PEABODY AVENUE
Pimlico
London SW1

City of Westminster

Geoarchaeological investigation

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MUSEUM OF LONDON ARCHAEOLOGY

REGISTERED ORGANISATION IfA

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Site Code: PBA08
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Project Manager	Gordon Malcolm
Author	Jason Stewart
Graphics	Juan José Fuldain González

Museum of London Archaeology

Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED
tel 020 7410 2200 fax 020 7410 2201
molas@museumoflondon.org.uk
www.musemoflondonarchaeology.org.uk

Summary (Non-Technical)

This report presents the results of geoarchaeological investigation work carried out by the Museum of London Archaeology (MOLA) on the site of Peabody Estates, Peabody Avenue, London SW1. The report was commissioned from MOLA by Mansell plc on behalf of the Peabody Trust.

The proposed development scheme consists of the construction of residential dwellings, which will be founded on continuous flight auger (CFA) piles. The geoarchaeological work consisted of drilling nine Terrier Rig boreholes in two intersecting transects across the site. Core samples were collected through the alluvial deposits of archaeological interest for off-site examination, in order to assess their potential for any further analysis.

The deposit characteristics recorded in the geoarchaeological boreholes have been added to the MOLA geoarchaeological database for the Westminster area and the modelling produced has helped to refine the initial assessment of the archaeological potential of the site. The site spans the edge of the lower lying part of the floodplain and the edge of the Lupus Street eyot. Such locations, at the transition from the wetland to higher drier ground were often targeted for occupation and other activity from the Mesolithic onwards, although no evidence for any occupation of the site prior to the post medieval period was recorded in the boreholes.

Much of the site, however, has suffered severe truncation down into the Pleistocene sands and gravels. The northern end of the site, in particular has been subject to severe truncation, removing all deposits prior to the 19th century.

In the south of the site a post medieval (and possible earlier) soil or landsurface was buried underneath the made ground. This soil seems to suggest gardening or horticulture taking place on site and it indicates that the environment was stable and dry for much of the historic period. The soil had formed in a sequence of bedded sands and clays, which provide evidence for changing fluvial regimes in the Late Pleistocene and Early Holocene, after which time a dry landsurface existed on the site from later prehistory onwards.

The core samples have revealed that environmental evidence is likely to be low, owing to prolonged dry conditions, leading to oxidation and decay of organic remains.

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1 Introduction

1.1 Site background

The investigation at the Peabody estate site was commissioned from the Museum of London Archaeology (MOLA) by Mansell plc on behalf of the Peabody Trust. It was requested in advance of redevelopment of the site as required by a condition applied to the consented scheme (08/07957/FULL).

The Peabody estate is located about 300m east of Chelsea Bridge. It is bounded to the west by a railway depot, comprising sidings and a carriage cleaning shed and by Turpentine Lane to the east, Grosvenor Road to the south and Ebury Teacher's Centre to the north. The Peabody estate as a whole measures approximately 150m by 30m and comprises two rows of five storey flats arranged either side of a central avenue, containing scattered mature and semi mature deciduous trees. The area of proposed redevelopment lies at the southern end of Peabody Avenue in an area that is known to have suffered bomb damage during the Second World War. This part of the estate, which was the focus of the geoarchaeological borehole investigation and henceforth known as 'the site', measures approximately 90m from north to south. The Ordnance Survey National Grid reference for the centre of the site is 528820 178070 (see Fig 1).

The development proposals comprise the demolition of some of the existing buildings and the construction of a new six storey L-shaped block of flats, which will be founded on continuous flight auger (cfa) piles. The pile caps and services are likely to lie within the modern made ground, with the only impact on deeper deposits arising from the piles themselves. It was therefore proposed to investigate the buried deposits by windowless sample boreholes in two transects across the site.

A method statement was prepared in advance of the works, which provides information about the past environment of the site (Corcoran 2008). A separate report has been prepared on the standing building recording (Tetreau & Westman 2009) that has taken place in order to satisfy a further condition placed on the planning consent in relation to the development scheme.

The geoarchaeological evaluation took place between the 29th June and the 2nd July 2009.

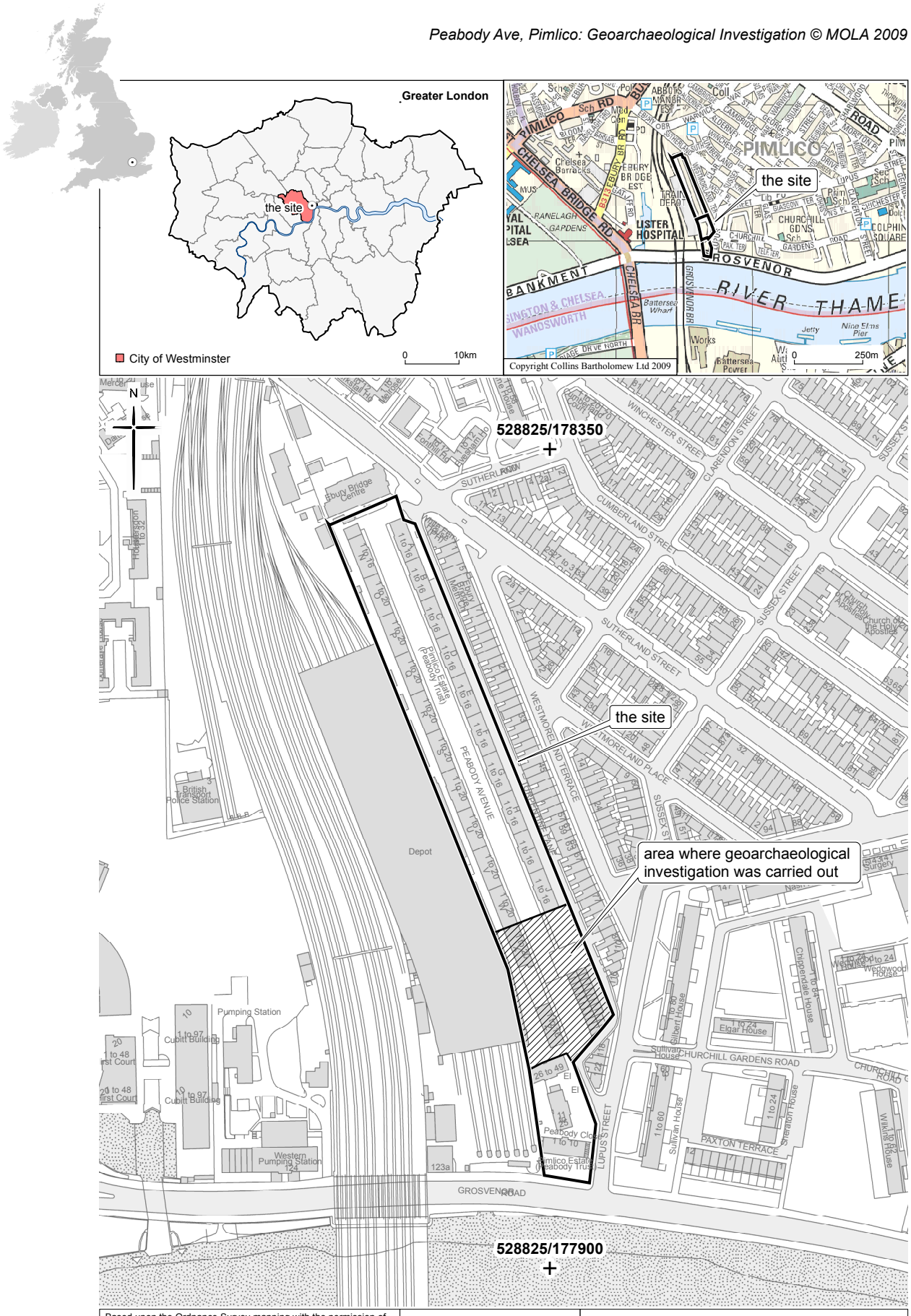

Fig 1 Site location

1.2 Origin and scope of the report

This report was commissioned by Mansell plc on behalf of the Peabody Trust and produced by Museum of London Archaeology. It has been prepared within the terms of the relevant Standard specified by the Institute of Field Archaeologists (IFA 1999).

The document reports on the results of the geoarchaeological examination of borehole core samples, in order to provide information about the past environment of the site. It is intended to provide sufficient information to determine archaeological and palaeo-enviornmental survival and the likely impact of the proposed scheme on any surviving deposits of archaeological interest, as well as the potential of the core samples to provide new information about the evolving environment of the Pimlico area.

1.3 Geoarchaeological Background

1.3.1 Previous understanding of the local deposit sequence and past environment it represents

According to British Geological Survey (BGS) mapping, upstream of Chelsea Bridge the floodplain of the River Thames, as identified by the extent of alluvial deposits, is relatively narrow, with river terraces little more than 0.5km apart from the northern to southern bank. Immediately downstream of the bridge, the floodplain in Westminster is roughly 1.5km across. In this area a wide swathe of alluvium is punctuated by several gravel outcrops (see BGS Sheet 270 South London). These are remnants of former floodplains (earlier river terraces), eroded by river scour and incision in the later stages of the Pleistocene to form islands of higher ground within the Holocene floodplain. In addition to these gravel islands, there are large bars of sand, some banked up against the earlier gravel, which were deposited in the late Pleistocene or early to mid Holocene (Late Upper Palaeolithic, Mesolithic or Neolithic), perhaps a result of the Thames and its tributaries flowing from the river terraces onto the wide floodplain of Central and East London. However the origin of the eyots is uncertain (Nunn 1983; Morley in press).

The date and environment of deposition of the fluvial sands, which lie beneath much of the floodplain in Westminster, are as yet poorly understood. Although a twig from the bedded sand of Thorney Island was dated to the Neolithic (Sidell *et al* op cit), at least some of the sands are likely to be older than this, as the stumps of trees growing in sandy clay in Southwark, thought to be roughly contemporary with the sands, have been dated to the Mesolithic (Corcoran in prep). Radiocarbon dating of organic remains preserved within the sands is typically used to date their deposition. However, the most appropriate method of dating the sands and associated fluvial deposits in Westminster and Southwark is likely to be Optically Stimulated Luminescence (OSL), which can measure the accumulation of radioactivity within silt and fine sand grains after they have been exposed to sufficient light to ‘zero’ the signal already built up within them. Such zeroing can occur when sediments are transported by a river, and the last time this took place was immediately prior to the sediments being deposited. Archaeologically it is important to date the sand, as it is not known for example, whether Mesolithic archaeology would be found above, within or below the fluvial deposits. Very recent dating of the sands from Thorney Island (Little Smith Street) has produced a date of c.15ka BP (Dr Phil Toms, for MOLA, pers comm) however more work is need to piece together the Early to Middle Holocene landscape evolution of the floodplain in Westminster.

Later prehistoric archaeology is typically found associated with the surface of the sand. Prehistoric occupation took place on the sandy islands ('eyots') of Westminster and Southwark, and in many cases ard marks and other features have been recorded cut into the surface of the sand. It is possible that the prehistoric settlers were utilising the open tracts of light and fertile land within the floodplain, especially as the dense forest that mantled the river terraces and heavier clay hills beyond might not have yet become established on the relatively recent sandy islands of the floodplain in Central and East London. Tree stumps and fallen trunks surviving from the thick prehistoric forest is known from foreshore surveys of the narrower floodplain upstream, in the vicinity of the Bankside Power Station for example. However, the environment of the wide floodplain in Westminster has not yet been studied in any detail, away from Thorney Island.

The lower lying wetland areas between the sandy eyots were probably followed by streams or occupied by ponds, lakes or meres, fringed by marsh and sedge fen. These wetland areas were also exploited, as has been demonstrated by the prehistoric platform and possible trackway structures within the Bankside Channel in Southwark (Corcoran in prep). As yet, no similar structures are known from Westminster, although the possibly ritual piled structure found in the river at Vauxhall demonstrates that such remains are likely to exist. Environmental indicators, such as insects, seeds, snails, pollen, diatoms and ostracods, are usually preserved in the lower-lying wetland areas. These are a valuable source of past environmental information, needed to reconstruct the landscape in which past human activity took place. Thus even where no archaeology survives, or in cases such as on the present site where standard excavation to find tangible archaeological remains is not feasible or warranted, evidence gathered about the evolving past environment can be a valuable archaeological resource in its own right (English Heritage 2002, 2004).

The MOLA geoarchaeology department have constructed 'deposit models' for parts of the Central and East London Thames floodplain, including Westminster. These models use information from previous archaeological investigations as well as geotechnical borehole logs to reconstruct the buried topography (essentially the surface of Pleistocene gravel or/and early Holocene sands) and examine the distribution of overlying deposits. The objective of these models is to enable the discrete information obtained from individual sites to be placed within its wider past landscape context and thus be better understood. By inputting the data obtained from any site examined geoarchaeologically into the relevant deposit model, it also means that information from any site, however small and insignificant when viewed on its own, can contribute to the bigger picture of past landscape evolution.

The Westminster deposit model and BGS mapping show that the site lies on the western edge of an eyot of high ground, perhaps a remnant of the Kempton Park Gravels (which form the lowest river terrace adjacent to the floodplain). A former channel of the Thames might exist between this eyot (the Lupus Street Eyot) and the river terrace to the west, as the area is low-lying in the deposit model, although very little data for this area is available. The edge of the terrace was picked up during recent geoarchaeological work at the Chelsea Barracks, where thick deposits of sand overlain by peaty deposits, which thickened into the channel area were found (Featherby and Halsey 2007; Hoyle 2008). The channel may have been a channel of the Thames, or one of its tributaries, as the Westbourne and Battersea Channel (Morley op cit) are confluent with the Thames in this area. An OSL date of c 22 to 42ka BP was obtained for the sands at Chelsea Barracks, suggesting that some, at least of the sands on that site were part of the river terrace.

If similar topography and overlying deposits exist below Pimlico Avenue to those on the Chelsea Barracks, it is likely that a dry landsurface existed here, at the margins of the lower-lying area, until subsumed beneath the expanding later prehistoric wetland. Wetland expansion was probably related to relative sea level rise during the Holocene, which caused impeded drainage and waterlogging. Subsequently estuarine environments encroached into Central London. Geoarchaeological work around Thorney Island (Sidell *et al* op cit) suggests that from the Bronze Age indicators of raised salinity, such as diatoms, foraminifera and ostracods demonstrate that tidal water and estuarine environments had reached Westminster. From this period onwards, sands, peat, tufa and other freshwater deposits, as well as any dry landsurfaces developed in these and earlier deposits, are sealed by thick swathes of alluvial clay representing a range of intertidal and saltmarsh environments. The upper weathered alluvial clay, however, probably represents the episodic flooding of reclaimed marshland from the medieval period onwards.

1.3.2 Previous understanding of site stratigraphy

Present ground level at the site lies at approximately 4.5m OD. An examination of borehole logs from a previous geotechnical investigation on the site (GEA 2008), drilled in the area of the proposed new building, shows that the surface of London Clay bedrock (the absolute bottom line for deposits of archaeological interest) lies between –8m and –9.5m OD. The surface of the overlying sandy gravels lies between +1m and –1m OD and roughly dips from east to west. The gravels are overlain by sandy clay, possibly *in situ* or redeposited alluvium (in part at least possible upcast from construction of the adjacent former Grosvenor Canal, later turned into railway sidings).

It is possible (given the current geoarchaeological mapping of the buried topography of the area) that the sand and gravel surface might dip down northwards along Peabody Avenue and the overlying deposits also become more organic in this direction. Whether a dry land surface formerly existed above the sandy gravel deposits and below the sandy clay alluvium / redeposited alluvium, however, cannot be concluded from the geotechnical logs, which were logged for purposes other than past environment reconstruction (and thus according to different criteria). Although numerous geoarchaeological investigations have been undertaken further downstream in Westminster, in the vicinity of the Houses of Parliament and Westminster Abbey (eg: Sidell *et al* 2000), previous investigations in Pimlico have been sparse.

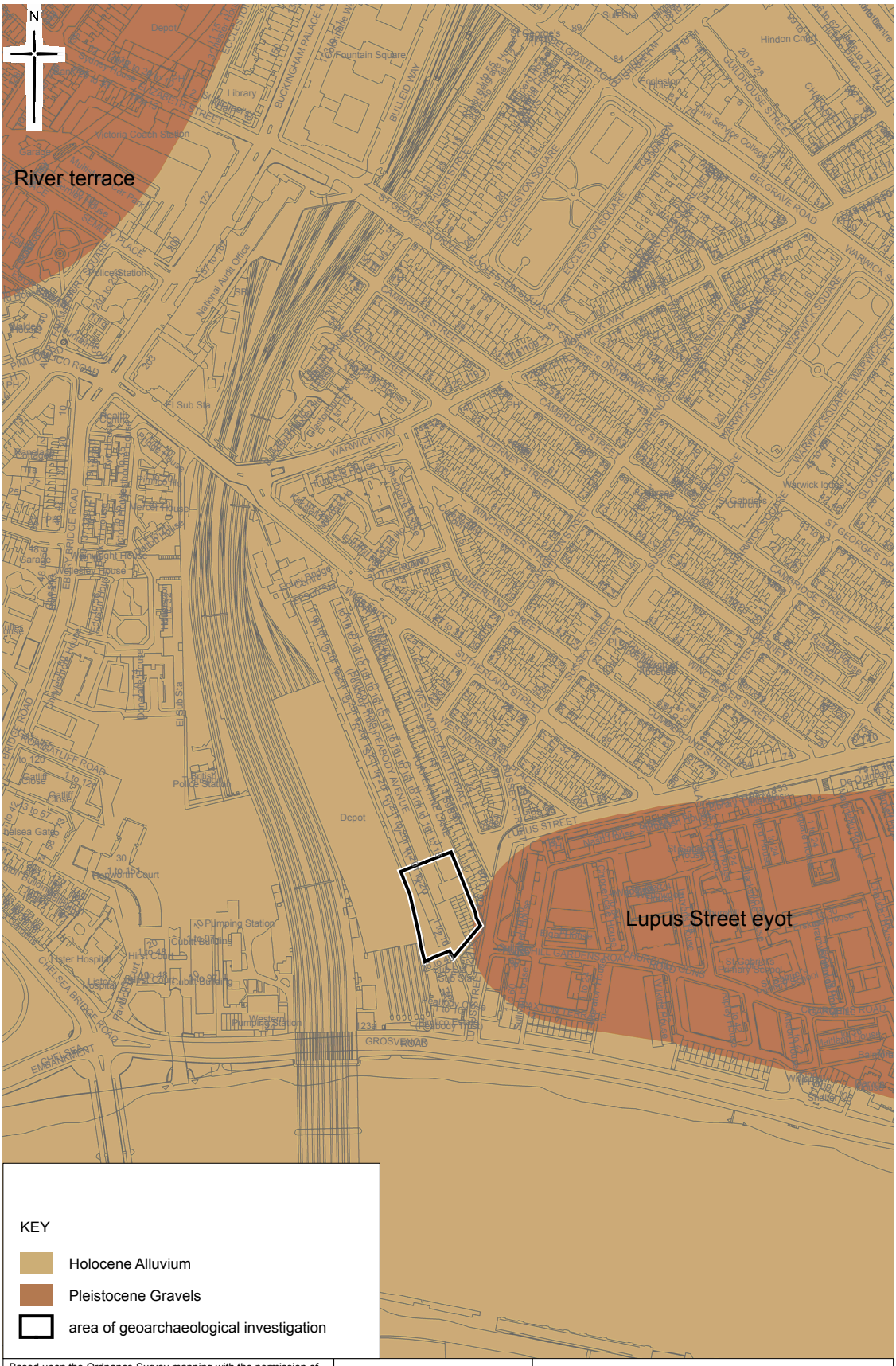

Fig 2 Surface Geology

1.4 Aims and objectives

1.4.1 General considerations

The purpose of the geoarchaeological investigation was to:

determine, as far as is reasonably possible, the nature of the archaeological resource within a specified area using appropriate methods and practices. These will satisfy the stated aims of the project, and comply with the Code of conduct, Code of approved practice for the regulation of contractual arrangements in field archaeology, and other relevant by-laws of the IFA.

1.4.2 Site specific aims and objectives

The aim of the geoarchaeological investigation was to drill up to ten boreholes across the site and obtain core samples suitable for off-site examination.

The objective of the borehole survey was to determine the potential of the core samples obtained for further off-site work, which might contribute new information to current knowledge of the evolving prehistoric and historic environment of Pimlico.

The site occupies an area of floodplain near to the Lupus Street Eyot and represented an excellent opportunity to investigate the western extent of the eyot and the floodplain around it; an area which is not been extensively mapped in terms of its geoarchaeological characteristics.

The survey has also assessed the likely preservation and potential of proxy palaeo-environmental indicators such as pollen, mollusc or diatoms, as well as other macro and micro- fossils, which may provide information about past environments, both on land and related to the fluvial environment throughout the Quaternary. In particular pollen might help recreate past vegetation; and molluscs, diatoms and ostracods changing river characteristics such as flow regime and salinity.

2 Methodology

The locations of the interventions monitored are given on Fig 3. Nine Terrier Rig boreholes (window sample 1 to 9) were drilled under the supervision of a MOLA geoarchaeologist. The cores obtained from five of the holes were examined on site; the cores from four holes were taken back to the MOLA geoarchaeology laboratory for further analysis. The boreholes were surveyed by MOLA and plotted on to the OS Grid.

All elements of the borehole investigation were carried out in accordance with the relevant Institute of Field Archaeologists Standards and. The work was also guided by the recommendations outlined in the English Heritage Guidelines for Environmental Archaeology and Geoarchaeology (EH 2002; 2004 respectively). The boreholes were drilled with a Terrier Rig by a sub-contracted drilling crew (PJ Drilling) through the Quaternary sequence down to the surface of the Pleistocene river gravels. The geoarchaeologist kept a field log of the boreholes and a photographic record of the site and cores.

Continuous cores were collected through the made ground and alluvial deposits. The cores were recovered in undisturbed 1m long Perspex tubes, roughly 100mm in diameter. The cores were slit open (five on-site, as these only penetrated made ground and four off-site as these appeared to have more complete alluvial sequences), cleaned and the sequence of sediments drilled in each borehole was described and recorded together with the nature and depths of the interfaces between the different sedimentary units on proforma sheets. Description followed standard geoarchaeological terminology (Museum of London 1994, Bullock et al 1983), which characterises the visible properties of each deposit, in particular relating to its texture, colour, structure, inclusions and evidence for depositional and post-depositional processes.

As the sediments were not considered suitable for radiocarbon (no organics were present) or OSL (the sand was too coarse) no samples have been submitted for dating.

The stratigraphic data, together with that from the previous geotechnical boreholes (GEA 2008) has been inputted into an Access / Excel compatible database (RockWorks 2006) and added to the MOLA Geoarchaeology Westminster database. The borehole sequences have been examined in site-wide working transects and the deposits ascribed to a stratigraphic sequence. Similar units occurring in adjacent boreholes have been linked and assigned to a range of ‘facies’, site-wide deposits, representing different sedimentary environments, which have been used as an aid to interpreting and presenting the data and discussing the results. This semi-interpreted data has been transferred to ArcGIS for modelling of the buried topography (top of sands and gravels – the ‘pre-Holocene template’) and deposit distribution, as appropriate.

The results have been used to delineate areas of differing archaeological potential across the site. The potential, in terms of its depth and location within the site is illustrated by means of a transect (schematic cross section across the site) and a plan (see figs 4 and 5).

The logs of each intervention will form part of the site archive. The site records will be archived under the site code PBA08 in the LAARC.

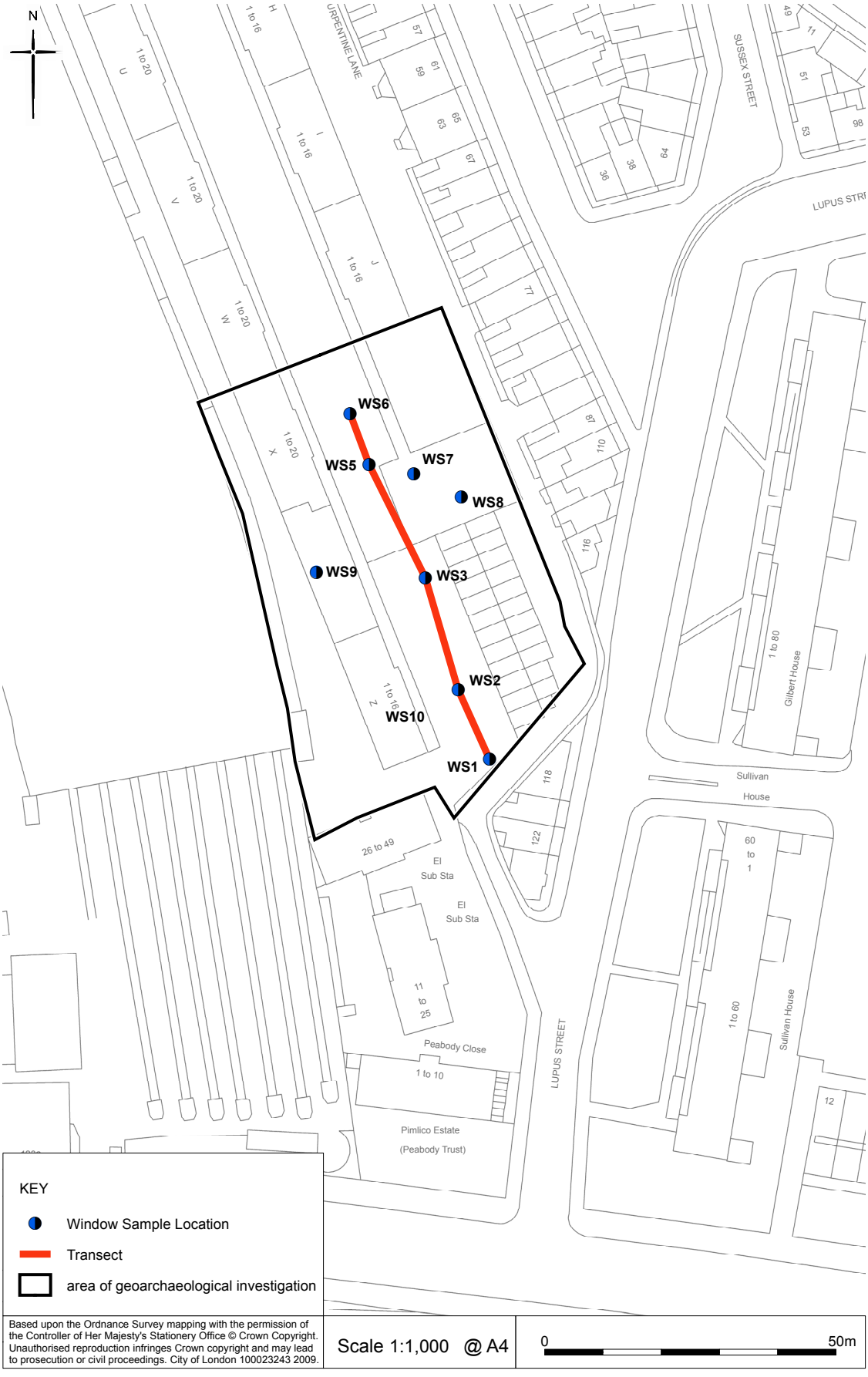

Fig 3 Location of Interventions

3 Results of the investigation

For the location of these interventions along the transect see Figs 2, 3 and 5.
For an explanation of the numbers (1-7) listed in the facies column, please see section 3.1.1.

Table 1 Window Sample 1

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528843.661, 178022.851		
4.5m OD	Ground level adjacent to borehole		
0.00-2.38m	Soft black sandy silt with frequent marine mollusc fragments (Oyster) Frequent fine to coarse brick fragments and animal bone fragments	Made ground	7
2.12m OD			
2.38-2.58m	Very hard mid greyish brown very sandy silt with small flecks of charchol and fine laminations of iron stained sediment	Possible truncated post medieval topsoil - A horizon	6
2.58-3.00m	Soft mid greyish brown very sandy silt getting less sandy /more clayey with depth patches of more finer clayey sediment	Lower profiles of soil profile, evidence of bioturbation and clay translocation	
plus1.5m OD			
3.00-3.11m	Light greyish brown silty clay no sand	Translocated clays/subsoil	5
+1.39m OD			
3.11-3.56m	Light redidish grey brown silty sand with patches and bands of silt. Very sharp boundary, could indicate erosion?	Seasonal changes in fluvial environment carbonate precipitation might indicate a cold weather environment	4
3.56-4.00m	Bands of medium and coarse sands with bands of silt and tufaceous in appearance silts with rare fine sand bands		
+ 0.50m OD			
4.00-4.43m	Medium and fine sands with fine subangular to subrounded gravels with carbonate rich silt and silty lenses at base	Late glacial to very early Holocene stream environment	3
+ 0.07m OD			
4.43-4.70m	coarse sands with moderate fine subangular to subrounded gravels with some Manganese staining	Pleistocene fluvial environment	2
4.70-5.13m	Bands of medium and fine sands		
-0.63m OD			
5.13-6.00m	Light brownish yellow coarse sand with moderate subangular to subrounded medium gravels	Pleistocene braided river.	1

-1.5m OD	**Base of borehole** *at 6.00m (bgl)*

Table 2 Window Sample 2

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528838.2684, 178034.7392		
4.50m OD	Ground level adjacent to borehole		
0.00-1.84m	Gritty dark brown/black loam with frequent bricks, coal and mortar, with sands and gravels	Made ground	7
2.70m OD			
1.84-2.00m	Firm dark brown gritty silty clay with rare fine gravel- feels slightly fibrous	A-horizon of post-medieval soil	6
2.00-2.40m	Very dark brown /black silt with rare brick fragments and small coal flecks , with sharp irregular boundary	Anthropgenic soil incorporating elements from post medieval landsurface, possibly horticultural/ garden soil	
2.1m OD			
2.40-2.90m	Mid yellowish brown clayey silt with sandy patches also clay lined root channels and aestivation chambers	Rooting and bioturbation shows movement from prehistoric soil to post medieval soil as the profile accumulates, this shows both evidence of a prehistoric land surface and the post-medieval B and C soil horizons	5
+1.6m OD			
2.90-4.00m	Mid yellowish brown clayey silt with disturbed clay lenses and beds	Evidence of disturbance of the natural due to pedogensis , bioturbation and weathering)	4
plus0.5m OD			
4.00-4.60m	Bands of medium and coarse sands interbedded with bands of sandy gravels	Lateglacial riverbed	3
-0.10m OD			
4.60-6.00m	Bands of (300mm interbedded medium and coarse sands and medium and coarse gravelly sands	Pleistocene arctic river, lower discharge than underlying (facies 1) deposits.	2
- 1.5m OD			
6.00-7.00m	Light greyish yellow and mid brownish yellow coarse gravelly sand	Pleistocene arctic river	1
- 2.5m OD	**Base of borehole** *at 7.00m (bgl)*		

Table 3 Window Sample 3

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528832.6652, 178053.8591		
+4.5m OD	Ground level adjacent to borehole		
0.00-1.80m	Friable balck very sandy silt with fine sand and very frequant medium subrounded gravels and yellow brick frags	Made ground	7
+2.7m OD			
1.80-2.00m	Hard very dark brown.black silty clay with lenses of yellow sand some Post med pottery and pockets of coal	Possible A horizon of buried anthropogenic soil.	6
2.00-2.17m	Soft dark brown black silty clay with moderate subangular to subrounded gravel	Possible B horizon of buried anthropogenic soil.	
+ 2.33m OD			
2.17-3.00m	orangey sand with silty pockets and laminatation throughout	Illuvated /biotrubated C horizon of buried soil	5
+ 1.5m OD			
3.00-4.00m	Soft dark yellowish brown banded sands with pockets of dark charchol at top and bands of silt and carbonate rich silt throughout	Lateglacial fluvial deposit	4
+ 0.50m OD			
4.00-4.60	bands of fine and medium sands with moderate fine gravels and some occasioanl medium gravels with rare silty bands between 3.38-3.40m bgl	Pleistocene arctic river deposits	2
- 0.10m OD			
4.60-7.00m	Mid yellow coarse sands with dark laminations at top , fine , medium and coarse subangular to subrounded gravels increasing with depth	Fast flowing Pleistocene arctic river	1
-2.5m OD	**Base of borehole** *at 7.00m (bgl)*		

Window sample 4 was abandoned, as it was located within the area of deep truncation.

Table 4 Window Sample 5

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528822.9859, 178073.3302		
4.50 m OD	Ground level adjacent to borehole		

0.00-2.00m	Mostly void, with 250mm of road matierial and dark coal and brick rich black silty loam		7
2.00-2.50m	Large brick fragments interspersed with medium and coarse sands		
2.50-3.70m	Black very sandy mostly comprised of coal fragments	Possibly remains of a coal dump or water pipe backfill	
0.80m OD	**Base of borehole** *at 3.70m (bgl) (refusal)*		

Table 5 Window Sample 6

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528819.7281, 178071.7092		
mOD	Ground level adjacent to borehole		
0.00-1.00m	Road surface and rebarred concrete with brick hardcore underneath	Modern road surface	7
1.00-1.60m	Large brick fragments with greyish white loam	Made ground	
1.60-2.00m	Black ash and large coal fragments (~50mm) in size	Possible coal bunker?	
2.00-3.00m	Mid brownish grey sandy loam with very frequant coarse brick fragments and concrete fragments		
3.00-7.00m	Mid slightly greyish yellow very slightly silty medium sand with rare coarse subrounded gravel and rare medium sized brick fragments also fine rare subangular gravel. bricks at 6m	Made ground	
-2.50m OD	**Base of borehole** *at 7.00m (bgl)*		

Table 6 Window Sample 7

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528830.6886, 178071.7092		
mOD	Ground level adjacent to borehole		
0.00-0.40m	Pinkish white sandy loam with very frequant brick fragments (~30% c.3cm in size	Deposts possibly associated with construction of the Peabody estate	7

0.40-1.00m	Black fragments of subrounded viterous looking waste		
1.00-1.80m	Large red brick and mortar fragments		
1.80-2.00m	Dark brownish grey very gritty fine medium and coarse sands with frequant small fragments of brick and coal		
2.00-2.50m	Brick, mortar and ashy residue		
2.50-3.00m	Dark brownish grey fine, medium and coarse sand with frequant brick		
1.50m OD	**Base of borehole** *at 3.00m (bgl) (refusal)*		

Table 7 Window Sample 8

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528838.8097, 178067.7922		
mOD	Ground level adjacent to borehole		
0.0-0.10m	Tarmac	Modern basketball court surface	7
0.10-0.40m	Subangular to subrounded medium to coarse white gravel		
0.40-0.60m	Fine subangular to subrounded gravels with medium sand coarse sands	Made ground	
0.60-1.00m	Black sandy loam with ash, brick and brick with coarse white mortar fragments		
1.00-1.70m	Large brick fragments		
2.80m OD	**Base of borehole** *at 1.70m (bgl) (refusal)*		

Table 8 Window Sample 9

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528813.9823, 178054.8759		
m OD	Ground level adjacent to borehole		
0.00-1.00m	Brick fragments concreate , modern topsoil and tree roots	Remains of memorial garden and bombed out flats	7
1.00-2.60	Brick, mortar and concrete		
2.60-3.00m	Very compact very dark brown/ black sliglty silty fine and medium sand with a pottery fragment (20thC) and very small wood fragments		
3.00-3.80m	bricks and mortar		

3.80-4.00m	Very compact very dark brown/ black sliglty silty fine and medium sand		
0.50m OD	**Base of borehole** *at 4.00m (bgl)*		

Table 9 Window Sample 10

depth (m bgl) **level (m OD)**	**Lithological unit and characteristics**	**Preliminary interpretation**	FACIES
Location	528833.6841, 178032.1085		
4.50mOD	Ground level adjacent to borehole		
0.00-~1.70m	Hard black sandy silty loam with frequent mortar and brick fragments	Made ground	7
2.8m OD			
1.70-2.70m	Dark brown black clayey silt with rare fine sands and gravels very disturbed by drilling , poor recovery	Remnants of post medieval anthropogenic soil	6
1.8m OD			
2.70-3.54m	Yellowish brown sandy silt with bands of fine sand	C horizon of buried soil, formed in fluvial deposits.	5
0.96m OD			
3.54-4.42m	Light brownish yellow fine sand with laminations of darker sand, fine gravels and fine silts	Lateglacial fluvial deposits	4
0.08m Od			
4.42-5.00m	Light golden yellow coarse and medium sand with frequent fine medium subangular to subrounded gravels	Late Pleistocene cold arctic environment climate braided stream	2
minus0.50 m OD	**Base of borehole** *at 5.00m (bgl)*		

N.B Characteristics and interpretation of sediments from 1-3m is uncertain due to poor recovery

3.1 Discussion of the results

3.1.1 Deposit sequence

This section summarises the main characteristics of the deposits observed in the monitored interventions. In order to examine the archaeological potential of the site, the environments represented by the surviving deposits have been reconstructed and the main characteristics of the deposit sequence and distribution are illustrated in Figs 4 and 5. The sediments recorded in each intervention have been ascribed to a series of 'facies'. These facies group the sediments with similar stratigraphic position and characteristics (in terms of sediment type, the processes that led to their deposition and those that may have led to their post-depositional transformation) into site-wide deposits, recognised across the site as a whole. The characteristics of the different facies are listed in Table 10, below.

Facies	Lithological characteristics	Initial Interpretation
7	Tarmac, modern soil, construction and demolition debris – typically sandy clay with frequent building material	Modern make-up and levelling (made ground of little or no archaeological interest)
6	Dark brown/ black sandy silty clay with occasional post medieval brick fragments	Anthropogenic soil (man made soil, formed by inputs of nightsoil, ashy debris from housefires and other nutritional material for horticulture and market gardening)
5	Interbedded sands and clays which show evidence of pedagensis, bioturbation or other forms of reworking	Disturbed fluvial deposits (may represent C horizon of prehistoric and later soil profile)
4	Yellowish brown fine and medium sands interbedded with brown silts and calcareous silts	Lateglacial and early Holocene fluvial deposits – unweathered parent material of prehistoric and later soil.
3	Loose interbedded coarse and fine sands	Pleistocene arctic river deposits – discharge and river load decreased from facies 2
2	Thick beds of sands and gravels	Pleistocene arctic river deposits – with decreasing water flux, sediment load and seasonal flow
1	Gravelly coarse sands	Fast flowing Pleistocene arctic river deposits

Table 10: The site stratigraphy

Facies one consists of gravels and coarse sands, indicative of a high energy cold climate regime, probably representing the arctic River Thames, charged with meltwater following the Last Glacial Maximum. This river probably cut down and reworked whatever remained of the earlier floodplain, leaving remnants of Pleistocene gravel as 'islands' in the new floodplain.

Overlying this 'massive' (non bedded) sand and gravel deposit are interbedded sands and gravels (facies 2), which were also likely to have been deposited by the arctic river prior to downcutting in the late Quaternary. These changes in sediment between bands could indicate a seasonal change in energy of the river: increased flow during spring, when the river was swollen with meltwater and a lower energy environment in the winter, when water was locked up as ice. Facies 3 reflects increasingly stable conditions with finer sediment and much reduced water discharge. It comprises sands and occasional gravels.

Facies 4 is made up of fine and medium sands, which are interbedded with silts and calcareous silts. The absence of organic material in these deposits suggest a cold climate still pertained, with a seasonally variable flow rate. However, the deposit characteristics (including planar bedding) indicate the deposits lay on the bed of a fast flowing early Holocene river, which was possibly part of a meandering river system.

In Facies 5 the fluvial sands and silts have been reworked and disturbed by pedogenic (soil formation) processes such as bioturbation (earthworms and root channels). It may have formed the subsoil of the prehistoric soil.

Facies 6 represents a post-medieval soil horizon, suggesting some form of horticulture or market gardening. The facies consisted of a dark slightly sandy silt with very small inclusions of post-medieval pottery. The productivity of this soil may have been increased by the addition of fertilisers and night soil. The lower horizons of Facies 6 are paler and more clayey, suggesting traces of the earlier landsurface survive. Clay-filled root channels were observed extending downwards from this layer, suggesting they existed prior to the build up of man-made soil. (Root channels from the man-made soil that extended into the sub-soil were clearly filled with the black sooty, gritty soil material). The presence of a buried land surface indicates that this area was dry and stable enough to allow soil formation. (It is likely that a land surface developed in the sands and silts of facies 4 and 5 from prehistory onwards).

Facies 7 represents Victorian to modern ground levelling and other dumped deposits. It is thickest in the northern part of the site where it is in excess of 6m thick and here truncation has removed facies 2-6, although the base of the made ground was not proved.

3.1.2 Distribution of deposits

The site has been divided into two 'landscape zones' each with differing characteristics and archaeological potential (Figs 4 and 5).

Landscape Zone 1 is characterised by good preservation of Lateglacial / Early Holocene river deposits (interbedded sands) with soil formation / landsurface development sealed by a post medieval anthropogenic (man-made) soil.

Landscape Zone 2 consists of made ground related to the bombing and subsequent demolition of Blocks Y, K, L and M. The archaeological deposits have also been truncated by the construction of London Sewage Pipe Number One, a part of the system designed by Bazalgette in the 1860s.The pipe runs underneath where block X and K are/were situated. It was constructed within a trench and comprises a roughly 2.06m diameter brick sewer with an invert level (the level of the lowest portion of a pipe) of between 5.5 and 6.00m below ground level (GEA 2008).

Table 11 Deposit thicknesses and interpretations

Facies	Lithological characteristics	Initial Interpretation	**WS1**	**WS2**	**WS3**	**WS5**	**WS6**	**WS7**	**WS8**	**WS9**	**WS10**
		Location	528843 178022	528838, 178034	528832 178053	528822 178073	528819 178071	528830 178071	528838, 178067	528813, 178054	528833, 178032
		illustrated in transect (Fig 4)	yes	yes	yes	yes	yes	no	no	no	no
		ground level (m OD)	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**
7	Tarmac, modern soil, construction and demolition debris	Made ground (of little or no archaeological interest)	2.38m	1.84m	1.80m	3.70m	7.00m	3.00m	2.80m	4.00m	1.70m
6	Dark brown/ black sandy silty clay with occasional post medieval brick fragments	Anthropogenic soil	0.62m	0.16m	0.37m	none	none	none	none	none	1.00m
5	Sands and clays which show evidence of pedogenesis, bioturbation or other forms of reworking	Disturbed fluvial deposits (may represent C horizon of soil profile)	0.11m	0.50m	0.83m	none	none	none	none	none	0.84m
4	Yellowish brown sands interbedded with brown silts and white calcareous silts	Late Glacial and Holocene fluvial deposits	0.89m	1.10m	1.00m	none	none	none	none	none	0.88m
3	Loose interbedded coarse and fine sands	Late Glacial and Holocene fluvial deposits	0.43m	0.60m	none	none	none	none	none	none	None
2	Thick beds of sands and gravels	Pleistocene arctic river deposits	0.7m	1.40m	0.60m	none	none	none	none	none	0.58m
1	Gravelly coarse sands	Faster flowing Pleistocene arctic river deposits	proved at 6m bgl	proved at 7.00m bgl	proved at 7.00m bgl	not reached	not reached	not reached	not reached	not reached	not reached
	deposits of potential archaeological or palaeo-environmental interest										

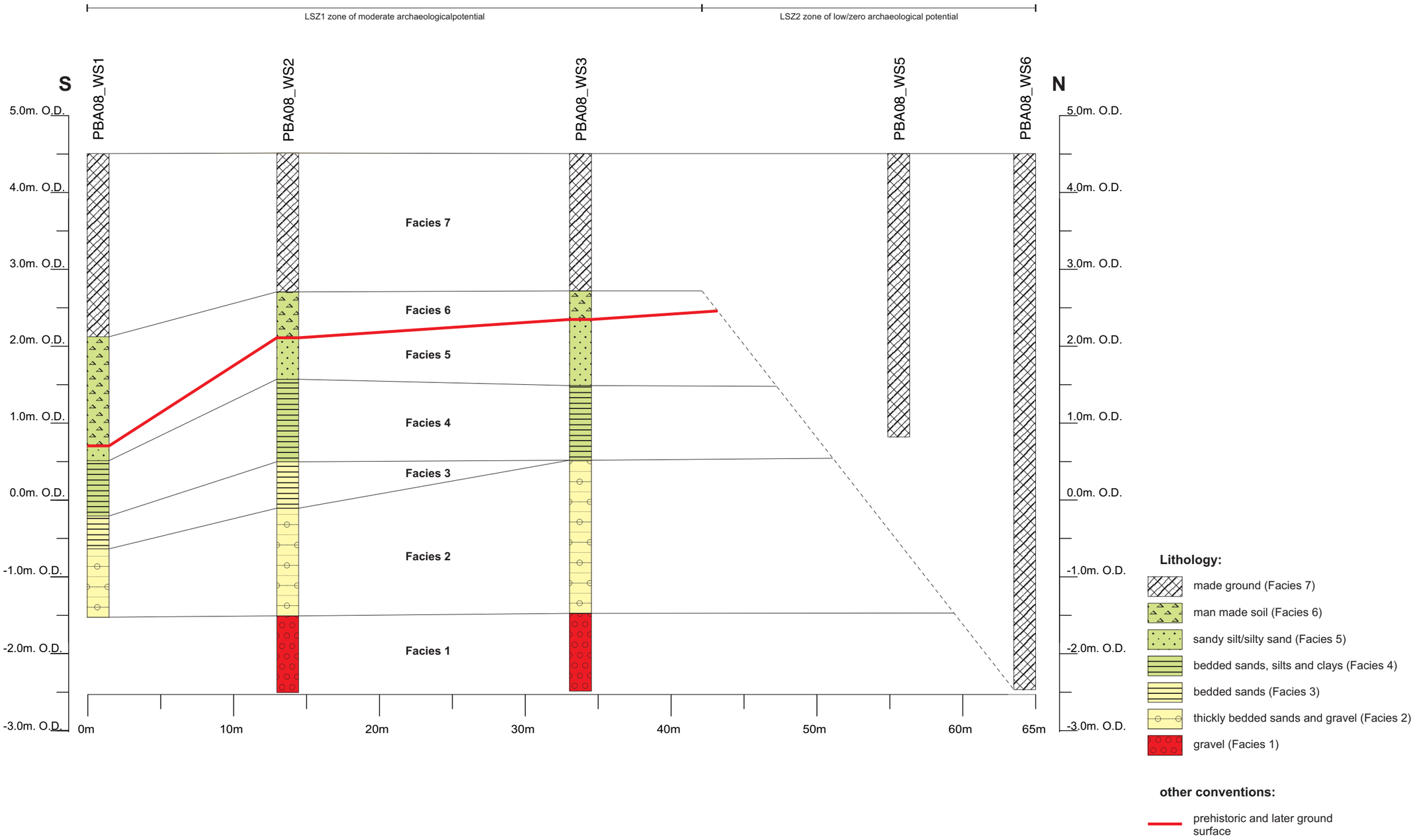

Fig 4 Transect across site from North to South

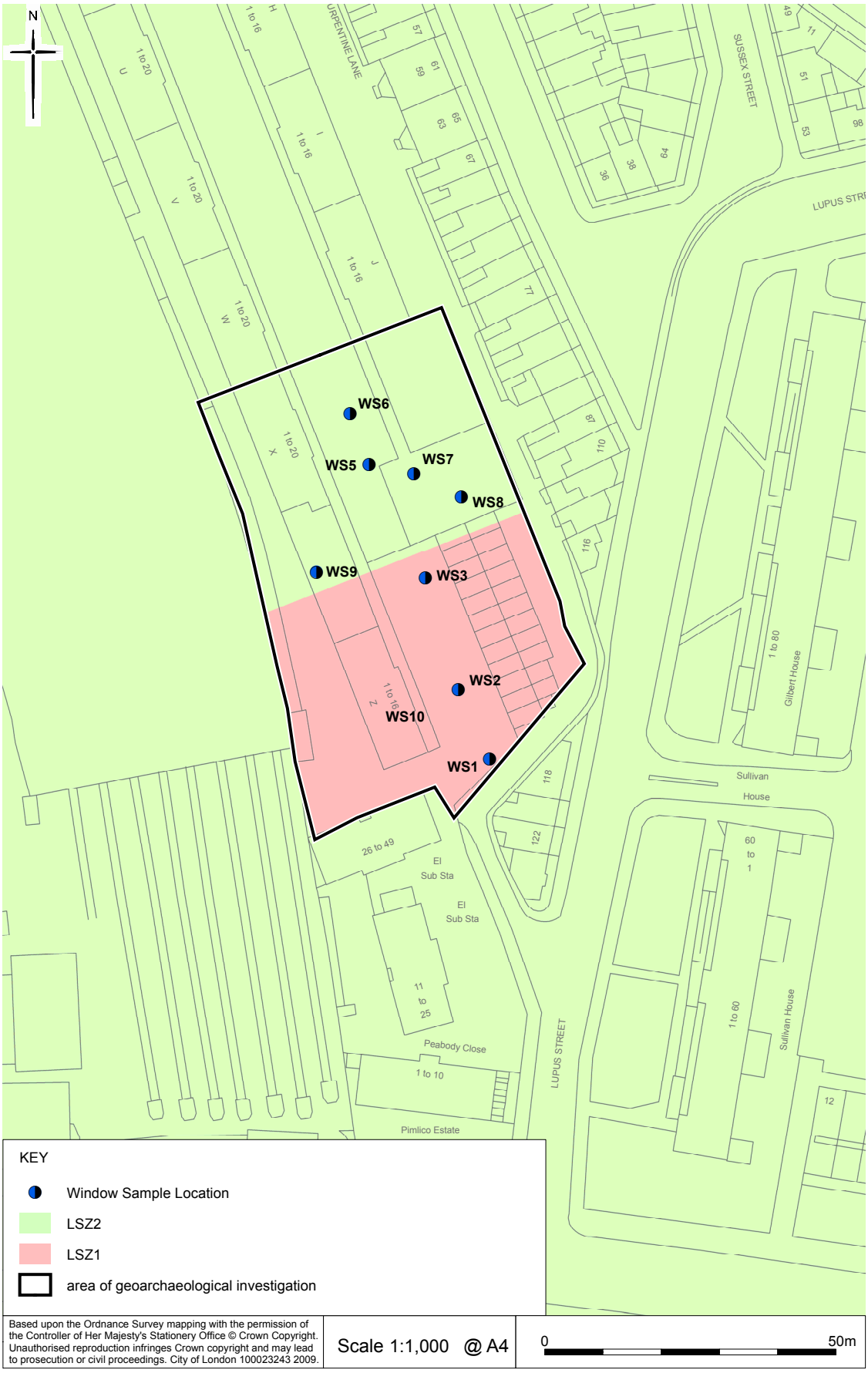

Fig 5 Landscape zones

4 Archaeological Potential

4.1 Summary of potential

Examination of the borehole cores has shown that the site can be divided into two areas, or 'landscape zones' (Fig 5). In the southern zone (LZ1) a buried landsurface was identified at the surface of fluvial sands, which were deposited by the River Thames in the Lateglacial or/and Early Holocene (Mesolithic). The sands are likely to have been banked up by the river against the gravel core of the Lupus Street Eyot and would have formed a dry landsurface from prehistory onwards. A post-medieval man-made (anthropogenic) soil built up above the former landsuface, suggesting horticulture or market gardening activities took place on the site. In the northern zone (LZ2) any Lateglacial and Holocene deposits that might once have existed have been truncated by recent activities.

The survival of deposits with archaeological potential in each of the boreholes is highlighted in Table 10.

The sandy texture and likely acidity of the sediments recorded, together with the likely history of soil formation and weathering identified in the cores, suggests that any form of calcareous proxy material such as molluscs and to some extent ostracods, pollen and diatoms would either not survive or be in a poor state of preservation within the deposits. In addition, no sediments suitable for the preservation of plant macro-remains, insects or chriominids were uncovered during the investigation. Furthermore, as a result of the coarse nature of the sands uncovered they were considered unsuitable for OSL dating; and no organic materials were uncovered from the interventions thus ruling out the possibility of radiocarbon dating.

Although no further work on the samples obtained is proposed, the information gathered from the boreholes has been added to the MOLA Geoarchaeology RockWorks database of the buried stratigraphy of Westminster. As a result it has been able to refine our understanding of the extent and characteristics of the Lupus Street Eyot.

4.2 Significance of the data

The results of the investigation are of local significance, since they have contributed to our understanding of the past topography of the local area and especially the relationship of the floodplain with the western edge of the Lupus Street Eyot which was previously lacking data. The results have also helped to map the truncation of the archaeological resource by recent industrial land use.

5 Recommendations

The geoarchaeological investigation at the site has provided an opportunity to record the floodplain deposits in an area currently not well understood. Although the results obtained from the site are not suitable for further analysis, they have provided information about the extent and characteristics of the Lupus Street Eyot which was previously unknown.

The results of the survey have been added to the MOLA Geoarchaeology Westminster deposit model and will therefore continue to contribute to our understanding of the past archaeology and environmental history of the area, as the model is developed.

6 Acknowledgements

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8 OASIS ID: molas1-62865

Project details

Project name	Peabody Avenue, Pimlico
Short description of the project	9 Window Samples were mointored prior to the development of a new residential housing on Peabody Avenue. The site lies between the edge of the lower lying (paleo-channel) part of the flood plain and the Lupus Street eyot. In the northern area of the site massive truncation had occurred due to bomb damage and Victorian sewer construction. In the southern area of the site a post medieval (and possibly earlier) soil or landsurface was buried underneath made ground, this seems to suggest on site horticulture or garden agriculture. Bellow that is evidence of changing fluvial regimes in the Late Pleistocene and Early Holocene. This suggests that the Lupus Street eyot extends further west than previously thought.
Project dates	Start: 29-06-2009 End: 02-07-2009
Previous/future work	Yes / Not known
Any associated project reference codes	PBA08 - Sitecode
Type of project	Field evaluation
Site status	Conservation Area
Current Land use	Residential 1 - General Residential
Methods & techniques	'Augering'
Development type	Housing estate
Prompt	Direction from Local Planning Authority - PPG16
Position in the planning process	After full determination (eg. As a condition)

Project location

Country	England
Site location	GREATER LONDON CITY OF WESTMINSTER WESTMINSTER Peabody Avenue, Pimlico
Study area	2700.00 Square metres
Site coordinates	TQ 28820 78070 51.4863897065 -0.144445559210 51 29 11 N 000 08 40 W Point

Project creators

Name of Organisation	MoL Archaeology
Project brief originator	Greater London Archaeology Advisory Service
Project design originator	MoL Archaeology
Project director/manager	Gordon Malcolm
Project supervisor	Jason Stewart
Type of sponsor/funding body	Private developer
Name of sponsor/funding body	Peabody Trust

Project archives

Physical Archive Exists?	No
Digital Archive recipient	LAARC
Digital Media available	'Database','GIS'

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Peabody Avenue, Pimlico; A report on the geoarchaeological evaluation
Author(s)/Editor(s)	Stewart, J
Date	2009
Issuer or publisher	MoL Archaeology
Place of issue or publication	MoL Archaeolgy
Description	A4 ring bound
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