), insect remains (1)	CPR: Cerealia indent (3), chaff (3) incl. glume bases, hazelnut frag. (1): WPR (2) *Polygonum aviculare*	Good CPR
2219	2115	Roman EC3-MC3	2217	Fill of pit/well	40	<5ml. Charcoal (3), modern roots (1)	CPR: Cerealia indent. (2); WPR (2) *Sambucus nigra.*	No
2220	2114	Roman MC-LC4	2217	Fill of pit/well	40	<5ml. Charcoal (2), modern roots (3), insect remains (1)	CPR: Chaff (1) incl. glume bases; WPR (2) *Chenopod album, Sambucus nigra*	No
2227	2108	?	2229	Pit fill	40	200 ml. Charcoal (3), modern roots (4)	CPR: Cerealia indent (1); WPR (1) *Galium, Chenopod album, Rubus fructicosus, Polygonum aviculare*	No
2230	2109	Roman EC2-MC3	2231	Fill of ditch with burnt flint ass. With round house	30	200 ml. Charcoal (4) >2mm, mostly oak, coal (2), modern roots (4), earthworm egg cases (1), insect remains (1)	CPR: Cerealia indent (1); WPR (3) *Rumex acetosa, Sonchus, Chenopod album, Fumaria*	No
2248	2110	Roman EC-EC2	2247	Secondary fill of ditch	40	210 ml. Charcoal (1), modern roots (4), insect remains (1), earthworm egg cases (2)	CPR: Weed seeds (1) incl. *Bromus;* WPR (3) *Sambucus nigra, Chenopod album, Polygonum aviculare, Rumex obtusifolius*	No
2249	2111	Mid-Late Iron Age	2250	Post hole fill	20	150 ml. Charcoal (2), modern roots (4), insect remains, earthworm egg cases (2), coal (2), gravel (2), burnt clay? (2)	CPR: Cerealia indent (1), chaff (1) incl. glume bases, weed seeds (1) incl. *Rumex acetosa;* WPR (3) *Chenopod album, Rumex acetosa, Polygonum aviculare*	No
2259	2112	Roman	2324	Kiln fill	10	7 ml. Charcoal (3/4) >2mm,	CPR: Cerealia indent (3),	Moderate CPR

Table 2. Charred and waterlogged plant remains from Area 1

Context	Sample	Phase	Fill of	Feature and description	Sample vol. (litres)	Flot description	Plant remains	Potential
						modern roots (3)	chaff (2) incl. glume bases, weed seeds (2) incl. *Galium, Rumex acetosella; WPR* (1) *Rubus fructicosus, Chenopod album*	**Moderate Charcoal**
2307	2116	?	?	Peat layer associated with burnt flint deposit	40	260 ml. Charcoal (4) >2mm, mostly diffuse, some oak, modern roots (4), insect remains (2)	WPR (2) *Urtica dioica, Chenopod album, Rumex acetosa*	**Good Charcoal**
2340	2185	Roman	2341	Cremation fill Spit 1	0.5	<5ml. Charcoal (1), modern roots (2)	WPR (1) Persicaria lapathifolia	No
2340	2125	Roman	2341	Cremation fill Spit 2	?	<5ml Charcoal (1), modern roots	WPR (3) *Juncus, Polygonum aviculare*	No
2342	2117	Roman	2341	Cremation fill spit	20	20ml. Charcoal (3), modern roots (4), earhworm egg cases (1), fungal sclerota	CPR: Cerealia indent (2), chaff (2) incl. glume bases; WPR (2) *Juncus, Sambucus nigra*	No
2342	2124	Roman	2341	Cremation fill spit 1 (bag 1) 0-20mm	?	<5ml. Charcoal (1), modern roots (3)	CPR: Cerealia indent (1); WPR (2) *Juncus*	No
2342	2124	Roman	2341	Cremation fill spit spit 1 (bag 2)	?	<5 ml. Charcoal (2), modern roots (2)	WPR (2) *Juncus*	No
2342	2126	Roman	2341	Cremation fill spit 30-40mm	?	<5ml, Charcoal (1), modern roots (2), earthworm egg cases, insect egg cases	WPR (2) *Juncus*	No
2342	2126	Roman	2341	Cremation fill spit 40-60mm	?	<5 ml. Charcoal (1), modern roots (2), earthworm egg cases, insect egg cases	WPR (3) *Juncus*	No
2344	2118	Roman	2341	Cremation fill spit (bag 1)	?	<5ml. Charcoal (2), modern roots (2)	CPR: Chaff (1) incl. glume bases	No
2344	2118	Roman	2341	Cremation fill spit (bag 2)	?	<5ml. Charcoal (1), modern roots (2)	WPR (2) *Juncus*	No
2371	2120	Roman EC3-LC4	2369	Secondary fill of ditch	40	20 ml. Charcoal (2), modern roots (4)	CPR: Cerealia indent (1); WPR (3) *Sambucus nigra, Juncus, Rubus fructicosus, Chenopod album, Stellaria media*	No

Table 2. Charred and waterlogged plant remains from Area 1

Context	Sample	Phase	Fill of	Feature and description	Sample vol. (litres)	Flot description	Plant remains	Potential
2372 CPR	2121	Roman	2369	Primary fill of ditch	49	<5 ml. Charcoal (3), modern roots (4)	CPR: Cerealia indent (1); WPR (2) *Juncus, Brassica, Sambucus nigra*	No
2372 WPR	2121	Roman	2369	Primary fill of ditch	1	<5 ml. Charcoal (2), modern roots (3) earthworm egg cases		No
2402	2123	Roman	2341	Cremation fill	10	15 ml. Charcoal (3) few >2mm, modern roots (3), fungal sclerota (3), earthworm egg cases (1), burnt bone (2)	CPR: Cerealia indent (2), chaff (1) incl. culm nodes WPR (1) *Juncus, Sambucus nigra*	No
2475	2159	?	?	Cut of ditch	20	190 ml. Charcoal (4) >2mm mostly diffuse incl. Round wood, modern roots (3), insect egg cases (4), metallic pieces (1)	CPR: Cerealia indent (2), chaff (2) incl. glume bases, weed seeds (2) incl. *Polygonum, Chenopodium*; WPR (1) *Urtica dioica, Galium, Polygonum aviculare, Chenopod album*	**Good Charcoal?**
2497	2128	Roman EC1-EC2	2496	Pit fill	20	650 ml. Charcoal (4) >2mm mostly oak, modern roots (2), insect egg cases (1), metallic fragments (1)	CPR: Weed seeds (1); WPR (1) *Bromus, Chenopod album, Fumaria,*	**Good Charcoal**
2514	2129	Roman	2515	Pit fill	30	200 ml. Charcoal (1), modern roots (4)	CPR: Cerealia indent (1), chaff (1) incl. culm nodes; WPR (2) *Galium, Polygonum aviculare, Rumex acetosa, Chenopod album, Polygonum convolvulus*	No
2542	2133	?	2543	Post hole fill	5	5 ml. Charcoal (2), modern roots (3)	CPR: Chaff (1) incl. culm nodes, weed seeds (1) incl. *Rumex acetosella;* WPR (2) *Chenopod album, Polygonum convolvulus, Rumex acetosella, Polygonum aviculare*	No
2553	2131	Roman	2504	Pit fill	20	20 ml. Charcoal (2), modern roots (3), earthworm egg cases(1)	CPR: Cerealia indent (1), chaff (1) incl. culm nodes; WPR (1) *Chenopodium*	No

Table 2. Charred and waterlogged plant remains from Area 1

Context	Sample	Phase	Fill of	Feature and description	Sample vol. (litres)	Flot description	Plant remains	Potential
							album	
2554	2132	Roman	2504	Pit fill	20	40 ml. Charcoal (3), modern roots (3), coal (2)	CPR: Cerealia indent (1), chaff (1) incl. *Galium;* WPR (2) *Potentilla erecta* type, *Chenopodium album, Juncus, Polygonum aviculare*	No
2561	2142	Roman MC1-EC2	2560	Tree bole fill	40	325 ml. Charcoal (2), modern roots (3), earthworm egg cases (2) wood(2), buds (2), flint frag. (2)	CPR: Chaff (2) incl. glume bases; WPR (4) *Persicaria lapathifolia, Potentilla erecta* type, *Prunus sp., Ranunculus repens* type, *Rubus fructicosus, Stellaria media, Sambucus nigra*	**Good WPR**
2566	2134	Prob. Modern feature?	?	Post hole fill	2	30 ml. Charcoal (4) few >2mm very hard & distorted, clinker (4), modern roots (3), mammal bone (3), insect remains (1), sand & gravel (4)	CPR: Cerealia indent (1), weed seeds (1) incl. Fabaceae; WPR (1) *Chenopod album, Rubus fructicosus, polygonum aviculare*	No
2595	2135	Roman EC3-LC4	2596	Ditch fill	40	75 ml. Charcoal (4) >2mm, modern roots (4)	CPR: *Cerealia* indent (1); WPR (1) *Rubus fructicosus, Rumex acetosa, Stellaria media, Sambucus nigra*	No
2599	2136	Post-Medieveal	2601	Ditch fill	40	30 ml. Charcoal (4) >2mm mainly oak some diffuse, modern roots (4), insect egg cases, coal (2), sand & gravel (4)	CPR: Mostly *Cerealia* indent, barley, bread wheat (3); WPR (1) *Chenopod album, Sambucus nigra*	No
2625	2138	Roman	2620	Well fill	40	200 ml. Charcoal (3), modern roots (4), wood (3), earthworm egg cases (2)	CPR: Cerealia indent (1), chaff (1) incl. glume bases; WPR (4) *Urtica dioica Rubus fructicosus, Rumex acetosella, Sambucus nigra, Prunus sp. Polygonum aviculare, Hyoscyamus, Carex* lenticular	**Good WPR**

Table 2. Charred and waterlogged plant remains from Area 1

Context	Sample	Phase	Fill of	Feature and description	Sample vol. (litres)	Flot description	Plant remains	Potential
2628	2139	Roman	2620	Well fill	40	450 ml. Charcoal (3)	CPR: Cerealia indent (1), chaff (1) incl. glume bases; WPR (4) *Hyoscyamus, Sambucus nigra, Polygonum aviculare, Stellaria media, Rubus fructicosus, Carex lenticular, Urtica dioica, Malus, Alnus/Betila*	**Good WPR**
2995	2163	Roman	2990	Fill of waterhole	10	10 ml. Charcoal (3/4) >2mm mostly diffuse, modern roots (2)	CPR: Cerealia indent (3), chaff (3) incl. glume bases; WPR (1) *Sambucus nigra, Rumex acetosella*	**Good CPR**
3003	2167	Roman	3000	Fill of waterhole	20	5 ml. Charcoal (3), modern roots (3)	WPR (1) *Rumex acetosa*	No
3013	2158	?	?	Pit fill	10	10 ml. Charcoal (4) few >2mm, modern roots		No
3049	2172	Roman EC1-MC1	3050	Pit fill	30	50 ml. Charcoal (1), modern roots (3), insect egg cases (4)	CPR: Cerealia indent (1), chaff (1) incl. glume bases; WPR (1) *Bromus, Galium, Rubus fructicosus*	No
3060	2173	Roman EC1-MC1	3061	Pit fill	20	25 ml. Charcoal (4) >2mm mostly diffuse, modern roots (4), insect egg cases (4), coal (2)	CPR: Cerealia indent (1), chaff (1) incl. culm nodes, weed seeds (1) WPR (1) *Chenopod album, Persicaria lapathifolia, Sambucus nigra*	No

Table 3: Assessment Results of the Charred Flots from Area 2

sample	context	Sample vol (l)	feature	flot vol (ml)	Date	grain	Id-grain	weeds	Other	charcoal	id-charcoal	C14 Potential
3100	3137	30	cremation	550				+		+++	Mixed incl Quercus	high
3101	3141	20	cremation	400	?LIA-ER					+++	Mixed	high

3102	3139	30	cremation	1250	?LIA-ER					++++	Mixed	high
3103	3143	10	cremation	800	?LIA-ER					++++	Mixed	high
3104	3145	30	cremation	1150	LIA-ER					++++	?Maloide	high
3105	3151	10	cremation	700	?LIA-ER					+++++	Quercus	low
3106	3153	40	cremation	700	?LIA-ER			+		+++	Mixed	high
3107	3147	10	cremation	200	LIA-ER					++	Mixed	high
3108	3149	10	cremation	40	?LIA-ER					+		no
3109	3155	20	cremation	600	?LIA-ER					+++	mostly Quercus	low
3110	3157	40	cremation	350	?LIA-ER			++	Gramineae basal culm nodes	+	Mixed (rare Quercus)	high
3111	3158	13?	cremation	1050	?LIA-ER					++++	Mixed, Quercus dominant	moderate
3111	3158			20					Gramineae basal culm nodes	+		no
3112	3160	10	cremation	250	?LIA-ER					+++	Mixed	high
3114	3227	30	cremation	60	AD10-70	+	indet			+		no
3115	3229	15	cremation	40	AD10-70					+		no
3116	3110	35	pit fill	1150	?					++++	Mixed	high
3117	3287	80	cremation	900	?					+++	Mixed	high
3118	3296	50	pit fill	700						+++	Mixed (Quercus dominant)	moderate
3120	3341	10	pit fill	140	Saxon?			+		++	mostly Quercus	low

3121	3342	10	layer	450		+	indet			++++	Mixed (Quercus dominant)	moderate
3123	3338	40	layer	200								
3124	3523	10	layer	40						+		no
3131	3578	40	?	300		+	Avena			++++	Mixed (Quercus dominant)	low
3132	3580	15	?	50						+		

11.11 APPENDIX 11 - HUMAN REMAINS

Human Remains *By Sharon Clough*

Cremated human remains were found in 14 contexts and have been provisionally dated to the Roman period. Twelve of the deposits were recovered from earth-cut pits, and two may have been deposited in urns. Occasional copper alloy and iron objects were recovered from the deposits.

The potential of the remains for full analysis was assessed by following the guidelines set out by Mays *et al.* (2004). This involved recording, for each context, weight (in grams) and, based on macroscopic examination, fragment size and colour.

The results are presented in Table 1, where 'potential for full analysis' refers to the level of information that may be gained from a full analysis of the deposits. This includes that which will facilitate interpretation of the nature of the deposits (for example, whether they are re-deposited pyre debris or cremation burials), inform about aspects of the funerary rite (for example, whether certain elements were selected for burial), and will allow the estimation of biological parameters (i.e. minimum number of individuals present, age and sex) and evaluation of the health status of the population by the identification of pathological conditions. Thus, highly fragmented deposits containing limited diagnostic elements were considered to be of low potential, whereas deposits containing frequent diagnostic elements were considered to be of high potential.

Table 1: Potential of cremated remains by context

Context	Colour of bone	Weight of bone (g)	Degree of fragmentation	Comments and potential for full analysis
3137	Buff white	13	10 mm only	Low
3139	Buff white and grey	874	Even amounts in 10 & 10-4 mm	High - lots of identifiable pieces
3141	Buff white	279	Fragmented, majority in 10-4 mm	Medium
3145	Buff white	187	10 mm only	Medium
3147	Buff white	210	Fragmented , majority in 10-4 mm	High
3149	Buff white	45	Fragmented , majority in 10-4 mm	Medium
3153	Buff white	318	Fragmented , majority in 10-4 mm	High
3155	Buff white	448	Fragmented , majority in 10-4 mm	High
3157	Buff white	289	Fragmented , majority in 10-4 mm	High
3159	Buff white	4	10 mm only	Low
3161	Buff white	41	Fragmented , majority in 10-4 mm	Medium
3227	Buff white	360	Fragmented , majority in 10-4 mm	High
3229	Buff white	52	Fragmented , majority in 10-4 mm	Medium
3287	Buff white	159	Even amounts in 10 & 10-4 mm.	High

All of the contexts contained bone that was buff white in colour. This indicates that temperatures greater than 600°C were achieved (McKinley 2000), and thus the efficiency (for example, good quality fuel, favourable weather conditions, well constructed pyres, etc.) of the cremations. Other colours, such as brown or black, indicate low temperatures.

The high number of individual deposits suggests that they may have comprised part of a cremation cemetery. However, the low weights of bone recovered from some of the contexts suggest that entire individuals are not present and that a token amount has been deposited, perhaps indicating that they are not cremation burials but some other type of cremation deposit such as re-deposited pyre debris. More detailed analysis is required to explore this further.

Fragmentation levels are high and this may affect identification of individual elements in some cases. However, at least seven of the deposits consist of remains that have the potential to indicate a minimum number of individuals, age and sex, and reveal evidence for pathology, if examined in more detail.

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11.12 APPENDIX 12 - GEOARCHAEOLOGY

SYNTHESIS OF GEOARCHAEOLOGY AND PALAEOENVIRONMENTAL REMAINS

By Carl Champness & Elizabeth Stafford

Introduction

As part of the mitigation of construction impacts on areas of archaeological potential at Beam Washlands in Dagenham, Greater London, a programme of geoarchaeological fieldwork was undertaken between 2005 and 2006. This work aimed to investigate the floodplain sediment sequence of an Iron Age/Romano-British site adjacent to the Wantz Stream and Beam River. Two phases of borehole sampling were undertaken to collect information and samples suitable for the interpretation of the depositional environment of the sediment sequence. It also aimed to identify any post-depositional processes that may have acted upon it, with the objective of reconstructing the past environment and its significance for human activity in the three areas of development impact.

This report synthesises the results of the all the geoarchaeological and palaeoenvironmental assessment of the floodplain sequence to addresses its overall significance and potential for further work. Detailed specialist reports for each material category can be found in Appendixes.

Summary of stratigraphy

The deposit model presented in the interim geoarchaeological statement (OA 2005a) has now updated with the data from the most recent phases of work (Fig. 13) which investigated the river valleys of the Wantz Stream and River Beam. These deposits were then investigated with two phases of targeted archaeological boreholes that explored the deepest and most complete sediment sequences. The model identified a deep sequence of alluvial and peat deposits associated with palaeochannels of the Wantz Stream.

Broadly the stratigraphy was relatively consistent and comprised:

- Made Ground/topsoil
- Upper Alluvium
- Peat/organic deposits.
- Lower Alluvium
- Pleistocene Gravels
- Bedrock

Similar sequences have been frequently recorded elsewhere in the east London marshes, mainly on the Thames floodplain (e.g. Bates 1999, Bates and Barnham 1995, Bates and Whittaker 2004, Devoy 1977, 1979, 1980, 1982, Haggart 1995, Marsland 1986, OA 2003, Sidell and Wilkinson 2004, Sidell et al 2000, Wilkinson 1988, Wilkinson et al 2000) although they have not been extensively investigated within the Dagenham area in the vicinity of the Beam River. Superficially the sedimentary sequences at Beam Washlands resemble the typical Lower Thames tri-partite sequence of clay-silt/peat/clay-silt. However, closer examination of the individual profiles within the purposive boreholes demonstrated variability in terms of altitude and lithology. This variability, did not allow easy comparison with Devoy's Thames-Tilbury model (Devoy 1979). Current models for the development of the Thames floodplain area commonly adopt a modified version of the Devoy model. Models of this kind however tend to look at the broader pictures of estuary development, that may be recorded in a mid floodplain situation, but ignore the very complex situations at the margins of floodplains and around tributaries where edge effects come into play. Bates and Barnham (1995) suggest in such situations small variations in sub-surface topography may result in peat formation in one area when much of the remaining area was subject to minerogenic deposition. This may have implications for detecting region-wide environmental events associated with fluctuations in river levels, although an event of sufficient magnitude ought to be identifiable.

Initial examination of the sediment sequence suggested significant potential for the preservation of a detailed record of the environmental development possibly covering a period from the Mesolithic period onwards. Since Devoy's original work, a considerable number of investigations have taken place within the region, many associated with developer-funded archaeological investigations. Other investigations have focused on

environmental change. Bates and Whittaker (2004) however note that despite these investigations only a few sites relate to the earlier parts of the Holocene; the Mesolithic and Neolithic periods.

Assessment strategy

An initial preliminary deposit model was undertaken for the site, based on geotechnical data being entered and correlated using computer modelling software (©Rockworks 2006). The basic lithological data was correlated into broad stratigraphic units to aid in the interpretation of the sequence. This model was then used to select the optimum locations for palaeoenvironmental sampling. Three initial boreholes were located along the Wantz Stream and River Beam, and followed up by a transect of 8 boreholes along the proposed pond excavations.

The initial three samples were drilled using a percussion shell and auger boreholes that drilled to recover intact column samples from key locations. Drilling was monitored in the field by a geoarchaeologist to ensure that the appropriate depth was reached. Where possible a continuous U4/U100 cores were taken continuously down the sequence. Drill shoe samples were retained as bulk samples between successive U4/U100 cores. All cores were labelled and assigned depths below ground surface and located in 3-dimensional space.

The 8 borehole samples taken during the 2006 pond excavations were drilled using a different drilling rig in order to recover a greater set of undisturbed sediment samples. These were spaced at 5m intervals along a transect stretching from the edge of the gravel terrace to the present course of the Wantz Stream. This drilling technique provided a continuous set of samples 1m length through the sequence with more of the sedimentary boundaries still intact within the core. The better integrity of the sediment samples can aid in the easy of stratigraphic correlation between cores and also the overall interpretation of the depositional sequence.

All sample cores were returned to OA and split longitudinally and the sediments logged by a geoarchaeologist. One half of the cores was subsampled for pollen, diatoms and radiocarbon dating, with the intact core retained for future analysis. The other half was cut into 5cm increments and a selection processed for macro remains. The remaining unprocessed increments were bagged and retained for future analysis.

Of the three initial boreholes, ARCBH1 produced the longest organic sequence. However, deposits from both ARCBH1 and ARCBH2 were both assessed due to the fact the organic deposits occur at different elevation suggesting they may have accumulated over different periods. An organic sequence exposed at higher elevations in the area excavated on the gravel terrace was also assessed (Fig. 13). Five radiocabon dates were processed in order to establish the age and date range of organic deposits encountered and to provide a preliminary chronological framework for the stratigraphy.

From the further eight boreholes from the pond excavation, OABH3 produced the longest intact organic sequence. However, deposits from both OABH3 and OABH4 were assessed due to sediment variation within the cores. Three new radiocarbon dates were also processed, in addition to the 5 obtained from previous boreholes, that aimed to establish the age and date range of organic deposits encountered and to provide a method of comparison.

Results

Boreholes ARCBH1, ARCBH2 and ARCBH3

The initial three boreholes were targeted on the thickest and most complete sediment sequences that were identified within the deposit model. A full sediment description and discussion of the palaeoenvironment sequence of these boreholes can be found in the previous interim reports (OA, 2006a/b). Only a brief summary of the sequence and its significance has been outlined here in order to aid in the comparison of the deposits.

The assessment of ARCBH1 and ARCBH 2 identified an early sediment sequence associated with the Wantz Stream. This consisted of silty sand/peat/silt sequence that covered most of the early Holocene. Palaeoenvironmental assessment of these deposits has revealed a detailed history of vegetation change throughout the Holocene. This sequence had considerable potential to help identify patterns of environmental change within the site and wider landscape.

ARCBH3 produced a sediment sequence associated with the River Beam. The sequences consisted of predominately minerogenic silty clay with increasing sand content indicating the presence of an adjacent high energy channel. It was concluded within the assessment that sequence associated with the River Beam had less potential to highlight patterns of environmental change and contain evidence of anthropogenic activity.

Pond Transect OABH1-OABH8 (Fig. 14)

The pond transect provided a cross-section of the palaeochannel sequence revealed in the deposit model just to north of the current Wantz Stream channel. The borehole transect was approximately 500 metres east of the previous boreholes that identified an early Holocene sediment sequence. The sequence consisted of a series of intercutting channels that reflected the shifting channel history of the Wantz Stream valley since the onset of the Holocene.

The basic stratigraphy comprised:

- 0.78m of modern disturbed ground (+0.78 to +0m OD).
- 0.68m of minerogenic silt-clay (+0.62 to – 1.3m OD)
- 4.50m of organic/peat deposits (-0.5. to –5.0m OD)
- 1.90m of minerogenic sand, silt and clay (-3.5 to – 5.4m OD)
- Fluvial gravel (-4.0 to -5.6m OD)
- Stiff clay (-6.9m OD)

Bedrock

Stiff clay was revealed at the base of sequence within borehole 4 at a depth of -6.30m bgl. The underlying bedrock across the site is mapped as London Clay and Thanet Beds (BGS Map Sheet 257). London Clay was only reached in OABH4 with its surface lying at -6.90m OD, and is described as a very stiff grey clay with fine laminations.

Sandy gavel

All of the boreholes were taken down to sandy gravel in order to map the terrace and channel profiles. The coarse grained character of the deposits suggests accumulation under cold climate conditions within a high energy braided streams. Thin layers of soft silty clay occasionally identified within this unit might represent infilling of eroded Pleistocene channels.

Minerogenic sand and silt

Overlying the gravels was a thin minerogenic sandy, silt and clay unit that is quite variable across the profile. It is generally described as a minerogenic greenish grey silty clay with a variable sand content. There generally appears to be an increasing sand content with depth. This unit may represent active channel sedimentation with sand bar formation in a meandering river system and overbank deposition. The finer grained nature of these deposits, as opposed to the underlying coarse grained gravels, suggest lower energy deposition perhaps during the transition to anastomising and more stable flow regime developing during the late glacial and early Holocene.

Main peat

The main organic/peat deposits lay between –5.0m and –0.5m OD. Closer examination of these deposits revealed a complex sequence of organic silt clay, silty peat and peat with occasional lenses of more minerogenic silt-clay and sandy silt within the lower levels. The peat deposits were generally moderately humified with little obvious identifiable plant material apart from woody reed fragments. The presence of areas without peat in the sequence may indicate areas of active channels or mud flat development during the main period of peat accumulation. Also fine silty lens within parts of the peat likely represent periodic flooding derived from active channels.

Upper silty clay

The overlying deposits consisted of minerogenic silty clays that extend across the pond profile and overlie the main peat unit. They are characterised as grey to brownish grey silty clay with reworked pockets of peat near to the base. The fine grained nature of these deposits indicate low energy deposition possibly within active channels.

Modern topsoil/disturbed ground

The alluvial sequence is sealed by various thickness of topsoil and made ground deposits. These are generally characterised as organic silty clay with frequent root material and occasional modern brick.

Pond Section 4000

Section 4000 was exposed during the pond excavations on the lower ground at the edge of the gravel terrace where ground levels averaged +0.495m OD. The basic stratigraphy comprised:

- 0.40m topsoil (4000)
- 0.50m silty clay (4001)
- 0.60m desiccated peat (4003)
- 0. m organic silty clay (4010 & 4011)
- 0.50m sandy silt (4013)
- Pleistocene gravel

The excavation consisted of a deep palaeochannel sequence that was identified at the edge of the gravel terrace. Several intercutting channels were recorded at various elevations with the main peat unit (4005 & 4006). Towards the edge of the channel was a fluvial sand that was overlain by thin deposits of peat (Fig. 12).

At the interface between the peat and sandy silt two small flint scatters were identified dated to the early Mesolithic period. The thin peat deposit appeared to be preserved in a slight hollow in the surface of the sandy silt. The peat at +0.23m OD was radiocarbon dated to 2455±30BP placing accumulation within the middle Iron Age.

The pollen assemblage from the peat at +0.23m OD was well preserved and broadly comparable in overall species range and composition to samples from ARCBH2; indicative of a locally dominant alder carr-woodland environment with a herbaceous understorey. Woodland dominates, with little evidence for anthropogenic activity. Microcharcoal was present, though only very occasionally. Diatoms were poorly preserved suggesting aerophilous (freshwater) conditions with species tolerant of desiccation.

Biostratigraphy

The previous assessment identified a basal peat in ARCBH1 at -4.56 m OD (5.19m bgl) that produced an unexpectedly early radiocarbon dates of 12160±60BP and 12290±60BP, which places the onset of accumulation within the Late Glacial period. This borehole was located in the southwest area of site where the geotechnical logs recorded significantly lower elevations in the underlying Pleistocene gravels (OA 2005a). It is possible that these deposits are preserved at depth as pockets within a subsurface hollow, perhaps at the edge or within an abandoned channel. This lower peat sequence does not appear to be represented anywhere else within any of the other sequences.

Unfortunately pollen, diatoms and plant remains appeared to be rather poorly preserved in samples assessed from the lowermost levels of this peat sequence, between -3.57m and –4.57m OD (-4.20m & -5.20m bgl). The pollen that was preserved may be considered consistent with a Late Devensian/Allerod or early Holocene date with the occurrence of birch and pine. Additional species included willow and a single alder pollen grain at -4.88 and -4.89m bgl. An alder seed was also recorded at -4.20m and 4.31m bgl. A poorly preserved diatom assemblage at -4.35 and -4.36m bgl suggested freshwater aerophile conditions i.e. ephemeral aquatic habitats.

The lower peat in ARCBH1 contained a significant amount of silt between -4.20 and -4.36m bgl and is described as disturbed or mixed with pockets of grey sandy silt. Between -4.05 and -4.20m bgl the peat is overlain by a thin band of sandy silt suggesting moderately high-energy sediment input and possibly erosion of the peat surface at this level from an adjacent channel. The sandy silt is overlain by a thin layer of organic silt clay at -3.88 and -

4.05m bgl. Pollen and plant assemblages were better preserved in this deposit. Although undated the pollen at this level is characteristic of the early Holocene and suggests a largely open environment of grasses and ferns with hazel and pine woodland. Diatom assemblages were absent. Similar deposits may be located at the base of OABH3, but this were not assessed as borehole OABH4 were believed to have the deeper sequence. Pollen preservation was found to be poorly preserved within OABH4, and not interpretable. The sequence represented at the base of ARCBH2 and OABH3 may offer better preservation.

The main peat body within the sequence between -0.50 and –5.00m OD (-2.25m and -3.88m bgl) was relatively homogenous and woody. The base of this unit is at present dated to 5820±30 BP. The pollen and plant remains were moderately preserved and indicate the development locally of alder carr woodland with lime dominated mixed deciduous woodland on the adjacent dry. The pollen profile from OABH3 is dominated by *Alnus glutinosa* (Alder) pollen with decreasing amounts of *Quarcus* (oak), *Betula* (birch) and *Corylus avellana* type pollen (hazel) with decreasing depth. The high levels of microscopic charcoal particles in the base samples may indicate low-level human disturbance of the environment. At -3.10 and -3.11m bgl in ARCBH1, around the middle of the main peat bed, a poorly preserved diatom assemblage is suggestive of mesohalobous or brackish conditions at this level. However a better preserved assemblage from OABH3 is dominated largely by freshwater species with a slight hint of a marine influence *with Anomoeoneis sphaerophora* and *Diploneis ovalis* tolerant of brackish conditions.

A temporary shift to reed swamp conditions may have occurred at -3.0m OD (-3.7m bgl) within OABH3, replacing the dry woodland. Fern spores and sedge pollen are seen to increase at the expense of alder pollen within the profile. This coincides with a shift from peaty clay to an organic silty clay within the sediment sequence. However alder carr was soon re-established at -3.00m OD (-3.25m bgl), with deciduous woodland also present on the dry ground. Two other episodes of organic silty clay deposition at -0.90m and -1.95m bgl may indicate similar shifts to wetter conditions within the main peat sequence. The top of the peat has been radiocarbon dated to 3765±35BP within ARCBH1 and 3320±30 BP within OABH3, which places it within the early/mid Bronze Age period. However, the upper 0.30m of the peat was described as mixed with pockets of grey silty clay. This together with the very abrupt contact with the overlying silt clays suggests some erosion of the upper peat levels may have occurred and a hiatus in the sequence may be present at this point.

The overlying minerogenic deposits comprised of a soft mid grey silty clay with increasing organic flecking and higher silt content approaching the lower contact with the peat. The diatom assemblages were well preserved and suggested estuarine conditions. The pollen and plant assemblages from the silt clays in ARCBH1 and ARCBH2 produced a similar signal of declining local alder carr woodland and an increase in aquatic and wet ground plants. Although herbaceous taxa, mainly grasses, goosefoots and sedges do increase slightly as the proportion of ferns decrease. An increase in pollen of oak and hazel and the decrease in alder –0.82 m OD (-1.45m and 1.46m bgl) towards the top of the sequence might suggest some drying out of the alder carr-woodland, with a subsequent encroachment of oak and hazel onto the wetland.

The opening of the woodland within the drier ground is reflected in the top most samples of the upper silty clay deposits from OABH3, after 3320BP, with poacaea (grasses) becoming dominate and cyperaceae (sedges) secondary. By the top of the profile grasses are consist of over 50%, sedge around 15% and cereal-type grains are recorded. This coincides with a significant increase in microscopic charcoal levels that indicate significant human activity within the locality. This evidence of woodland clearance and expansion of open ground taxa is not recorded in the ARCBH1 pollen profile (Brown, 2006), which suggests that the clearance was either very localised or that it commenced after the accumulation of the upper most sediments analysed in ARCBH1 and ARCBH2.

The accumulation of the upper silt clay deposits also represent a transitions from freshwater to brackish conditions. The diatom assemblage at -0.90m bgl consisted of a mixed assemblage of marine planktonic forms, like *Paralia sulcata* and *Actinoptychus*; brackish diatoms in the form of *Stauroneis phoenicenteron*, *Diploneis didyma* and *D. interrupta*; and freshwater inputs of *Pinnularia spp. notably P. streptoraphe*, *P. borealis* and *P. virridis*. This indicate that the deposit was either intertidal with a dominate marine signal with freshwater inputs or it marked a transition period between brackish and freshwater inputs. By the accumulation of the silty clays at -0.60m bgl, the assemblage was again predominately freshwater with only the rare signals of marine influence.

Significance and potential

The Late Glacial and early Holocene sequence

Radiocarbon dating has demonstrated the organic/peat sequences from ARCBH1 at Beam Washlands appears to have accumulated from the late glacial to Late Neolithic periods. The pollen profile was dominated by pine, birch, and willow, with buttercup and sedges present locally. It appears that these deposits significantly predates the onset of the main floodplain peat sequence on the site dating from the Late Mesolithic onwards. These deposits therefore appear to represent a exceptional rare case of preservation.

If the lower part of the peat sequence is indeed confirmed to commence in the Late Devensian it is of considerable regional importance and both pollen, waterlogged plant and insect remains should be further analysed. They have the potential to contextualize possible Late Palaeolithic activity and climatic change. The significance of the sequence at Beam Washlands is perhaps somewhat enhanced by the presence of two early Mesolithic flint scatters identified on the higher ground of the gravel terrace.

Environmental evidence for the Late Glacial and Early Holocene period from Greater London is far from abundant. Although some published sequences exist, as yet there are no sites in the region, which have yielded continuous unbroken environmental sequences from the late Glacial (Upper Palaeolithic) to the Boreal (Earlier Neolithic) periods though several partial sequences are available e.g. Bramcote Green, Three Ways Wharf and West Heath, Hampstead (MoLAS 2002, 2000:50).

Both alder pollen and seeds recorded within the lower peat sequence suggest perhaps an early date for the migration of the taxa in the Lower Thames valley. Alder is thought to have become established in South East Britain c 8000BP perhaps as early as 8300 BP (Birks, 1989, Tallentire 1992). However there are records of alder pollen in Britain from c 10,000 BC at levels to suggest that the tree was growing locally (Rackham, 2003 97-98). These records for alder and the possible date are therefore of considerable importance and need to be confirmed.

Detailed recording of the cores from ARCBH1 however does suggest that some truncation may have occurred associated with channel activity, represented by the sandy silt within the lower part of the profile that may have produced hiatuses within the sedimentary sequences. In addition the palaeoenvironmental assemblages assessed from the lower levels of the peat sequence were poorly preserved. The potential of the sequences at this level to provide further significant environmental data for the late glacial and early Holocene periods is therefore somewhat limited.

Note should be made however of the better preserved assemblage from the overlying organic silt clay that produced a pollen assemblage characteristic of the early Holocene within ARCBH2 and also potentially represented in OABH3. The pollen profile suggested an open environment of grasses and ferns with hazel and pine woodland. The dating and further palaeoenvironmental analysis of these deposits might help to place the early Mesolithic activity identified at the edge of the river valley within a more detailed environmental context.

The mid-late Holocene sequences

The phase of alder carr succession represented by the accumulation of the main wood peat most likely equates with CLM Stage 4 (c.3-5ka BC, Bates and Whittaker 2004 in OA 2005). The base of the peat unit is dated to c.4655±73BC in OABH3 and c.4471±34BC in OABH4, placing accumulation within the late Mesolithic period. The top samples produced a range of dates from the early Bronze Age date at c. 2150±150BC in ARCBH1, mid Bronze Age at 1582.5±60.5 BC with OABH3 and a middle to Late Iron Age date of c.315±85BC in ARCBH2 at higher elevations. The range of dates likely reflecting shifting channel activity within the upper sequence that may have truncated part of the upper peat sequence. Also active channels could have continued to deposit peat at its edges while silty clay accumulated within the channel. Evidence for the presence of such channels can be identified within the pond excavation section 4000.

The wood peat at Beam Washlands produced a better preserved environmental assemblages although both the pollen and plant remains appear to have been dominated by the local alder carr signal within ARCBH1 and ARCBH2. Only in borehole OABH3 is there better preservation to be able to discuss more regional patterns of vegetation change. The overall interpretation of the pollen from the peat unit is consistent of dry woodland being

eventually replaced by alder carr woodland with deciduous trees elsewhere on the drier ground. There was several brief transition to reed swamp conditions, that was marked by the deposition of organic silt clays. However it was not before long until alder carr woodland was re-established and peat again began to accumulate up until the early Bonze Age.

The asynchronous lime decline, usually occurring between the late Neolithic and the middle Bonze Age and usually ascribed to human activity, is difficult to recognise within the sequence. The taxon does decline in percentage terms at -3.0 m OD (-3.7m bgl) within OABH3, but its persists within the profile at low values, and the absence of anthropogenic indicators, may indicate that this does not represent the traditional lime decline. However, the elm decline can be recognised within the sequence between -2.10m OD (-2.3m bgl) and -3.20m OD (-3.4m bgl), but the coarse sampling does not allow for finer resolution in dating. An interprelated date between the two radiocarbon dates would estimate the date to c. 5063 bp. This parallels the results from a number of sequence nearby, such as the Mar dyke (Scaife 1988, 112), Silvertown, London (Wilkinson et al 2000), Stonemarsh (Devoy 1980) and Bryan Road, Rotherhitthe (Sidell et al 1995).

Woodland clearance is represented within the upper deposits of OABH3, after c.1582.5±60.5 BC, with grasses and sedges becoming dominant within the pollen profile. The increase in charcoal values and the presence of cereal-type pollen within the profile indicate that agriculture was the most likely cause, with arable cultivation occurring with the vicinity. It was under this environmental backdrop that human disturbance of the environment can be detected from the middle Bronze Age onwards. The Iron Age and Roman activity within the site most likely occurred when the stream channel was still active.

The closest comparable sequence to this on the Thames floodplain comes from Dagenham Vale approx. 500m to the southwest where a Pleistocene gravels and sands were overlain by an organic silt clay which was in turn overlain by a thick deposits of wood peat, reed peat and alluvial silt clays. The organic silt was dated to c. 4650±150BC at –3.88m OD and the base of the wood peat c.3550±50BC at –3.30m OD. The wood peat was similarly suggestive of local alder carr with adjacent mixed woodland, but oak/lime dominated on drier soil. The top of the reed peat however was dated to c. 300±100 BC at –1.39m OD, which is closely comparable to the date from ARCBH2. Here only relatively small values of tree pollen were attained from the top of the peat although oak and hazel remained as a more regional vegetation component. The autochthonous vegetation showed development from grass-sedge fen with near, fringing alder carr. This developed into wetter, poor fen with burr-reed and reed-mace and sedges. Prior to this, however, there is evidence at -1.40m OD of freshwater. Expanding *Chenopodiaceae* (goosefoots and oraches) and *Hystrichospheres* (dinoflaggellates) suggested however the possibility of salt-marsh habitats within the catchment.

Sea-level change

The potential late glacial deposits from the basal deposits of ARCBH1 indicate fresh water conditions that may reflect a lower sea-level than present. The channel would have been seasonally active, draining what was likely still a permanently frozen landscape.

A transition to gradually increasing brackish conditions occurred with the accumulation of the main floodplain peat unit. This has been dated to the late Mesolithic period, and post-dates the evidence of the flint scatters identified at the edge of the channel. The onset of the main peat may have been caused by rising sea level in the early/mid Holocene that caused a backing up of freshwater tributaries. In ARCBH1 the upper organic silt clay appear to post-date at least the late Neolithic or early Bronze Age at c. 2150±150 BC (i.e. the date from the top of the peat). Although as noted some truncation may have occurred at this horizon. The diatom assemblages indicate estuarine sedimentation within ARCBH1, and increasing marine inputs with decreasing depth within OABH3. On the basis of elevations it is quite possible that the sequences were predominately freshwater with only temporal marine incursion up until the early Bronze Age.

There was a change to more mixed conditions represented by the accumulation of silty clays within OABH3 and peats in ARCBH2 during the Bronze Age and Iron Age. The diatoms from these samples indicate a transition from freshwater to brackish conditions, with strong marine influences. It is possible that the assemblage represents an essentially marine deposit that was subject to secondary inclusions of freshwater diatoms. The environmental data

suggests the continued dominance of local alder carr woodland within ARCBH2, although with an increasingly open aspect with an increase in fern spores and herbaceous taxa that was likely the result of human disturbance. Grasses and sedges dominated the pollen profile from the silty clays from OABH3, with clear evidence of clearance activity and agriculture. It may be that the settlement activity identified within the excavation area only occurred during this period after the transition from mixed to predominantly freshwater conditions had been made.

Sidell *et al* (2000) have documented a phase of estuary expansion in the Thames that took place between about 2250 and 1000 BC during which tidal waters reached as far upstream as Westminster. For instance, several sites in central London such as Union St., Southwark and St. Stephen's East, Westminster record marine conditions reaching -1.0m in this time interval. The first evidence of tidal penetration in the east London marshes, Southwark and Rotherhithe also occurred at this time (Meddens, 1996; Rackham, 1994; Sidell *et al.*, 2000; Wilkinson *et al.*, 2000). At Silvertown, Wilkinson *et al.*, (2000) report emplacement of intertidal muds after c. 2100BC within the general altitudinal range -1.1 to -0.75m. Sidell *et al.* (2000) then suggest that after about 1000BC the location of the tidal head seems to have fluctuated, but in a generally downstream direction. This could in turn have resulted in a lowering of the watertable and have led to a second phase of alder carr peat formation possibly represented by the clayey peats in ARCBH2.

There is a suggestion of a second phase of estuary expansion during the Iron Age. In Westminster, for instance, there is evidence for marine penetration to altitudes of about -0.2m OD after c.750-350BC at Storey's Gate, Westminster and Joan St., Southwark (Sidell *et al.*, 2000). In East London, too, Wilkinson *et al.* (2000) found evidence for marine transgression after c.750–420BC in the more landward areas of their Silvertown site. There is also good archaeological evidence that at the start of the Roman period (between 1540 and 1907 years ago) the tidal head was located further up the estuary at Roman *Londinium*. These periods of estuary expansion could provide a mechanism for a rise in water table forcing a change from alder carr to reedswamp, perhaps also with periodic tidal inundation as indicated by the presence of brackish and marine diatoms.

Overall the sequence at Beamwashlands indicates that the hydrological and biological conditions were conducive to peat growth which was able to keep pace with sea-level rise, excluding periods of possible marine inundation. More detailed examination of the upper peat/sediment contacts at Beam Washlands is therefore relevant to our knowledge of the changing regional and local relative sea level, and resulting changes in palaeogeography. In this sense the estuarine diatom assemblage identified from the middle of the wood peat in ARCBH1 and the assemblage from the upper deposits of OABH3 are of interest.

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11.13 APPENDIX 12.1 Geoarchaeology: Pollen

Assessment of Pollen *By Dr Lucy Verrill*

Introduction
Oxford Archaeology was asked to assess the potential of two sediment sequences (BH3 and BH4) from Dagenham Beam Washlands for palynological analysis. A total of thirteen subsamples were assessed.

Quantification and Methods
Quantification and sediment description
The monoliths were cleaned, described and subsampled. The sediment types and their depths are shown in Tables 1 and 2. Depths given are relative to the top of the monolith. Only sediments sampled for pollen analysis have been included here.

Depth m	Sediment description
0.44-0.88	Highly compacted silty clay
0.88-1.16	Silty clay with root material
1.16-1.82	Compacted wood peat
1.82-2.20	Compacted silty clay with root material
2.20-2.40	Compacted wood peat
2.40-2.90	Compacted peat with wood fragments and root material
2.90-3.00	Compacted peaty clay with large wood fragment
3.00-3.55	Compacted peat with large wood fragment
3.55-4.00	Organic silty clay
4.00-4.64	Peaty clay with occasional root fragments

Table 1: BMV BH3 sediment types

Depth m	Sediment description
4.70-5.00	Structureless clay
5.00-5.45	Clayey peat
5.45-5.70	Organic silty clay with rare pockets of reworked peat

Table 2: BMV BH 4 sediment types

Laboratory Methods
Ten samples from BMV BH3 and three samples from BMV BH4 were prepared for pollen analysis using a standard chemical procedure (method B of Berglund & Ralska – Jasiewiczowa, (1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles > 170 microns, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000 cs silicone oil. Slides were examined at a magnification of 400x (1000x for critical examination) by ten equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slide (Brooks & Thomas, 1967). Pollen identification was made using the key of Moore *et al* (1991) and a small modern pollen reference collection. Andersen (1979) was followed for identification of cereal-type grains. Indeterminable grains were also recorded as an indication of the state of the pollen preservation. Plant nomenclature follows Stace (1997), utilising the modifications suggested by Bennett *et al* (1994). The results of the assessment are shown in Tables 3 and 4 and are given as numbers of total pollen grains and pteridophyte spores counted, except for tree/shrub pollen, herb pollen and spores, which are given as percentages of the pollen and pteridophyte spore sum where a total sum of over 100 was achieved.

Results
BMV BH3
Pollen was preserved in all the samples assessed, although at low frequencies in some levels (1.20-1.25m, 3.40-3.42m, 3.70-3.72m and 4.50-4.52m). In general, pollen preservation was fair, with only one sample (0.60-0.62m) containing over 25% indeterminate pollen (sum plus indeterminates).

The opening of the pollen profile is marked by an increase in *Alnus glutinosa* (alder) pollen from around 30% to 70% of the pollen sum. Correspondingly, the other principal arboreal pollen taxa – *Quercus* (oak), *Betula* (birch) and *Corylus avellana*-type (hazel) – decline. The exception is *Tilia cordata* (lime) pollen, which is stable until 3.90-3.92m at 10%, and then declines, remaining at less than 10% for the majority of the profile. *Ulmus* (elm), which is poorly represented in the record, increases from 3.9m to 3.4m, declines markedly in percentage terms between 3.4m and 2.3m, and then disappears from the profile. Total pollen concentrations are low in the lowermost four spectra, increase between 2.5m and 1.9m, and then decline in the topmost three spectra.

Between 3.90-3.92m and 1.20-1.25m, all samples are dominated by arboreal pollen, with only minor percentages of herb pollen and fern spores. This situation changes at 0.90-0.92m, at which point the major tree pollen taxa decline, and values of open-ground taxa correspondingly increase: Poaceae (grasses) to 30% and Cyperaceae (sedges) to 6%. By the top of the profile, grasses reach over 50%, sedges around 15% and Cereal-type grains are also recorded. Fern spores decline to negligible values by the uppermost spectrum. Microscopic charcoal levels are relatively high in the lowermost spectrum, then decrease to low values, until the uppermost two spectra in which they are well-represented.

BMV BH4

Pollen was preserved in all the samples assessed, although in low frequencies in the lowermost two samples. Pollen preservation was fair in the upper two samples, although indeterminate pollen in the sample 5.60-5.62m comprised 29% of the pollen sum plus spores.

The principal feature of the BH4 profile is an overall increase in alder pollen from c. 20% to 40% of the sum, concurrently with lesser increase in oak pollen and mirrored by declining values of birch pollen. Hazel pollen remains more or less stable throughout the profile. Open-ground pollen taxa are poorly represented in all three samples, with sedges being the best represented of this group. Grasses, initially fairly well-represented, decline to zero in the middle spectrum before re-emerging in low values at 4.8-4.82m. Fern spores are poorly represented throughout the profile although they are better represented in the upper sample. Microscopic charcoal values, initially high, decline in the upper two samples.

Interpretation and discussion:

BMV BH3

The profile opens in the late Mesolithic in a wooded environment. The high levels of microscopic charcoal particles in the basal spectrum may indicate human alteration of the environment. The proportions of tree and shrub pollen remained constant in the lowermost two spectra, with the dynamics of taxa within this group shifting slightly. The sedimentary change from a peaty clay to an organic silty clay, together with the palynological record, indicate that alder carr succeeded dryland woods in the locality. A minor, temporary shift towards reed-marsh conditions may have occurred at 3.7m, where fern spores and sedge pollen are seen to have increased, partially replacing alder. However, alder carr was soon re-established, with deciduous woodland – birch, hazel, oak and lime - also present in dryland areas. If the low disperal rates of lime are taken into consideration, it is evident that lime constituted a significant proportion of the dry woodland.

Although the sampling resolution is too low to ascertain exactly when the mid-Holocene elm decline occurs in the profile, it is represented between 3.4 and 2.3m. Using linear interpolation between the two available radiocarbon ages, the sample at 3.4m can be estimated to date to c. 5063 bp. This more or less parallels the mid-Holocene elm decline recognised in nearby sequences, such as Mar Dyke (Scaife 1988, 112), Silvertown, London (Wilkinson *et al* 2000), Stonemarsh (Devoy 1980) and Bryan Road, Rotherhithe (Sidell *et al* 1995). The elm decline does not appear to mark the commencement of Neolithic human activity in the locality, and indeed no such human activity is recorded in the pollen profile until the early/mid Bronze Age. However, the pollen source area in an alder carr is likely to be extremely localised, and not representative of the wider landscape on drier ground further away from the floodplain. Whilst some Thames floodplain sites have yielded palynological evidence of reasonably intensive Neolithic human activity - Mar Dyke (Scaife 1988) and Bryan Road, Rotherhithe (Sidell *et al* 1995) - the general regional indication is one of low-level activity, with larger-scale, permanent clearances in existence only from the Middle Bronze Age (Sidell & Wilkinson 2004, 43).

The asynchronous lime decline, usually occurring between the late Neolithic and the Middle Bronze Age and usually ascribed to human activity, is difficult to recognise in this profile. The taxon does decline in percentage terms at c. 3.7m, but its persistence at low values for the remainder of the profile, and the absence of other human activity indicators, counter the suggestion that this point represents the traditional lime decline. The lime decline may well therefore The overall interpretation of alder carr woodland with deciduous woodland elsewhere on drier ground in the area, is in agreement with pollen data from ARCBH1 and ARCBH2 (Brown 2006).

Woodland clearance is reflected in the topmost two spectra, after c. 3320 bp, with Poaceae becoming dominant and Cyperaceae secondary. Woodland coverage decreased, with reductions apparent in proportions of the main trees – alder, birch and hazel – whilst oak and lime remained stable at relatively low values. Other than grasses and sedges, herbs were not well-represented, although the diversity was wider than in previous spectra. The increase in microscopic charcoal values suggests that fire was used to create woodland openings. This factor, together with the presence of a single cereal-type pollen grain in the topmost spectrum, indicates that early/mid Bronze Age human activity was the likely cause and that agriculture, including arable cultivation, was occurring in the vicinity. Woodland clearance and the expansion of open ground is not recorded in the ARCBH1 pollen profile (Brown 2006), which suggests that the clearance was either very localised or that it commenced after the accumulation of the uppermost sediments analysed in ARCBH1.

BMV BH 4

The potential for interpretation of this profile is extremely limited, due to the low sampling resolution, the lack of dating evidence, the small number of samples and the poor state of pollen preservation. A tentative interpretation of alder carr expansion from the late Mesolithic over time can be suggested.

Conclusions and recommendations

Thirteen samples from two boreholes at Beam Washlands, Dagenham, were assessed for palynological content. Whilst pollen preservation was not ideal in terms of either number of grains preserved or quality of preservation, a reasonable assessment of changes in landscape and environment over time was achieved from BH3. Most of the profile recorded an alder carr environment, with a possible reed-swamp expansion at 3.7m. At the top of the profile, woodland clearance and agricultural activity were recorded. The results from BH4 were more difficult to interpret and only tentative suggestions of alder carr incursion could be made.

BH3 is recommended for full palynological investigation as the top of the sediment sequence provides information interpreted as reflecting human activity in the locality. Although the nearby profile ARCBH1 includes older sediments (see radiocarbon dates in Brown 2006) it does not contain any indication of human activity. The varying quality of pollen preservation in BH3 might inhibit its potential for full investigation, as satisfactory sums might not be reached in all spectra. Were further investigation to commence, a finer sampling interval would be recommended, most detailed in the upper metre and also including sections in which sampling was sparse in the assessment. It is anticipated that an initial sampling interval of 16cm would suffice between 4.5m and 1.5m, totalling 20 samples, and an initial sampling interval of 8cm would be appropriate between 0.6m and 1.5m, totalling 12 samples, which equals a grand total of 32 samples.

Further investigation of BH4 would not be recommended, due to poor preservation conditions, the restricted range of taxa and the general absence of significant changes in the assessment profile.

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Sample	**Depth m**	0.60-0.62	0.90-0.92	1.20-1.25	1.90-1.92	2.30-2.32	2.50-2.52	3.40-3.42	3.70-3.72	3.90-3.92	4.50-4.52
Tree & shrub pollen %		26.4	42.9		82.1	91.5	91.1			94	
Herb pollen %		73.6	46		4.8	3.4	2.6			1	
Pteridophyte spores %		0	11.2		13.1	5.1	6.3			5	
Sum (pollen + spores)		121	161	64	290	294	191	83	60	201	52
Total fossil concentration (grains/cm^3)		236689	153429	64287	538907	312194	591559	42844	76895	177866	49555
Trees & shrubs											
Alnus glutinosa	Alder	7	45	46	170	182	124	42	24	142	15
Betula	Birch	2	3	3	9	17	5	2	2	8	7
Corylus avellana-type	Hazel	3	5	5	11	24	5	4	5	11	8
Castanea	Sweet chestnut		2								
Fraxinus excelsior	Ash		1		1	2	2		1	1	
Quercus	Oak	6	6	3	31	30	30	19	5		9
Pinus sylvatica	Scots pine		1			2	1		1	2	
Salix	Willow	4		1							1
Taxus baccata	Yew	6	1								
Tilia cordata	Lime/linden	2	2	2	16	11	6	1	5	21	5
Ulmus	Elm					1		3	1	3	
Calluna vulgaris	Ling	1									
Vaccinium	Bilberry	1									
Hedera helix	Ivy		1							1	1
Rosaceae	Rose family		2								
Cf *Sambucus*	Elderberry						1				
Herbs											
Cereal-type		2									
Poaceae	Grass family	65	49		6	5	2	4	1	1	1
Cyperaceae	Sedge family	17	9		6	3	1		6		1
Artemisia-type	Mugwort		2			1					

Solidago virgaurea-type		1	1								
Lactucea	Dandelion-type		1				1				
Apiaceae	Cow parsley family				2			1		1	
Caryophyllaceae	Pink family	1	1								
Chenopodiaceae	Goosefoot family		1								
Filipendula	Meadowsweet		1								
Brassicaceae	Cabbage family										1
Hypericum perforatum-type	St John's wort		1								
Lotus-type	Bird's-foot-trefoil					1					
Melampyrum	Cow-wheat	1					1				
Plantago lanceolata	Ribwort plantain	2	1								
Ranunculus-type	Buttercups		2								
Rumex	Dock		1								
Urtica	Nettle		4								
Pteridophytes											
Polypodium vulgare-type	Polypody		1			1	2	1	1	5	
Pteridium aquilinum	Bracken		4			1					
Frilly type					1	2	1				
Pteropsida (monolete) indet.	Ferns		13	4	37	11	9	6	8	5	3
Sphagnum											1
Aquatics											
Typha angustifolia/Sparganium-type	Bur-reed	3									
Indeterminate		38	31	2	36	13	24	10	3	22	10
Microscopic charcoal particles		100	75	25	17	9	10	10	9	23	32

Table 3: Dagenham Beam Washlands Borehole 3 pollen assessment table.
The numbers in the table are the actual counts except for the grouped tree and shrub pollen, herb pollen and fern spores, where they are the percentages of total land pollen and spores.

Sample	Depth m	4.80-4.82	5.40-5.42	5.60-5.62
Tree & shrub pollen %		76.6		
Herb pollen %		14.9		
Pteridophyte spores %		8.5		
Sum (pollen + spores)		141	73	52
Total fossil concentration (grains/cm^3)		134369	150729	28421
Trees & shrubs				
Alnus glutinosa	Alder	59	34	9
Betula	Birch	10	3	9
Corylus avellana-type	Hazel	8	3	4
Fraxinus excelsior	Ash		1	
Hedera helix	Ivy	1		
Pinus sylvatica	Scots pine	4		3
Quercus	Oak	21	11	2
Rosaceae undiff	Rose family		1	1
Tilia cordata	Lime/linden	3	5	
Ulmus	Elm	2	3	
Herbs				
Poaceae	Grass family	4		12
Cyperaceae	Sedge family	15	10	5
Apiaceae	Cow parsley family	1		1
Melampyrum	Cow-wheat	1		
Pteridophytes				
Pteropsida (monolete) indet.	Ferns	12	2	6
Indeterminate		17	10	15
Microscopic charcoal particles		43	35	159

Table 4: Dagenham Beam Washlands Borehole 4 pollen assessment table.
The numbers in the table are the actual counts except for the grouped tree and shrub pollen, herb pollen and fern spores, where they are the percentages of total land pollen and spores.

11.14 APPENDIX 12.2 Geoarchaeology: Plant Remains

By Sandra Bonsall and Elizabeth Huckerby

Introduction

As part of the mitigation of Area 1 construction impacts on areas of archaeological potential at Dagenham Beam Washlands, a series of 8 purposive boreholes were drilled in the low-lying areas of the site adjacent to the Wantz Stream and Beam River. The boreholes were drilled in order to collect information and samples suitable for interpreting the depositional environment of the sediment sequence and any post-depositional processes that may have acted upon it, with the objective of reconstructing the past environment and its significance for human activity in the three areas of impact.

Preliminary ^{14}C dates of 12,211-11,900 cal BC (12160±60BP; Poz-14656) and 12;642-12,041 cal BC (12290±60BP; Poz-14925) obtained from an earlier OA borehole (ARC-BH1) in which a thick organic/peat sequence was identified indicate that the sequence started to accumulate in the Late Glacial period. There were potentially significant early examples of alder pollen and seeds present in ARC-BH1 as well. The upper limit of the sequence dated to 2292-2041 cal BC (3765±35BP Poz-14655) i.e. the late Neo-Early BA. Therefore this earlier sequence has the potential to reveal habitat details for a large span of time including the Early Mesolithic when a small scatter of flint blades and a core were deposited within silts on the edge of the gravel terrace OA (2006).

As part of this earlier phase of work, subsamples were taken from two of these boreholes, BH1 and BH2, and assessed for waterlogged plant remains in 2006 as to their potential to aid the reconstruction of the past environment and its possible significance for human activity (Huckerby 2006). It was decided in this second phase of work to assess the potential for waterlogged plant remains from two further boreholes BH3 and BH4 so that a judgement could be made on the overall quality of the various biological indicators as to which sequence would be provide the better record. The pollen from these sequences forms a separate report (Verrill 2007).

Quantification and methodology

A total of thirteen samples were assessed as to their potential for the analysis of waterlogged plant remains. The samples were taken, over a 0.10m interval, with ten from borehole BH3 and three from BH4. They were hand-floated and the flots collected on a 250 micron mesh and retained in water. A representative sample of each flot was scanned with a Leica MZ6 stereo microscope and the plant material recorded and provisionally identified. The data are shown in Table *, botanical nomenclature follows Stace (1997). Plant remains were recorded on a scale of abundance of 1-5, where 1 is rare (up to 5 items) and 5 is abundant (>100 items) but expressed in table * as present or abundant. The components of the matrix were also noted.

Results

Most samples contained abundant waterlogged plant remains except for two from BH4 at depths of 4.80-4.90m and 5.60-5.70m and two from the upper part of BH3 at depths of 0.60-0.70m and 0.90-1.00m where the flots were relatively small. The remaining samples were rich in amorphous plant remains and wood fragments including alder (*Alnus glutinosa*) seeds and catkins although the seed assemblages were not diverse. Leaf and moss fragments were also noted in some samples.

A diverse assemblage of seeds was only recorded in two samples from a depth 4.5-4.6m from BH3 and at 5.4-5.5m in BH4. In the first sample (4.5-4.6m BH3) large numbers of waterlogged plant remains included *Ranunculus repens* creeping buttercup), *Rumex acetosa* (common sorrel), *Stellaria media* (common chickweed) and *Urtica dioica* (common nettle) seeds. The other sample (5.4-5.5m, BH4) with any significant number of seeds included seeds of *Carex lenticular, Carex trigonous* (sedges), *Ranunculus repens* (creeping buttercup), *Ranunculus sceratus* (celery leaved buttercup), *Stellaria media* (common chickweed) and a fragment of *Corylus avellana* (hazelnut).

Discussion and potential

Although many samples contained very abundant amorphous plant remains and wood fragments very few seeds were preserved except at depths of 4.5-4.6m in BH3 and 5.4-5.5m in BH4. The seed assemblages from these samples suggest the proximity to the palaeochannel of both fen and waste ground. The waterlogged plant remains have the potential to record the peat development from the area but there are no obvious indicators of anthropogenic activity. This assessment of the waterlogged plant remains confirms the observation made in 2006 that the peat is a wood peat, which formed when a carr woodland was growing in the low lying areas adjacent to the Wantz Stream and Beam River.

Alder seeds were recorded at depths of 5.40-5.50m in BH4 and 4.50-4.60m in BH3 and in the absence of the radiocarbon results it is surmised that the peats above these depths post date the alder expansion. It is generally considered that alder became established in South East Britain around 8000BP, perhaps as early as 8300 BP

(Birks, 1989, Tallentire 1992), but the identification of an alder seed at a depth of 4.20.-4.31m from BH1 (Brown 2006) indicated the possibility of an earlier date for the arrival of this taxon in the Lower Thames valley. Published pollen data also supports this view of an earlier migration, since there are records of alder pollen from around 10,000BC in the local area (Rackham, 2003 97-98).

The assessment of the waterlogged plant remains from these cores has demonstrated that the plant assemblage in this sequence is less diverse than in the 2006 assessment (Huckerby 2006). The seed assemblages were poor and only two of the samples at depths of 4.5-4.6m in BH3, and 5.4-5.5m BH4 contained any significant numbers, however the presence of some species indicative of waste ground may be indicative of anthropogenic activity within the local environment. The analysis of the waterlogged plant remains in BH3 and BH4 is unlikely to provide as a good record as that from the earlier assessment and therefore further work on these sequences is not recommended.

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Table **. Assessment of waterlogged plant remains from Dagenham Beam Washlands, Boreholes 3 and 4

Core	BH3	BH3	BH3	BH3	BH3	BH3	BH3	BH3	BH3	BH4	BH4	BH4
Depth m	0.6-0.7	0.9-1.0	1.2-1.3	1.9-2	2.5-2.6	2.9-3	3.4-3.5	3.7-3.8	4.5-4.6	4.8-4.9	5.4-5.5	5.6-5.7
Modern roots	+											
Amorphous plant material	++	++	++			++	++	++				
Wood		+	++	++	++	++	++	++	++	+	++	+
Leaf fragments												
Alnus catkin scales												
Buds									+			
Charcoal									++	+	+	+
Bryophyte fragments											+	
Fungal sclerotia												
Insect remains	+		+		++						+	
Silt/clay		++			++			++				
Coal			+									
Sand										+		+
WATERLOGGED REMAINS												
Trees and shrubs												
Alnus glutinosa - alder seeds					++				++		++	
Corylus avellana - nut fragments												
Rubus fructicosa-blackberry						++						
Solanum dulcamara-bittersweet					+		+					
Dryland herbs												
Chenopodium album-fat-hen			+									
Ranunculus repens - type buttercups					+	++			++		++	
Rumex acetosa-common sorrel									+			
Stellaria media-common ditchwort											+	
Urtica dioica - common nettles							+	+	++		+	
Ranunculus repens - type buttercups					+	++					++	
Wetground plants												
Carex lenticular - sedge					+							
Carex trigynous - sedge												
Lycopus europaeus-gypsywort				+		+	+					
Ranunculus scleratus - celery leaved buttercup					+						++	

+= present ++=abundant

11.15 APPENDIX 12.3 Geoarchaeology: Diatoms

By Andrew Haggart

Introduction
Thirteen samples from two boreholes, BH3 and BH4 were made available for diatom analysis

Methods
Diatom preparation followed standard techniques (Battarbee, 1986) with the aim of minimizing disturbance to the samples. Organic material was removed by adding cold 30% Hydrogen peroxide to approximately 2g of fresh material. After several days, when the reaction had stopped, the samples were allowed to settle and the supernatant liquid decanted. The samples were then washed through a 10µm Nytex mesh using distilled water to remove clay sized particles (Morley *et al.*, 2004). A random sample was then transferred, using a pipette, to a coverslip and allowed to settle and dry. The coverslip was then fixed on a microscope slide using Naphrax diatom mountant. The slides were systematically scanned using an Olympus BX40 microscope at 400x and 1000x magnification and an assessment made of diatom presence, quality of preservation, concentration, diversity and probable depositional environment.

Identifications were made with reference to Hustedt (1930-66), Cleve-Euler (1951-55), Hendey (1964), Hartley (1996) and van der Werff and Huls (1957-64). Nomenclature follows Williams *et al.* (1988) and the current UCL Amphora checklist. Salinity requirements of the diatom taxa identified follow the checklist compiled by Denys (1991/92) based on the halobian system of Hustedt (1953).

Results
Diatoms were found in only 11 of the 13 samples (Table 1) and in variable concentrations and states of preservation.

Table 1: Diatom assessment summary showing presence, preservation, concentration, species diversity, environment (m = marine; b = brackish; f = fresh) and potential for further analysis

Borehole	Depth	Diatoms	Preservation	Concentration	Diversity	Environment	Potential
3	0.60-0.65	Present	Poor	Low	Low	f?	Poor
3	0.90-0.92	Present	Variable	Good	Low	Mixed mbf	Moderate
3	1.20-1.25	Absent	N/A	N/A	N/A	Unknown	None
3	1.90-1.92	Present	Good	Good	Medium	F	Good
3	2.30-2.32	Present	Good	Good	Medium	F	Good
3	2.50-2.52	Present	Good	Good	Medium	F	Good
3	2.90-2.92	Present	Good	Good	Medium	F	Good
3	3.40-3.42	Present	Poor	Low	Low	F?	None
3	3.70-3.72	Present	Poor	Low	Low	F?	None
3	4.50-4.52	Present	Very poor	Very low	Very low	Unknown	None
4	4.90-4.92	Absent	N/A	N/A	N/A	Unknown	None

4	5.40-5.42	Present	Very poor	Very low	Very low	Unknown	None
4	5.60-5.62	Absent	N/A	N/A	N/A	Unknown	None

The results, which are shown in Table 2, will now be discussed in more detail.

Borehole 3 0.60-0.65m
This sample is from a highly compacted dull yellowish brown structureless silty clay. Diatoms were present but incomplete. Fragments of *Pinnularia* sp. raphe and central area dominate with *P. streptoraphe* and *P.cardinalis* present. *Cymbella* sp. fragments were also noted, most probably attributable to *C. aspera*. This limited evidence and the absence of any diatoms with affinities to saline environments suggests a freshwater depositional environment.

Borehole 3 0.90-0.92m
The assemblage from this sample, taken from the upper part of a poorly compacted brownish black silty clay with frequent roots is a mixed one. In terms of frequency the most dominant is the largely marine planktonic genus *Thalassioisira* but almost always as degraded forms. Of the better preserved examples, one was attributed to *Thalassiosira decipiens*. There are other marine indicators including *Actinoptychus senarius* (degraded), *Pseudopodosira westi*, *Paralia sulcata* and *Rhaphoneis amphiceros*. However there are also indicators of freshwater conditions with the oligohalobous indifferent to halophobous forms *Amphora ovalis, Cymbella aspera, Hantzschia amphioxys, Pinnularia borealis* and *P. viridis*. This could be taken to indicate a deposit with elements derived from both marine and freshwater sources. Alternatively, given the degraded nature of the majority of *Thalassiosira* sp. it could represent an essentially marine deposit which was subject to secondary inclusion of freshwater diatoms.

Borehole 3 1.20-1.25m
The third sample came from the upper part of a highly compacted dark reddish brown wood peat with no signs of any structure. Following oxidation of the organic component in Hydrogen peroxide there was virtually no mineral component left and no diatoms or fragments of diatoms were observed. This probably represents a highly organic terrestrial peat.

Borehole 3 1.90-1.92m
The assemblage, from a highly compacted olive black silty clay with occasional root matieral, is dominated by the largely freshwater genus *Pinnularia*, notably *P. nobilis* though with *P. cardinalis*, *P. streptoraphe*, *P. viridis* and *P. abaujensis* also present. Other largely freshwater forms include *Amphora libyca*, *Caloneis ventricosa*, *Cymatopleura elliptica*, *C. librile*, *Cymbella aspera*, *Epithemia adnata*, *Gomphonema angustatum*, *Hantzschia amphioxys*, *Navicula americana*, *N. cuspidate fo. craticula*, *Navicula gastrum*, *Neidium iridis* and *Stauroneis phoenicenteron*. Of this latter group *S. phoenicenteron* is the most abundant. However there are still hints of a slight marine influence with *Anomoeoneis sphaerophora* and *Diploneis ovalis* tolerant of brackish conditions. In addition there are occasional sponge spicules and glauconitic mineral grains.

Table 2: Diatom assessment. Species: + present, ++ common, +++abundant

Borehole	3	3	3	3	3	3	3	3	3	3	4	4	4
Depth	0.60 - 0.65	0.90-0.92	1.20-1.25	1.90-1.92	2.30-2.32	2.50-2.52	2.90-2.92	3.40-3.42	3.70-3.72	4.50-4.52	4.90-4.92	5.40-5.42	5.60-5.62
Oligohalobous halophobous													
Eunotia arcus					+		+						
Frustulia rhomboides					+								
Pinnularia streptoraphe	+	+		+	+				+				
Oligohalobous indifferent to halophobous													
Pinnularia biceps						+	+						
Pinnularia cardinalis				+		+	+						
Pinnularia nobilis				++	++	++	++						
Oligohalobous indifferent													
Amphora libyca				+									
Amphora ovalis		+			+								
Caloneis ventricosa				+									
Camplodiscus noricus v. *hibernicus*					+								
Cymatopleura elliptica				+									
Cymatopleura librile				+	+	+	+						
Cymbella aspera	+			+	++	++	++		+				
Cymbella naviculiformis						+							
Epithemia adnata				+		+							
Gomphonema acuminatum v. coronatum					+								
Gomphonema angustatum				+	+								
Hantzschia amphioxys		+		+									

Borehole	3	3	3	3	3	3	3	3	3	3	4	4	4
Depth	0.60 - 0.65	0.90-0.92	1.20-1.25	1.90-1.92	2.30-2.32	2.50-2.52	2.90-2.92	3.40-3.42	3.70-3.72	4.50-4.52	4.90-4.92	5.40-5.42	5.60-5.62
Navicula americana				+			+						
Navicula cuspidate fo. Craticula				+		+	+						
Navicula gastrum				+			+						
Navicula radiosa					+								
Neidium iridis				+	+	+	+						
Pinnularia abaujensis				+	+	+	+						
Pinnularia borealis		+											
Pinnularia microstauron					+								
Pinnularia viridis		+		+	+	+	+		+				
Stauroneis phoenicenteron				++	++	++	++						
Surirella biseriata							+						
Oligohalobous halophilous to indifferent													
Diploneis ovalis		+		+									
Gyrosigma acuminatum						+	+						
Mesohalobous to oligohalobous indifferent													
Anomoeoneis sphaerophora				+		+	+						
Cyclotella meneghiniana		+											
Polyhalobous to mesohalobous													
Actinoptychus senarius		+											
Pseudopodosira westii		+											
Thalassiosira decipiens		+											
Polyhalobous													
Paralia sulcata		+											

Borehole	3	3	3	3	3	3	3	3	3	3	4	4	4
Depth	0.60 - 0.65	0.90-0.92	1.20-1.25	1.90-1.92	2.30-2.32	2.50-2.52	2.90-2.92	3.40-3.42	3.70-3.72	4.50-4.52	4.90-4.92	5.40-5.42	5.60-5.62
Rhaphoneis amphiceros		+											
Unknown													
Coscinodiscus sp.		+											
Cyclotella sp.		+											
Cymbella sp.	+	+		+	+			+	+				
Epithemia sp.				+									
Eunotia sp.		+											
Gyrosigma sp.													
Navicula sp.		+											
Navicula perrotettii						+							
Nitschia sp.				+		+	+		+			+	
Pinnularia sp.	+	+		+++	++			+	+	+		+	
Stauroneis sp.				+	++								
Surirella sp.				+			+						
Surirella elegans						+	+						
Synedra sp.				+		+							
Thalassiosira sp.		+++											
Others													
Sponge spicules		+		+	+		+	+	+	+		+	
Glauconitic grains				+					+	+			

Borehole 3 2.30-2.32m
This sample is from a highly compacted brownish black structureless wood peat. It has a higher mineral component than 1.20-1.25m and once again diatoms of *Pinnularia* sp. are dominant. Largely freshwater forms include *Eunotia arcus, Frustulia rhomboides, Pinnularia streptoraphe, Pinnularia nobilis, Amphora ovalis, Camplodiscus noricus* v. *hibernicus, Cymatopleura librile, Cymbella aspera, Gomphonema acuminatum v. coronatum, Gomphonema angustatum, Navicula radiosa, Neidium iridis, Pinnularia abaujensis, Pinnularia microstauron, Pinnularia viridis* and *Stauroneis phoenicenteron.* Unlike the assemblage from 2.30-2.32 no diatoms indicating higher salinities were encountered suggesting a freshwater environment. The presence of sponge spicules in the sample may however suggest proximity of marine conditions.

Borehole 3 2.50-2.52m
Below the wood peat is a compacted black peat with occasional wood fragments and root material. The assemblage from 2.50-2.52 comes from the upper part of this deposit and again is dominated by freshwater forms, notably *Pinnularia* spp., *Cymbella* sp. and *Stauroneis* sp. Two species, *Gyrosigma acuminatum* and *Anomoeoneis sphaerophora* may suggest slightly more saline conditions nearby.

Borehole 3 2.90-2.92m
This sample comes from the base of the compact black peat at its boundary with a highly compacted brownish black peaty clay with a large wood component. Again the assemblage is dominated by freshwater forms including *Pinnularia nobilis, Cymbella aspera* and *Stauroneis phoenicenteron* although again the presence of sponge spicules suggests the proximity of marine conditions.

Borehole 3 3.40-3.42m
This assemblage comes from within the highly compacted brownish black peaty clay. Only fragments of raphe and central area attributable to *Pinnularia* spp. and *Cymbella* sp. were noted suggesting post-depositional loss.

Borehole 3 3.70-3.72m
Again only fragments of *Pinnularia* spp. and *Cymbella* sp. were noted in this sample from a moderately compacted black structureless organic silty clay. Some of the better preserved were attributed to *Pinnularia viridis, P. streptoraphe* and *Cymbella aspera* suggesting a dominantly freshwater environment though again with occasional sponge spicules hinting at marine conditions nearby.

Borehole 3 4.50-4.52m
A very sparse and poorly preserved diatom component was noted from this sample which came from a moderately compacted black peaty clay. Only a few fragments attributable to *Pinnularia* sp. were noted .

Borehole 4
Three samples were taken from 4.90-4.92, 5.40-5.42m and 5.60-5.62m representing the lower part of the sequence. No diatoms or fragments of diatoms were noted in the first and last of these samples though there were some fragments of *Pinnularia* sp. and *Niztschia* sp. in the middle sample, though too badly damaged to be attributed to species.

Discussion
The sediments from Beamwashlands boreholes 3 and 4 lie within the approximate altitudinal range -7.7 to +0.2 m O.D. and are well within the altitudinal limits of Devoy's (1977; 1979) transgression sequences. However both boreholes are predominantly organic in nature and apart from the sample between 0.90-0.92m in borehole 3 the diatoms indicate freshwater conditions were dominant. It seems probable therefore that hydrological and biological conditions at the Beamwashlands site were conducive to peat growth which was able to keep pace with sea-level rise, excluding marine inundation. These conditions are not unusual, having been documented in the Forth valley west of Stirling (Sissons and Smith, 1965) and suggested for the Thames sequence between Tilbury and Stone Marsh during the Thames II transgression (Haggart, 1995).

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11.16 APPENDIX 12.4 Geoarchaeology: Radiocarbon Dating

KIA32918 BMV05 ; BH3 ; 1.20 - 1.25 m

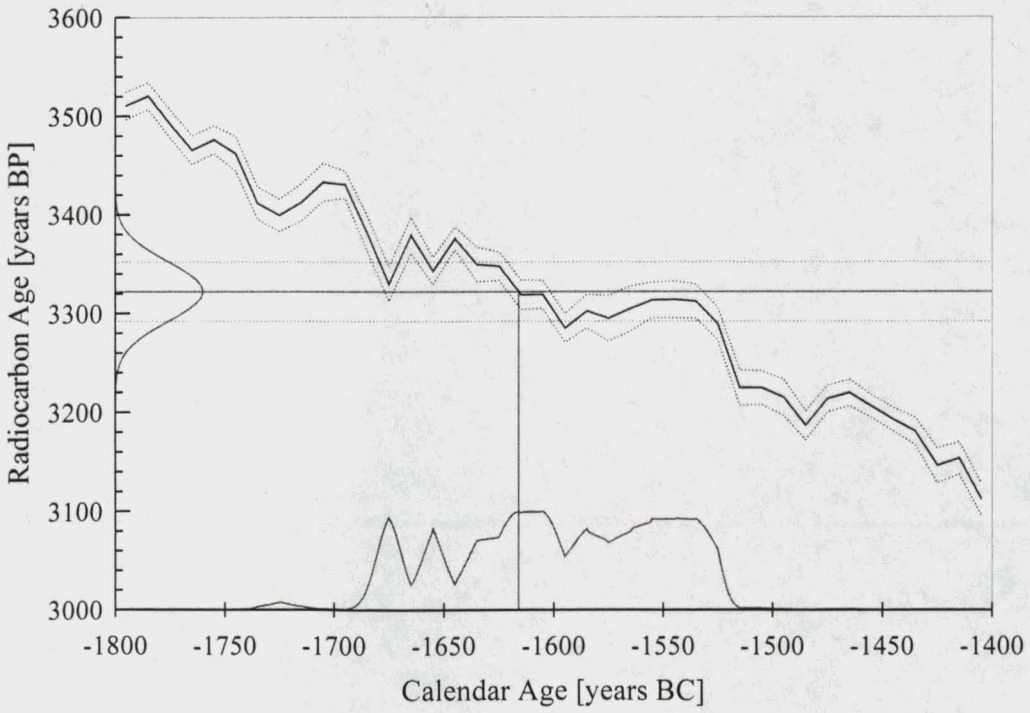
Peat, Beam Washlands, Dagenham, UK (TQ 502 836), sample depth: 1,20 - 1,25 m

Fraction	Corrected pMC†	Conventional Age	$\delta^{13}C$(‰)‡
wood from peat, alkali residue, 2.7 mg C	66.13 ± 0.25	3320 ± 30 BP	-27.16 ± 0.16

Radiocarbon Age: BP 3322 ± 30
Calibrated Age: cal BC 1616

One Sigma Range: cal BC 1679 - 1671 (Probability 4.7 %)
(Probability 68,3 %) 1656 - 1653 (Probability 2.0 %)
1630 - 1598 (Probability 23.7 %)
1589 - 1578 (Probability 6.8 %)
1572 - 1528 (Probability 31.1 %)

Two Sigma Range: cal BC 1683 - 1666 (Probability 9.5 %)
(Probability 95,4 %) 1663 - 1647 (Probability 7.6 %)
1643 - 1522 (Probability 78.2 %)



References for calibration:

The calibrated age is according to "CALIB rev 4.3" (Data set 2),
Stuiver et al., Radiocarbon **40**, 1041 - 1083, 1998

KIA32919 BMV05 ; BH4 ; 5.40 - 5.42 m

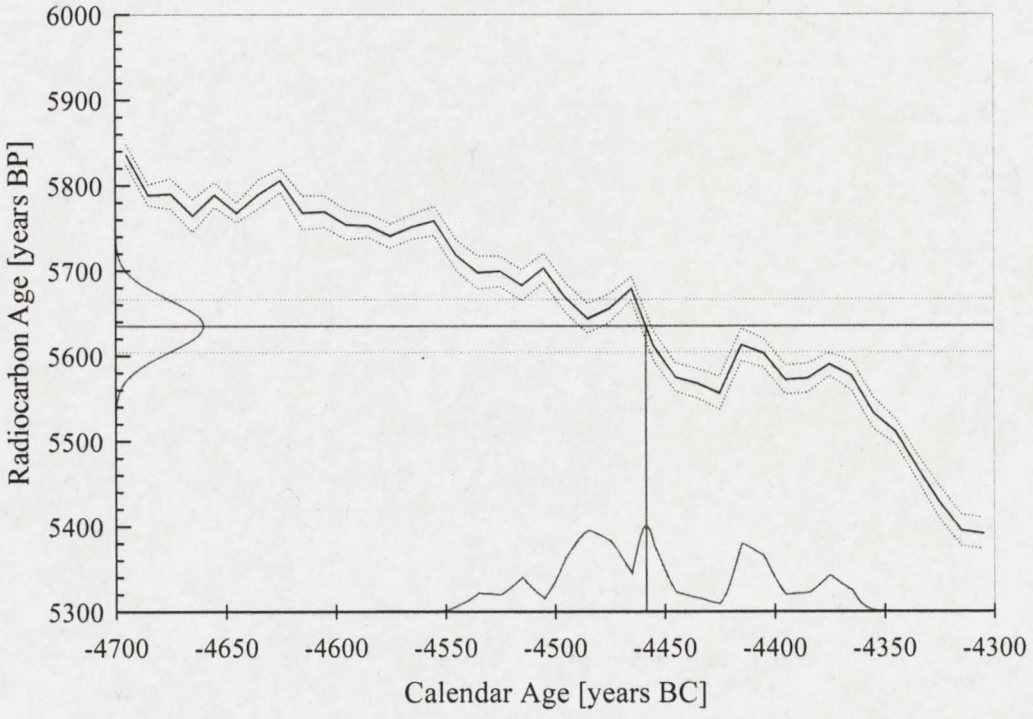
Peat, Beam Washlands, Dagenham, UK (TQ 502 836), sample depth: 5,40 - 5,42 m

Fraction	Corrected pMC†	Conventional Age	$\delta^{13}C$(‰)‡
peat, alkali residue, 7.7 mg C	49.59 ± 0.19	5635 ± 30 BP	-27.58 ± 0.16

Radiocarbon Age: BP 5635 ± 31
Calibrated Age: cal BC 4458

One Sigma Range: cal BC 4516 - 4514 (Probability 0.7 %)
(Probability 68,3 %) 4500 - 4448 (Probability 49.2 %)
4420 - 4400 (Probability 16.4 %)
4377 - 4373 (Probability 2.0 %)

Two Sigma Range: cal BC 4537 - 4506 (Probability 10.5 %)
(Probability 95,4 %) 4505 - 4437 (Probability 54.4 %)
4423 - 4363 (Probability 30.5 %)



References for calibration:

The calibrated age is according to "CALIB rev 4.3" (Data set 2),
Stuiver et al., Radiocarbon **40**, 1041 - 1083, 1998

KIA32920 BMV05 ; BH3 ; 4.50 - 4.52 m

Peat, Beam Washlands, Dagenham, UK (TQ 502 836), sample depth: 4,50 - 4,52 m

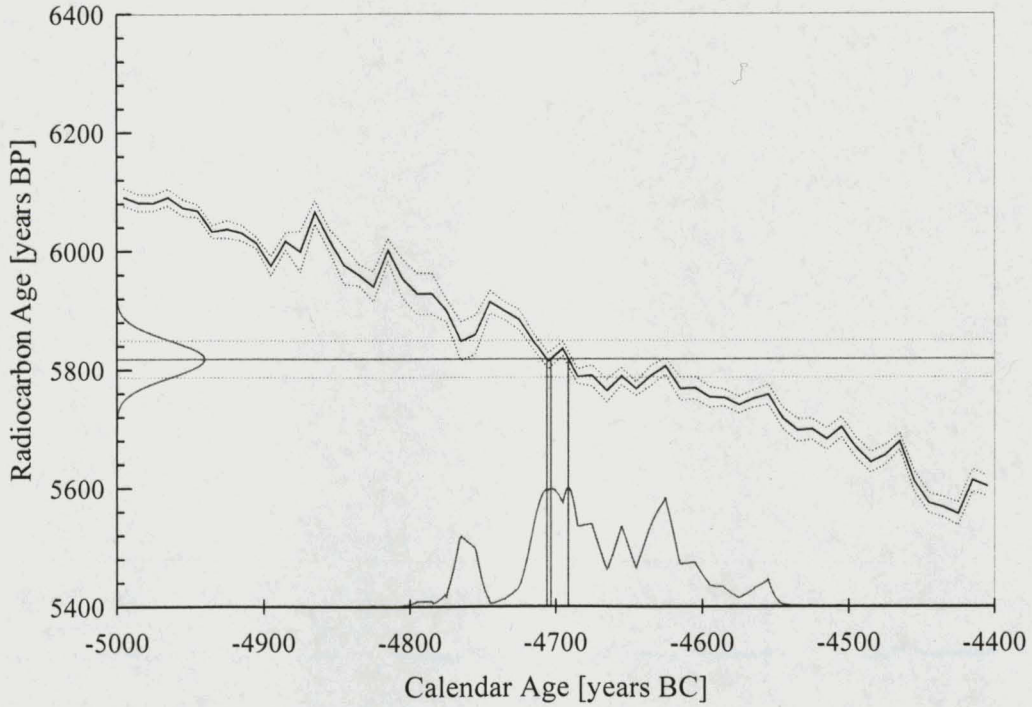
Fraction	Corrected pMC†	Conventional Age	$\delta^{13}C$(‰)‡
peat, alkali residue, 6.8 mg C	48.47 ± 0.18	5820 ± 30 BP	-25.87 ± 0.18

Radiocarbon Age: BP 5818 ± 31

Calibrated Ages: cal BC 4706, 4703, 4691

One Sigma Range: (Probability 68,3 %)
cal BC 4767 - 4756 (Probability 6.8 %)
4718 - 4670 (Probability 39.2 %)
4660 - 4650 (Probability 5.4 %)
4640 - 4618 (Probability 16.9 %)

Two Sigma Range: (Probability 95,4 %)
cal BC 4774 - 4748 (Probability 10.5 %)
4728 - 4582 (Probability 82.0 %)
4568 - 4552 (Probability 2.9 %)



References for calibration:

The calibrated age is according to "CALIB rev 4.3" (Data set 2), Stuiver et al., Radiocarbon **40**, 1041 - 1083, 1998

Scale 1:50,000

Figure 1: Site location

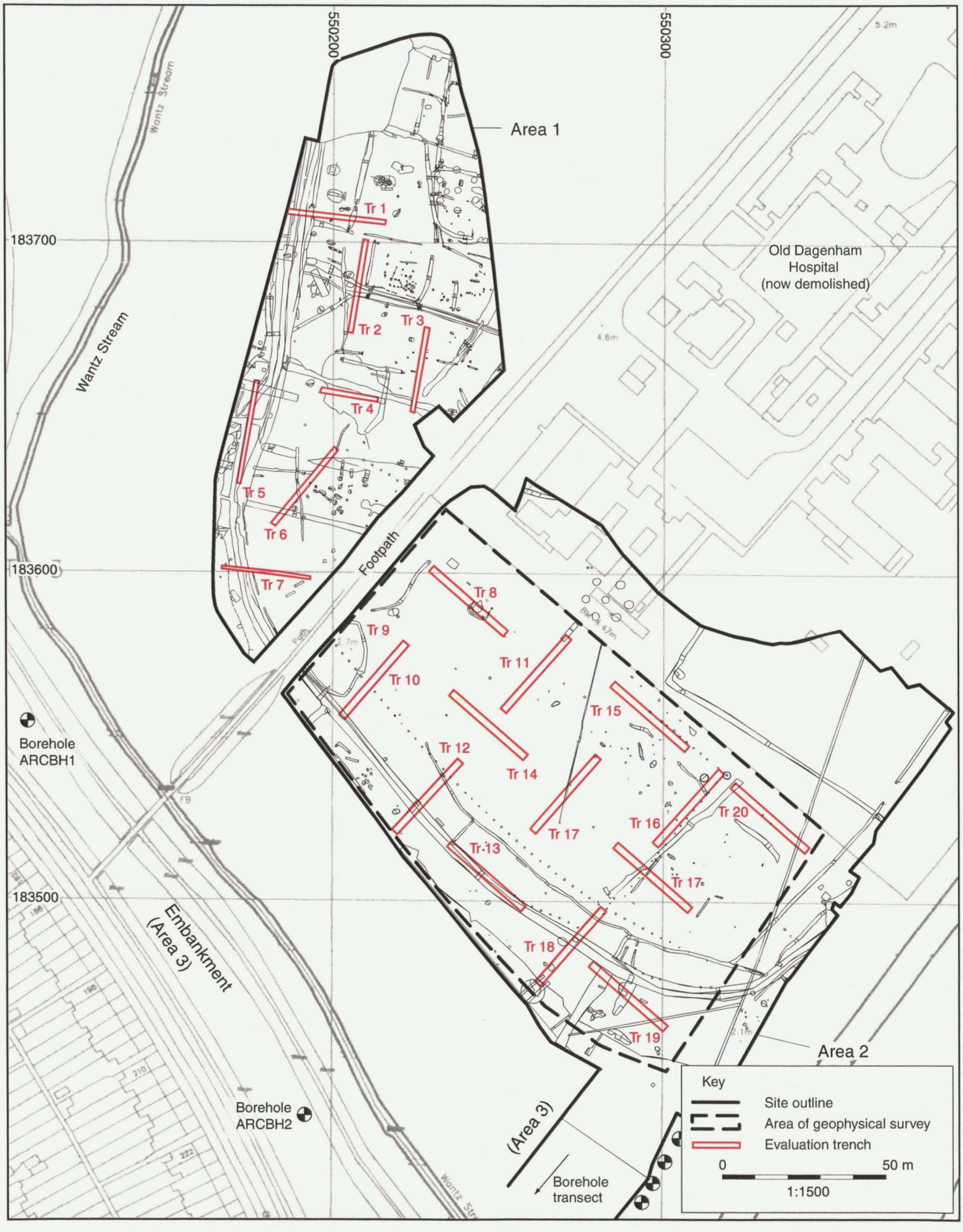


Figure 2: Location of Archaeological works (within NGR TQ) and distribution of all archaeological features

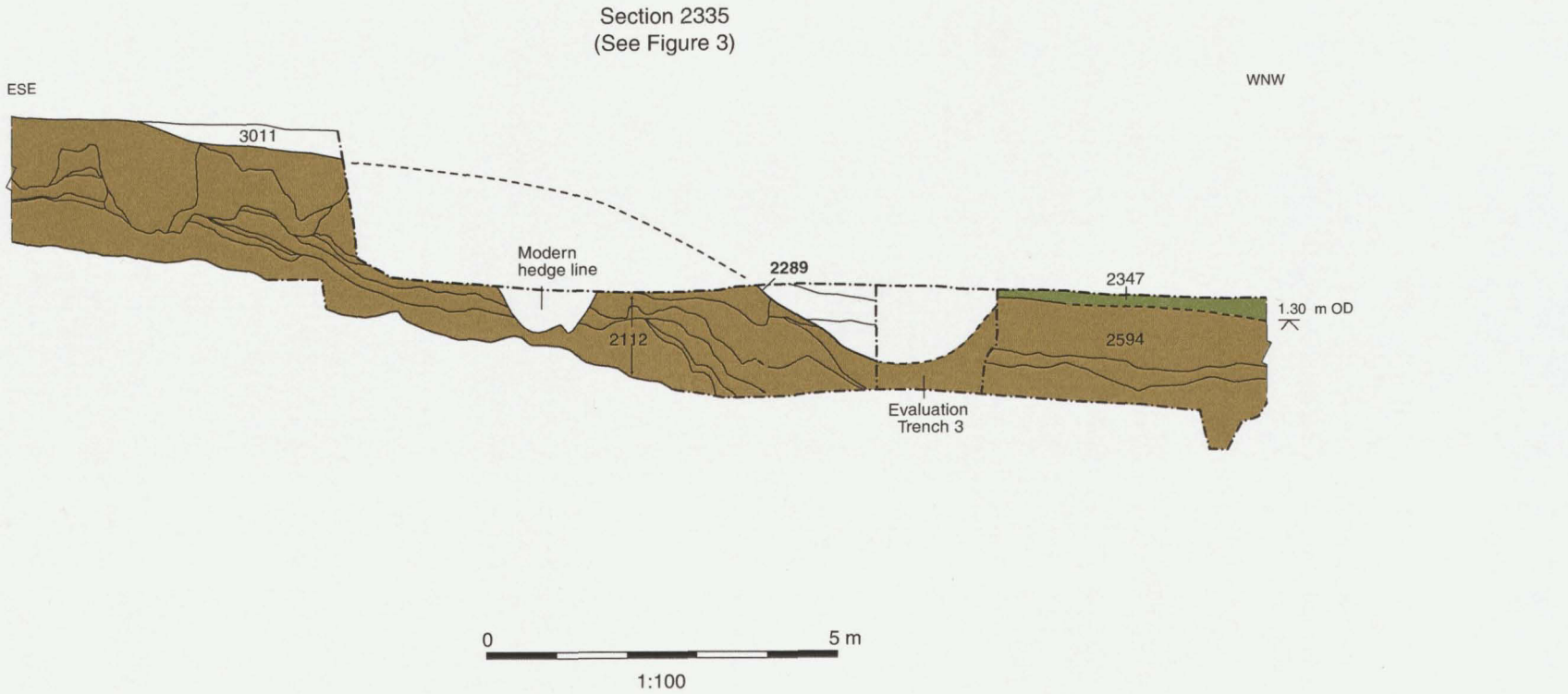
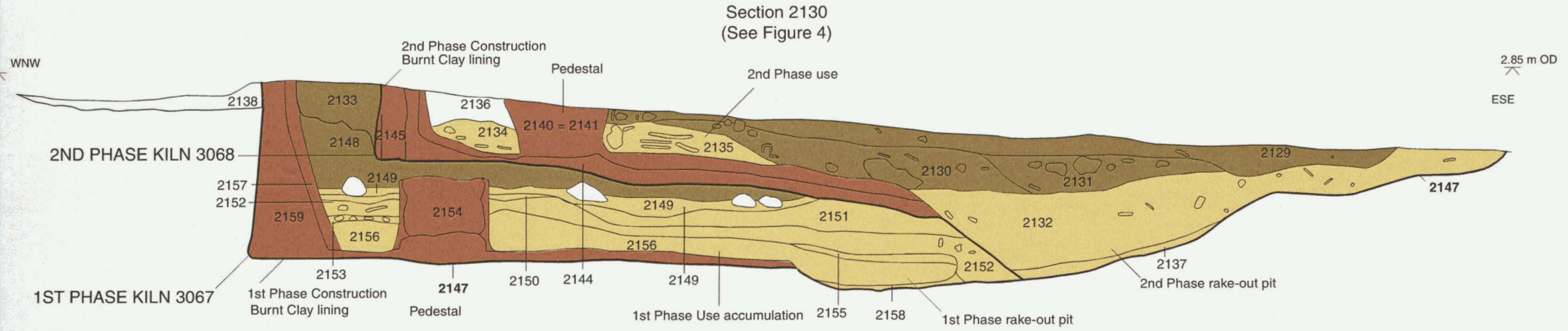
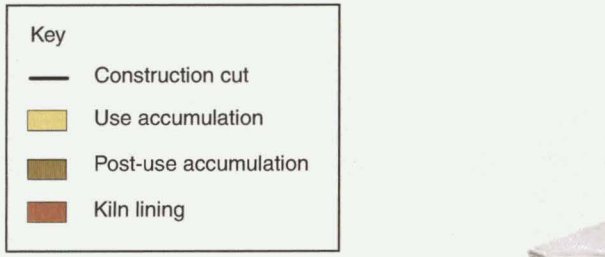
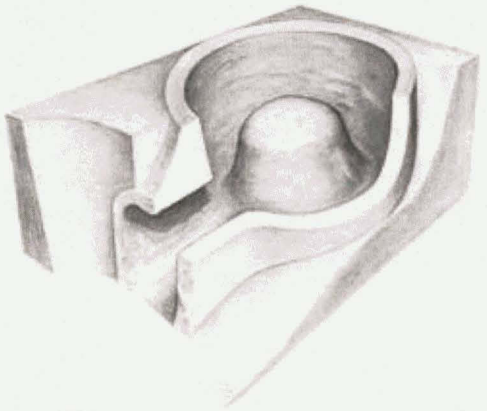


Figure 8: Section through Mesolithic deposit and Mucking gravels







Approximate scale 1:50

Scale of plan 1:100

Figure 9: Section through Roman pottery kilns 3067 and 3068, with schematic reconstruction (Swan 1984)

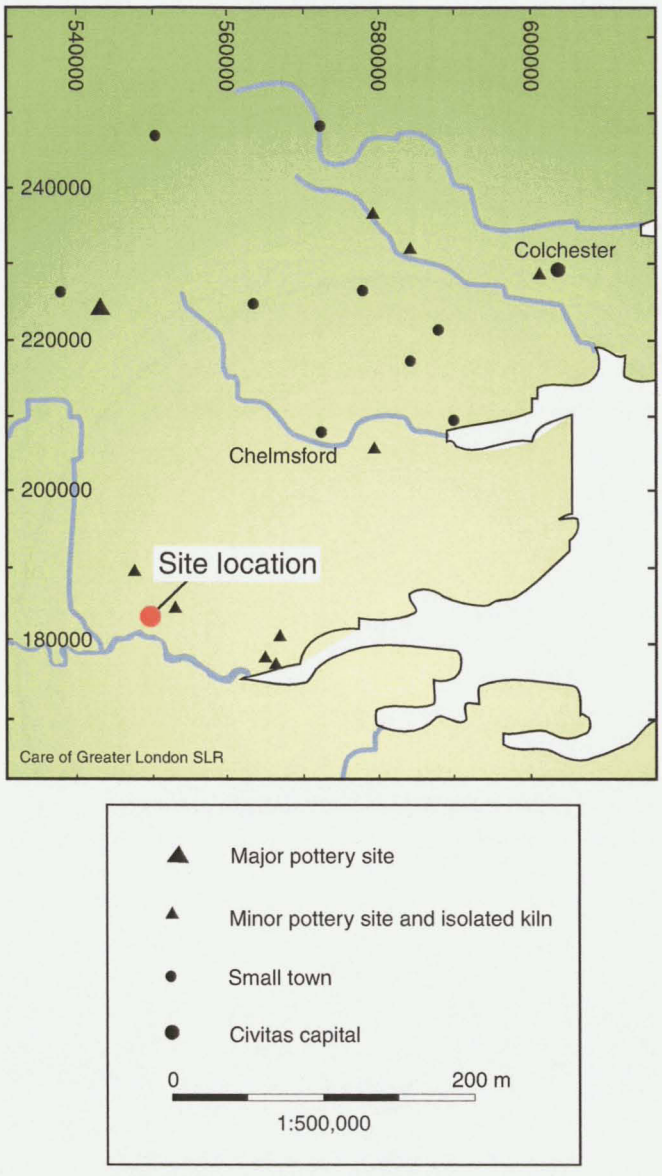


Figure 10: Kiln sites in east London and Essex

Figure 3: All areas - Prehistoric phases

Figure 4: All areas - Roman phases

Figure 5: All areas - Post Roman phases

Figure 6: Phase plan of Area 1

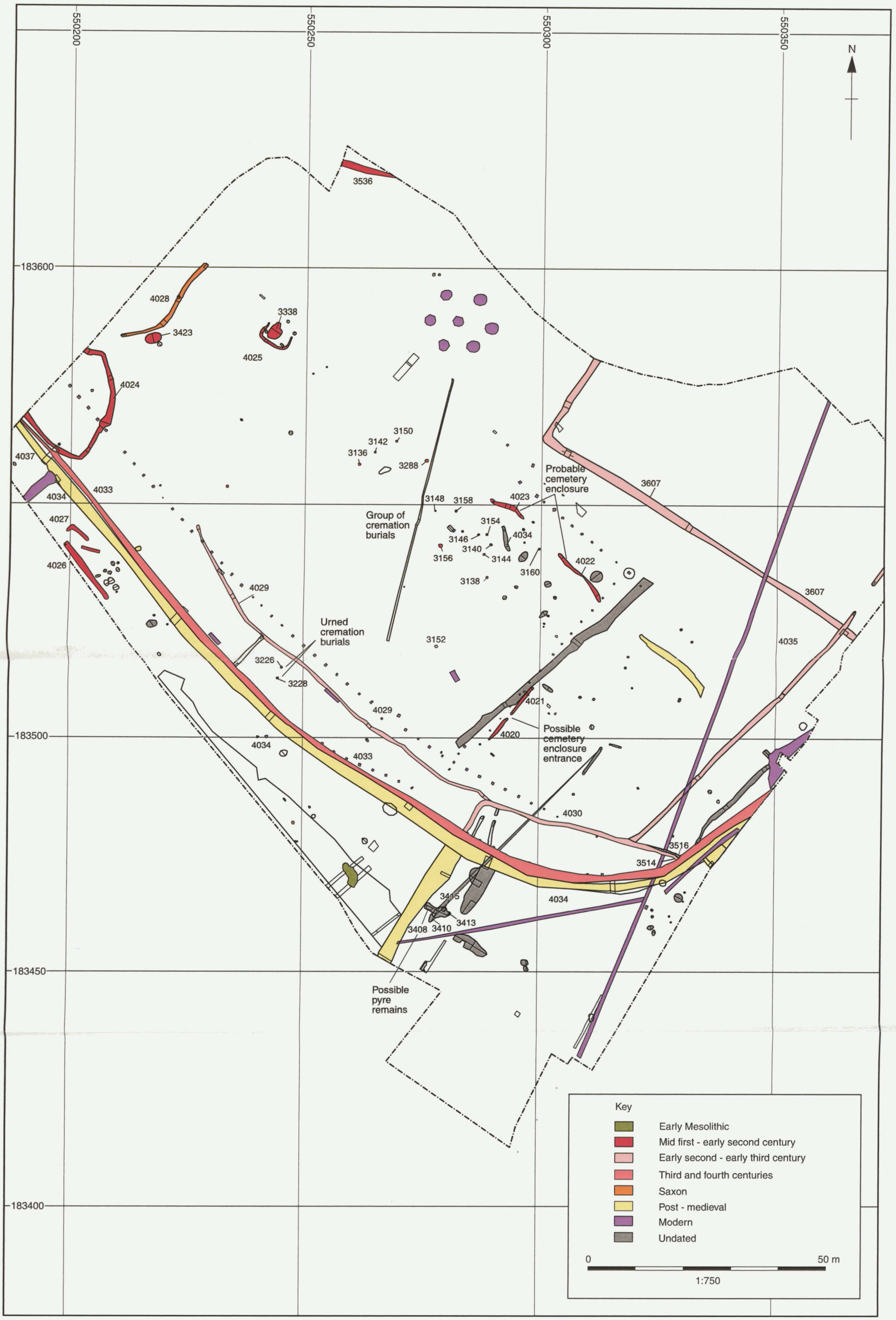


Figure 7: Phase plan of features of Area 2

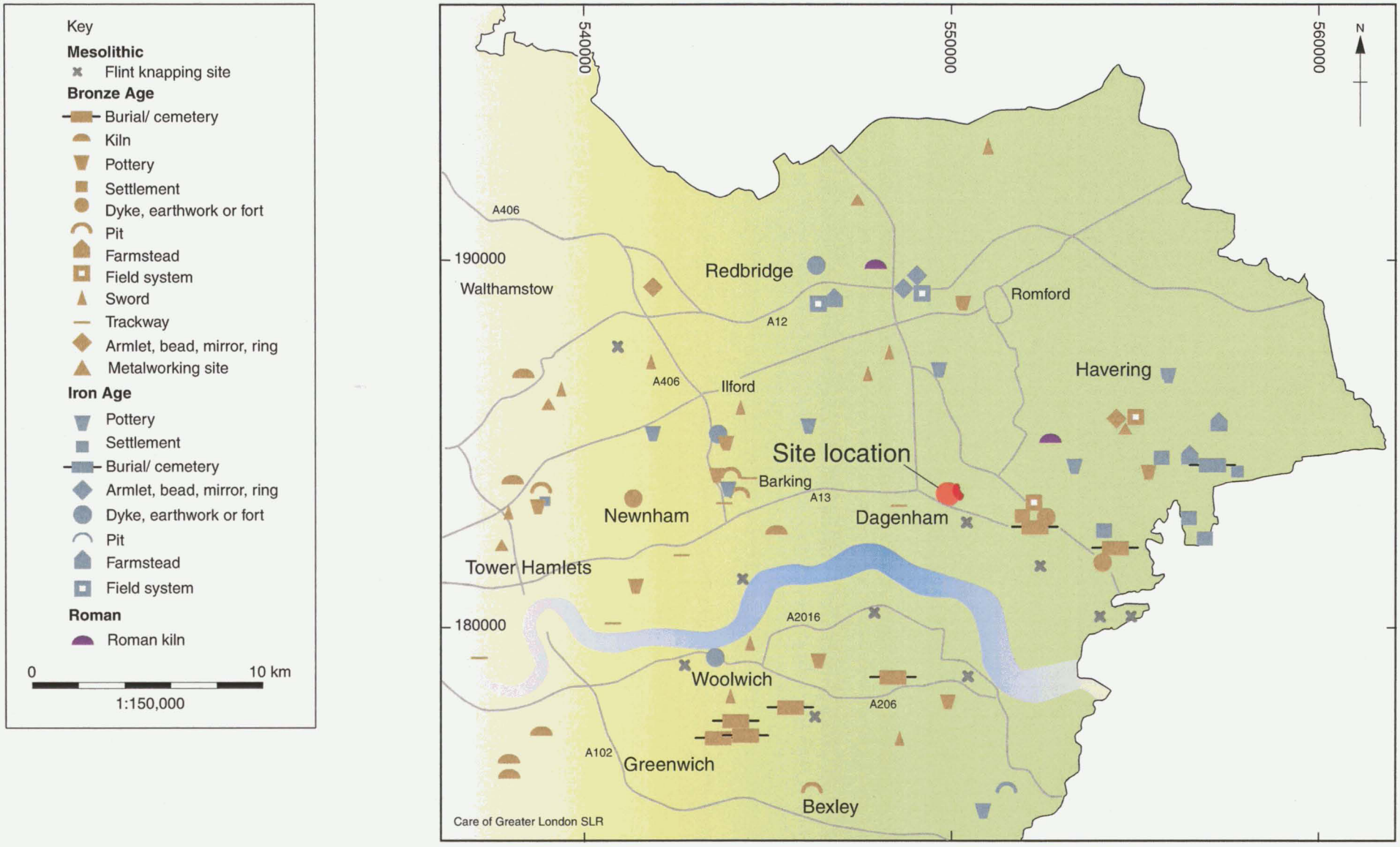


Figure 11: Sites in north-east London

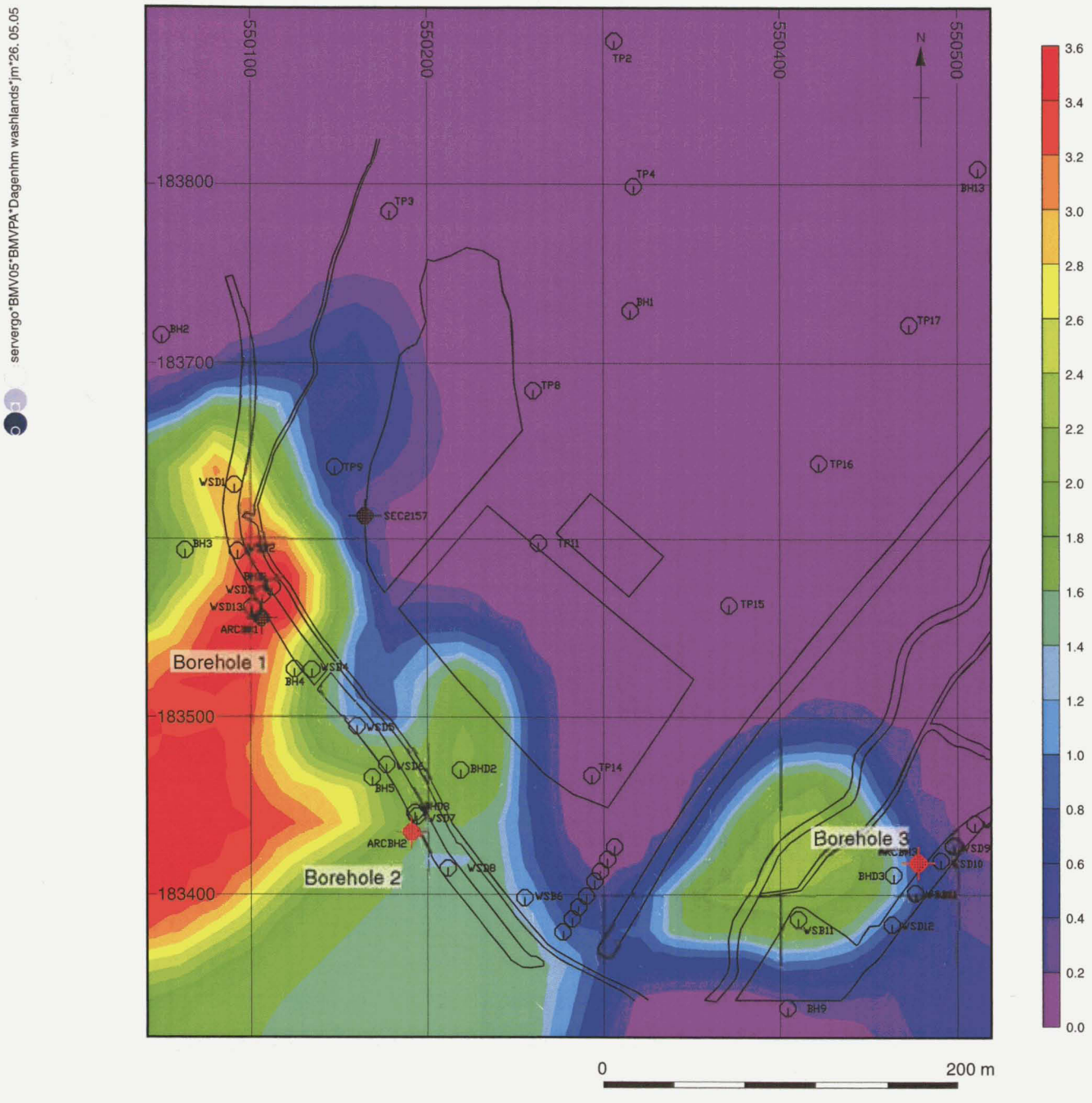


Figure 12: Thickness and extent of peat/organic deposits

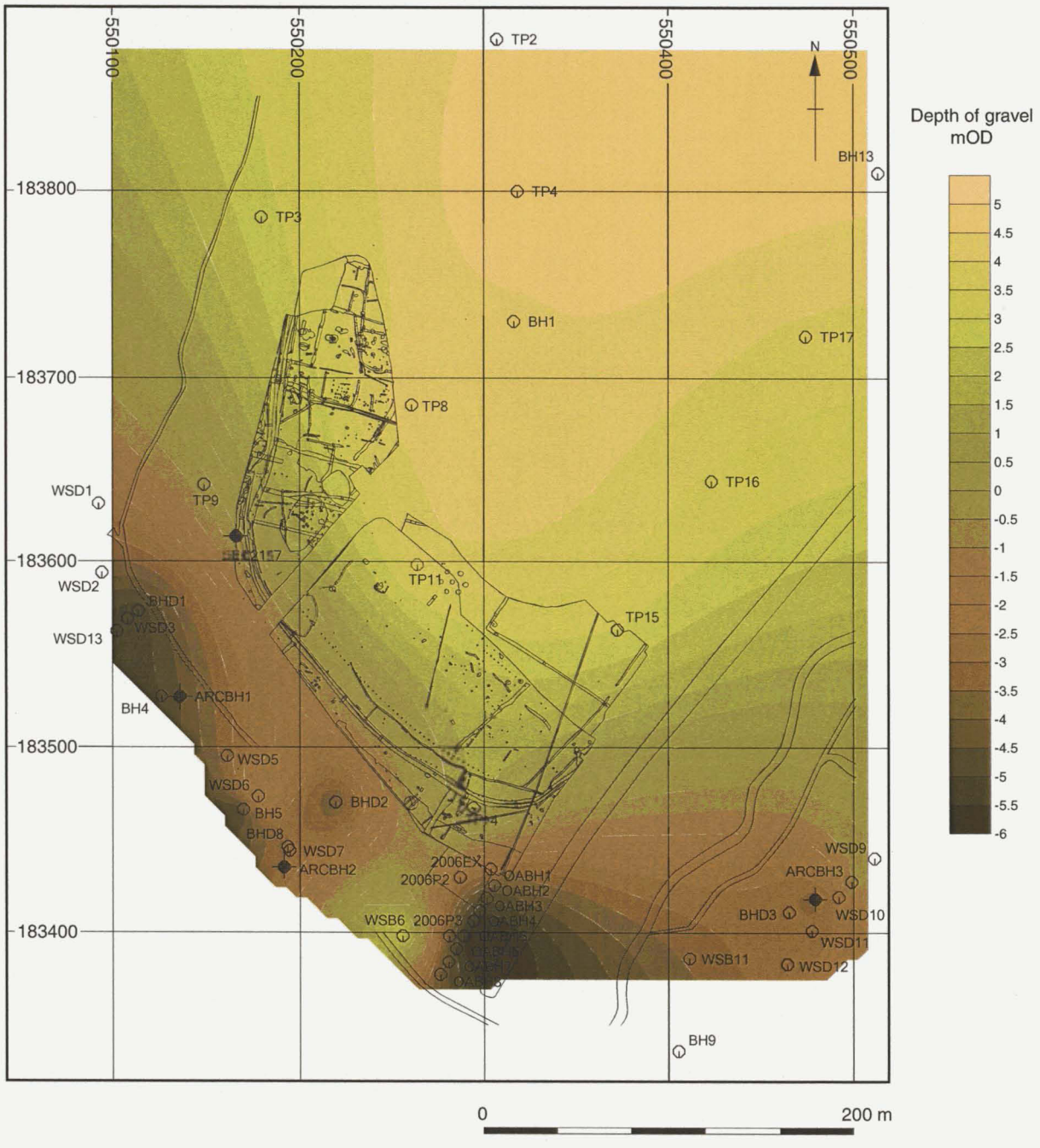


Figure 13: Elevations of sandy gravel unit showing the excavation and borehole locations

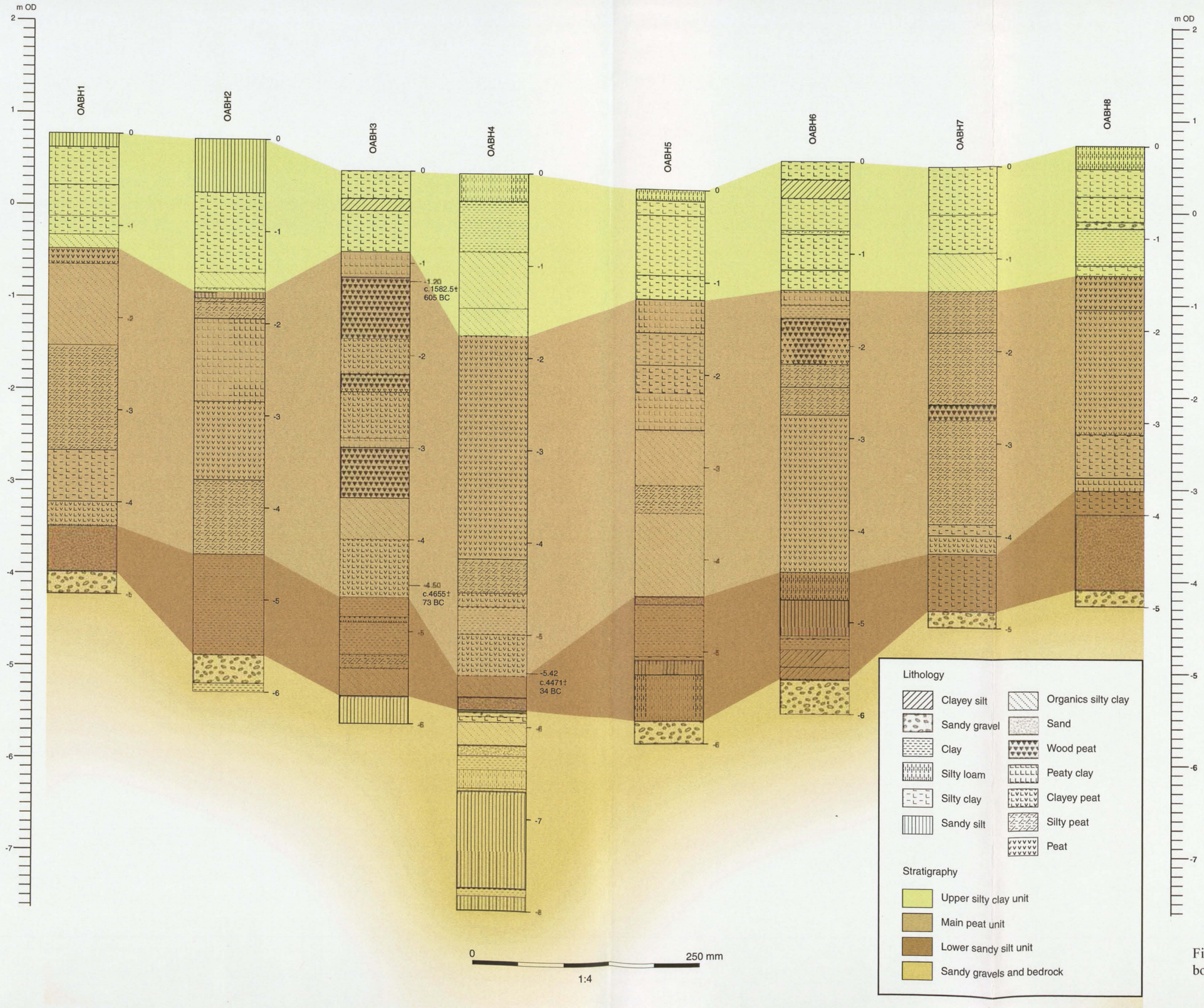


Figure 14: Pond borehole transect

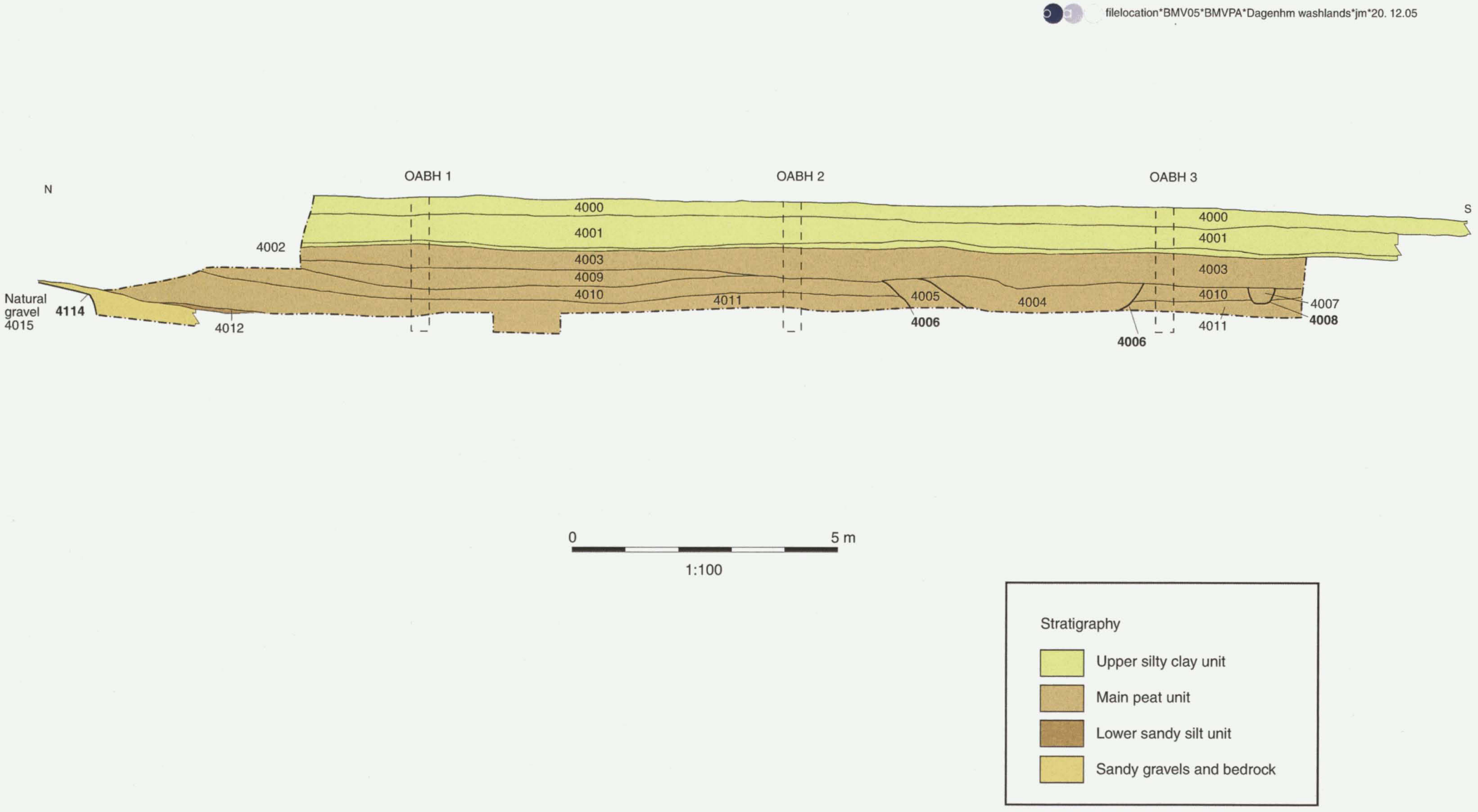


Figure 15: Borehole transect S.OABH2

Plate 1: View of the waterfront area of site after stripping

Plate 2: Roman kilns under excavation

Plate 3: Deposit of triangular kiln bricks under excavation

Plate 4:An early mesolithic flint core

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