LAND AT 40-42 PONTON ROAD, NINE ELMS, LONDON BOROUGH OF WANDSWORTH (SITE CODE: PON15): GEOARCHAEOLOGICAL FIELDWORK AND DEPOSIT MODEL REPORT

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INTRODUCTION

This report summarises the findings arising out of the geoarchaeological fieldwork and deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of land at 40-42 Ponton Road, Nine Elms, London Borough of Wandsworth (Site Code: PON15; National Grid Reference: *centred on* TQ 297 774; Figure 1). Quaternary Scientific were commissioned by CgMs Consulting to undertake the geoarchaeological investigations. The site is located on the floodplain of the River Thames, approximately 200m from the modern waterfront (Figure 1). The site is mapped by the British Geological Society (BGS) as lying towards the main axis of a substantial former channel, where the superficial geology is recorded as alluvium overlying London Clay bedrock (1:50,000 Sheet 270 South London 1998). Previous geoarchaeological investigations to the west and southwest of the site (Dawson *et al*., 2009; Morley, 2009; Corcoran *et al*., 2007; Branch *et al*., 2010) have revealed that a number of channels, bisecting areas of higher gravel 'islands' (eyots), existed in the Battersea area during the Late Devensian/early Holocene. The same channel on which the site is thought to lie has been identified to the southwest (Morley, 2009) as the Battersea Channel, a subsidiary channel of the Thames that at this location is aligned approximately SW-NE. Recent investigations (Morley, 2009) indicate that the channel was active until at least the early Holocene, the main channel accommodating a network of smaller channels, within which a sequence of Shepperton Gravel, Alluvium and Peat (radiocarbon dated to the Mesolithic period) accumulated. By the Roman period the Battersea Channel had been reduced to a narrow creek, due to a combination of climate alterations, changes in sea level and the impacts of human intervention (Morley, 2009).

At the Wandsworth Road and Pascal Street site (Sainsbury's Nine Elms; Young *et al*., 2013), *ca*. 100m to the east of 40-42 Ponton Road, a channel was identified in the eastern area of the site, aligned approximately southwest-northeast and which may have formed part of the Battersea Channel, either as a tributary joining the main channel from the southeast, or as part of a network of channels on the floor of the Battersea Channel itself. Within this channel the Shepperton Gravel surface was recorded at between *ca*. -2.5 and -3.0m OD, consistent

with investigations at the 120-146 Stewarts Road site (Figure 1; Morley, 2009), where a channel was identified within which the Gravel surface was recorded at between *ca*. -2.8 and -3.0m OD.

At the Wandsworth Road and Pascal Street site the gravel was overlain by Alluvium, in places containing Peat. Where Peat was recorded is was present between *ca*. -1.0 and 0.5m OD, and was between 0.10 and 0.60m thick. Radiocarbon dating of the Peat horizon here demonstrated that accumulation commenced during the Middle Bronze Age (3460 to 3360 cal BP), and that cessation occurred during the Late Bronze Age/Early Iron Age (3150-2930 cal BP). During the accumulation of the Peat, the pollen and seed remains were indicative of an alder carr dominated environment on the Peat surface, with mixed deciduous woodland on the dryland. No definitive evidence for human activity was recorded within the Peat; however, a possible decline in lime woodland may be associated with human activity. Significantly, the Peat horizon at the Wandsworth Road and Pascal Street site is later, and is recorded at a higher elevation than those at the Stewarts Road and Battersea Power Station sites. At 120-146 Stewarts Road (Morley, 2009) Peat was recorded between *ca*. -1.25 and -1.75m OD. The upper part of this horizon was subsequently radiocarbon dated to 7670-7510 cal BP (the Mesolithic cultural period). At the Battersea Power Station (Branch *et al*., 2010) Peat horizons radiocarbon dated to the Middle Neolithic (5320 to 4960 cal BP) and Middle Bronze Age (4000 to 3690 cal BP) were identified at -2.09 to -2.16 and -1.52 to -1.56m OD respectively. Relatively few palaeobotanical records are available for this part of the Middle Thames Valley; however, at the Battersea Power Station site the presence of mixed coniferous/deciduous woodland is indicated during the Late Mesolithic and Early Neolithic, with evidence for woodland clearance and cultivation at some point during the Late Mesolithic/Early Neolithic transition (Branch *et al*., 2010). During the Middle Neolithic and through to the Early Bronze Age open, mixed oak and lime woodland is indicated on the dryland, with alder and willow on the wetland surface with evidence for periods of cultivation on the dryland (Branch *et al*., 2010).

The aim of the geoarchaeological investigations at the site was to (1) clarify the nature of the sub-surface stratigraphy, in particular the presence and thickness of Alluvium (including Peat) across the site, and (2) to evaluate the potential of the sedimentary sequences for reconstructing the environmental history of the site and its environs. In order to achieve this aim, three selected geotechnical boreholes at the site were monitored by Quaternary Scientific.

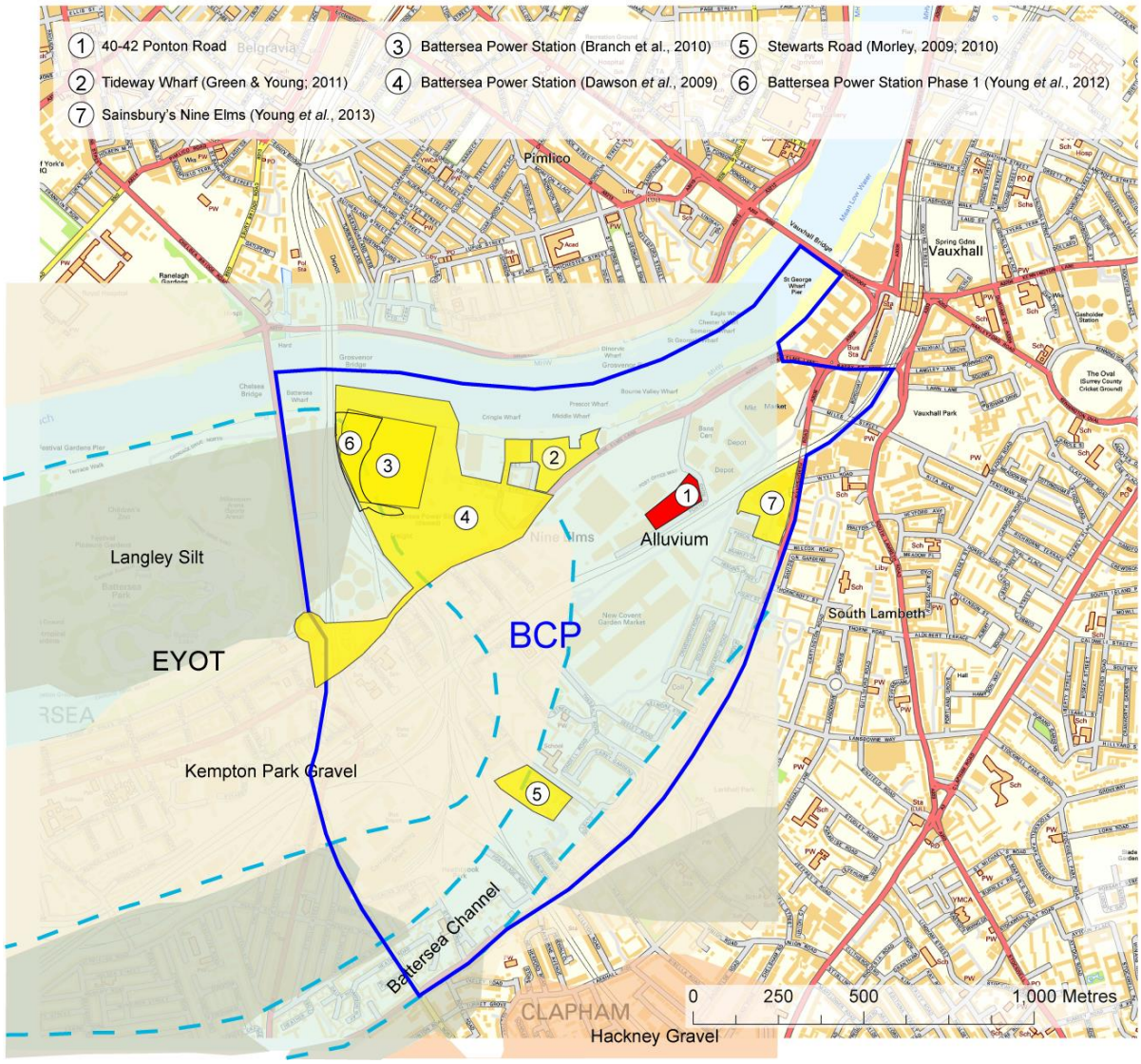

Figure 1: Location of (1) 40-42 Ponton Road, Nine Elms, London Borough of Wandsworth (Site Code: PON15) and other geoarchaeological investigations [(2) to (7)] within the area of the Battersea Channel Project (BCP; blue outline). Superficial geology is shown as mapped by the British Geological Survey, Dawson *et al*. (2009) and Corcoran *et al*. (2007). *Contains Ordnance Survey data © Crown copyright and database right [2012]*

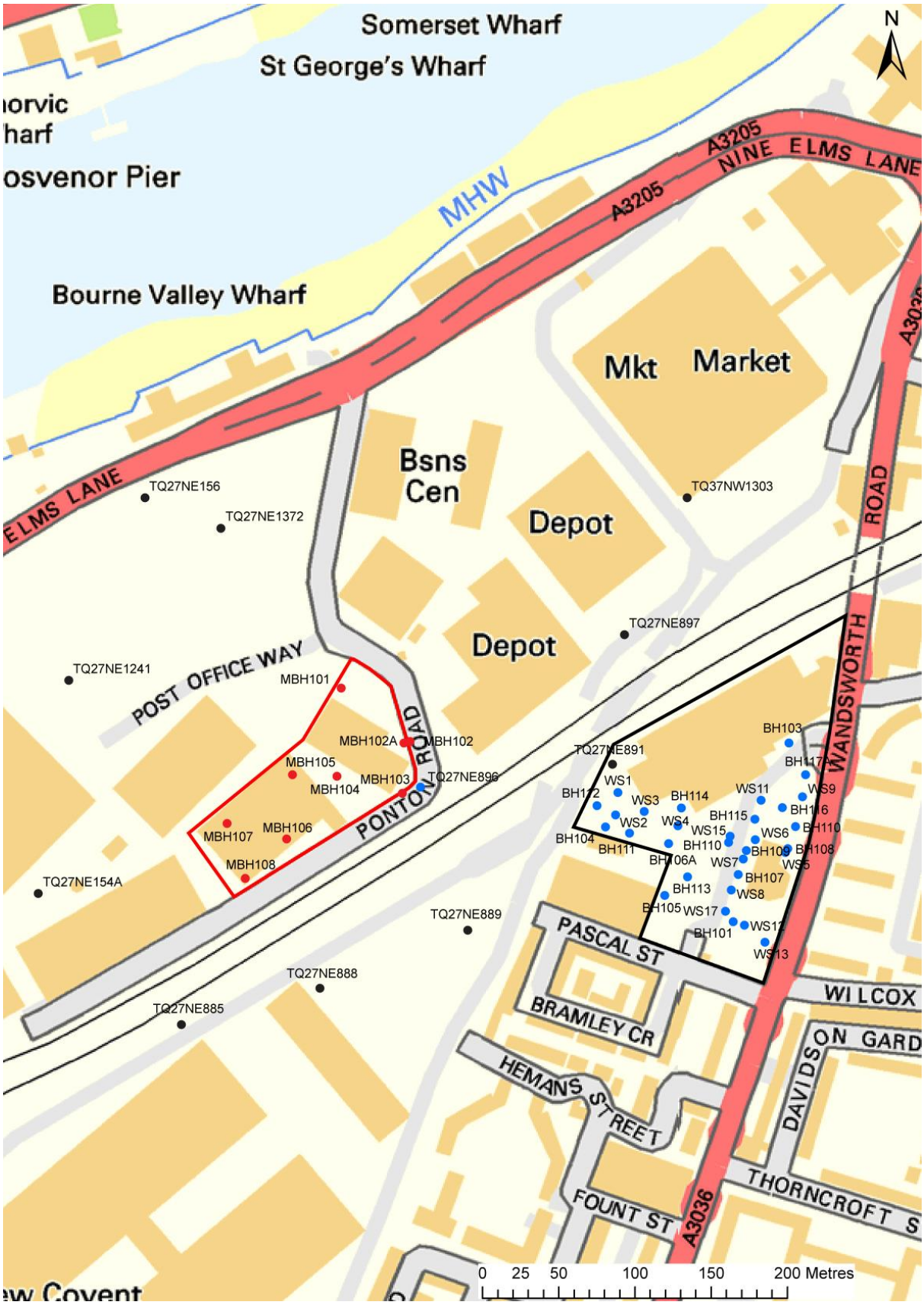

Figure 2: Detailed site map incorporating the location of the new geotechnical boreholes at 40-42 Ponton Road (red), existing BGS borehole records (black) and geotechnical boreholes at Wandsworth Road and Pascal Street (blue; Young *et al.*, 2013). *Contains Ordnance Survey data © Crown copyright and database right [2012]*

METHODS

Field investigations

Nine geotechnical boreholes were put down at the site by Merebrook Consulting using either a rotary rig (boreholes MBH101 to MBH105) or cable percussion (MBH106 to MBH08). Of these, the three cable percussion boreholes were monitored by Quaternary Scientific. The lithostratigraphy of these boreholes was described using standard procedures for recording unconsolidated sediment and organic sediments, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts) (Tröels-Smith, 1955). The procedure involved: (1) examining grab samples from the geotechnical boreholes where possible; (2) recording the physical properties, most notably colour using a Munsell Soil Colour Chart; (3) recording the composition; gravel (Grana glareosa; Gg), fine sand (Grana arenosa; Ga), silt (Argilla granosa; Ag) and clay (Argilla steatoides); (4) recording the degree of peat humification and (5) recording the unit boundaries e.g. sharp or diffuse. The spatial attributes of each borehole are shown in Table 1 and in Figure 2 along with other boreholes used in the deposit model, including those from Wandsworth Road & Pascal Street (Young *et al*., 2013) and BGS archive boreholes.

Table 1: Borehole attributes for those records used in the deposit model, 40-42 Ponton Road, Nine Elms, London Borough of Wandsworth.

Borehole	Easting	Northing	Elevation (m OD)
Geotechnical boreholes (Merebrook Consulting; present investigation)			
MBH101	529779	177495	4.77
MBH102	529824	177460	4.66
MBH102A	529820	177459	4.66
MBH103	529831	177430	4.84
MBH104	529776	177437	5.20
MBH105	529747	177438	5.20
MBH106	529743	177396	5.20
MBH107	529704	177406	5.20
MBH108	529716	177370	5.20
Geotechnical boreholes from Wandsworth Road & Pascal Street (Young et al*., 2013)*			
WS1	529960.442	177426.502	2.91
WS2	529959.041	177411.763	2.87
WS3	529977.790	177414.054	2.78
WS4	529999.926	177404.609	2.76
WS5	530070.602	177387.014	3.00
WS6	530050.651	177395.361	2.88
WS7	530042.976	177382.769	2.96
WS8	530034.951	177362.428	2.91
WS9	530081.688	177423.532	2.98
WS10	530077.173	177404.102	2.85
WS11	530054.584	177421.375	2.76
WS12	530043.669	177339.337	3.07

WS13	530056.987	177328.160	3.17
WS15	530034.192	177397.605	2.87
WS17	530031.207	177348.430	2.94
BH101	530036.272	177341.689	2.93
BH103	530072.980	177458.854	2.74
BH104	529952.360	177403.905	2.94
BH105	529991.379	177358.931	2.73
BH106A	529993.812	177392.881	2.87
BH107	530039.469	177372.683	3.00
BH108	530072.039	177389.653	2.99
BH109	530044.882	177388.406	2.93
BH110	530033.192	177393.592	2.92
BH111	529968.212	177399.789	2.92
BH112	529946.870	177417.745	2.90
BH113	530006.246	177371.131	2.71
BH114	530002.192	177416.146	2.82
BH115	530050.519	177408.961	2.82
BH116	530068.428	177416.517	2.87
BH117A	530083.781	177438.251	2.96
BGS borehole records			
TQ27NE897	529965.000	177530.000	4.27
TQ27NE891	529957.000	177445.000	2.59
TQ27NE896	529819.000	177426.000	4.88
TQ27NE889	529862.000	177336.000	2.59
TQ37NW1303	530006.000	177620.000	3.96
TQ27NE1372	529700	177600	3.90
TQ27NE1241	529600	177500	3.16
TQ27NE156	529650	177620	3.66
TQ27NE888	529765	177298	2.74
TQ27NE885	529674	177274	3.96

Deposit modelling

The deposit model was based on a review of 50 borehole records, incorporating the nine new geotechnical boreholes, ten BGS archive boreholes and 31 geotechnical borehole records form the neighbouring Wandsworth Road & Pascal Street site (Young *et al*., 2013; see Figure 2).

Sedimentary units from the boreholes were classified into four groupings: (1) Gravel; (2) Peat; (3) Alluvium, and (4) Made Ground. The classified data for groups 1-4 were then input into a database with the RockWorks 16 geological utilities software. Models of surface height (using a nearest neighbour routine) were generated for the Gravel and Alluvium (Figures 3 and 4), with thickness models for the Alluvium, Peat and Made Ground (Figures 5 to 7) (also using a nearest neighbour routine). Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models generated using RockWorks is variable. In general, reliability improves from outlying areas where the models are largely supported by scattered archival records towards the core area of commissioned boreholes. Because of

the 'smoothing' effect of the modelling procedure, the modelled levels of stratigraphic contacts may differ slightly from the levels recorded in borehole logs.

In addition, the reliability of individual models is affected by the quality of the stratigraphic records which in turn are affected by the nature of the sediments and/or their post-depositional disturbance during previous stages of development on the site. As a consequence of this the modelling procedure has been manually adjusted so that only those areas for which sufficient stratigraphic data is present will be modelled. In order to achieve this, a maximum distance cut-off filter equivalent to a 100m radius around each borehole is applied to all deposit models except the Peat, where a maximum distance cut-off filter equivalent to a 50m radius is applied, since these horizons are present in only a limited number of boreholes. In addition, it is important to recognise that at least three sets of boreholes are represented, put down at different times and recorded using different descriptive terms and subject to differing technical constraints in terms of recorded detail including the exact levels of the stratigraphic boundaries. Of the records used in the deposit model, the cores from the boreholes observed by Quaternary Scientific represent the most detailed record of the sediment sequences.

RESULTS AND INTERPRETATION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS AND DEPOSIT MODELLING

The results of the geoarchaeological investigations (Tables 2 to 4) have permitted a programme of deposit modelling of the surface elevation and thickness of each major stratigraphic unit recorded at the site (Figures 3 to 7).

The basal unit at the site is a horizon of sand and gravel, the surface of which generally lies at between 1.2 (MBH104 and MBH105) and 1.7m OD (MBH10106 and MBH108) (Figure 3). There is an indication in the borehole records that the surface of the sand and gravel is slightly higher in the southern area of the site, lying at between 1.4 and 1.7m OD in boreholes MBH106 to MBH108, falling towards the north to between 1.27 and 1.46m OD in boreholes MBH101, MBH102, MBH104 and MBH105. The Gravel surface is recorded at its lowest (0.34m OD) in borehole MBH103, in the northeastern area of the site.

Given the elevation of the surface of this horizon across the site it is considered to equate to the Kempton Park Gravel of Gibbard (1985). These sediments were most likely deposited during the Early or Middle Devensian (*ca*. 30-120,000 years BP) within a high energy braided river system, either (1) forming a north-easterly extension of the eyot (referred to

previously as the Battersea Eyot; Morley, 2009) that is mapped to the southwest, or (2) representing a separate gravel high (eyot) in this area. In the area of the wider deposit model the Gravel surface falls towards the east to below -2.5m OD in the eastern part of the Wandsworth Road & Pascal Street site (Young *et al*., 2013). Elsewhere, the Gravel surface falls towards the northwest and northeast to below -1.5m OD, and to the southeast of the site to below 0.0m OD.

The Gravel is overlain across the site by a horizon of generally sandy and in places gravelly silty clay or clayey silt Alluvium. The surface of this unit is highly variable across the site (Figure 4), lying at between 3.66 (MBH102/MBH102A) and 0.54m OD (MBH103) (average = 2.3m OD). As a result the thickness of this unit is also highly variable, recorded at between 0.2 (boreholes MBH101, MBH103, MBH106 and MBH108) and 2.2m thick (MBH102 and MBH102A) (Figure 5). These coarse-grained mineral-rich deposits are typical of deposition within a fluvial environment, including fine-grained sediments (clay and silt) that would have been deposited from a suspended sediment load. There is no indication within the Alluvium of any Peat or organic horizons such as that recorded at the Wandsworth Road & Pascal Street site (Young *et al*., 2013), where thicknesses generally up to 0.6m were recorded (Figure 6).

The Alluvium is overlain across the site by between 4.3 (MBH103) and 1m (MBH102/102A) of Made Ground (Figure 7). The thickness of Alluvium surviving at the site appears to reflect the variable extent of truncation by Made Ground rather than the underlying natural topography; in all boreholes there is a negative relationship between the thickness of the Made Ground and thickness of the Alluvium. The modern surface of the site is relatively even at between 3.2 and 4.5m OD.

Table 2: Geotechnical and geoarchaeological description of borehole MBH106, 40-42 Ponton Road, Nine Elms, London Borough of Wandsworth (Site Code: PON15

Depth (m bgs)		Depth (m OD)		Geotechnical description	Additional Geoarchaeological description (m bgs)	Stratigraphic interpretation
Top	**Base**	**Top**	**Base**			
0.00	0.30	5.20	4.90	Concrete	*Concrete*	MADE GROUND
0.30	3.30	4.90	1.90	Sand/sandy gravel/silty sand/sandy clay with brick and concrete fragments	*Made Ground of sand/sandy gravel/ashy fill with clinker, brick and shell (oyster)*	
3.30	3.50	1.90	1.70	Silty sandy clay with occasional gravel	*As2 Ag1 Gg1; brown silty gravelly clay.*	ALLUVIUM
3.50	3.60	1.70	1.60	Clayey gravel		
3.60	7.50	1.60	-2.30	Sandy gravel; angular to sub-angular	*Gg3 Ga1; sandy gravel. Flint clasts up to 60mm in diameter, sub-angular to well-rounded.*	KEMPTON PARK GRAVEL

Table 3: Geotechnical and geoarchaeological description of borehole MBH107, 40-42 Ponton Road, Nine Elms, London Borough of Wandsworth (Site Code: PON15

Depth (m bgs)		Depth (m OD)		Geotechnical description	Additional Geoarchaeological description (m bgs)	Stratigraphic interpretation
Top	**Base**	**Top**	**Base**			
0.00	0.30	5.20	4.90	Concrete	*Concrete*	MADE GROUND
0.30	1.60	4.90	3.60	Sand, concrete and gravel fill/silty gravelly clay with brick fragments	*Made Ground of sand/sandy gravel/silty sand with frequent brick fragments*	
1.60	1.70	3.60	3.50		*As3 Ag1 Gg+; brown silty clay with occasional gravel clasts*	
1.70	2.00	3.50	3.20	Slightly sandy slightly gravelly clay	*As3 Ag1; brown silty clay*	ALLUVIUM
2.00	3.30	3.20	1.90		*As3 Ag1 Gg+; brown silty clay with occasional gravel clasts*	
3.30	3.50	1.90	1.70	Slightly sandy, clayey silt with occasional shell fragments and gravel	*Ag2 As2; dark grey silt and clay with occasional Mollusca.*	
3.50	3.80	1.70	1.40	Sandy clay with occasional gravel	*Ag2 As2; grey silt and clay. Some iron staining.*	
3.80	4.00	1.40	1.20	Slightly sandy clayey gravel; angular to sub-rounded	*As2 Ag1 Gg1; orange silty gravelly clay. Some iron staining.*	
4.00	7.70	1.20	-2.50	Sandy gravel; angular to sub-angular	*Gg3 Ga1 Ag+; orange sandy gravel with a*	KEMPTON PARK

					trace of silt. Flint clasts up to 60mm in diameter; sub-angular to well-rounded.	GRAVEL

Table 4: Geotechnical and geoarchaeological description of borehole MBH108, 40-42 Ponton Road, Nine Elms, London Borough of Wandsworth (Site Code: PON15

Depth (m bgs)		**Depth (m OD)**		**Geotechnical description**	**Additional Geoarchaeological description (m bgs)**	**Stratigraphic interpretation**
Top	**Base**	**Top**	**Base**			
0.00	0.30	5.20	4.90	Concrete	*Concrete*	MADE GROUND
0.30	2.50	4.90	2.70	Sand, concrete and gravel fill/gravelly silty sand with lenses of clay/gravelly clayey sand with frequent brick inclusions	*Made Ground of ashy fill, brick, sand and mortar*	
2.50	3.20	2.70	2.00		*As3 Ag1; brown silty clay with frequent brick and mortar inclusions (Reworked alluvium)*	
3.20	3.30	2.00	1.90		*As2 Ag1 Ga1 Gg+; orange silty sandy clay with occasional gravel clasts*	ALLUVIUM
3.30	3.40	1.90	1.80	Gravelly clayey silty sand with frequent lenses of sand/wood and organics		
3.40	3.50	1.80	1.70		*As2 Ag1 Gg1 Ga+; dark orange silty gravelly clay with a trace of sand. Flint clasts with occasional chalk clasts, up to 40mm in diameter; sub-angular to sub-rounded*	
3.50	4.00	1.70	1.20	Slightly sandy clayey gravel	*Gg3 As1; reddish orange clayey gravel. Flint clasts up to 50mm in diameter, sub-angular to well-rounded.*	KEMPTON PARK GRAVEL
4.00	7.40	1.20	-2.20	Sandy gravel; angular to sub-angular		

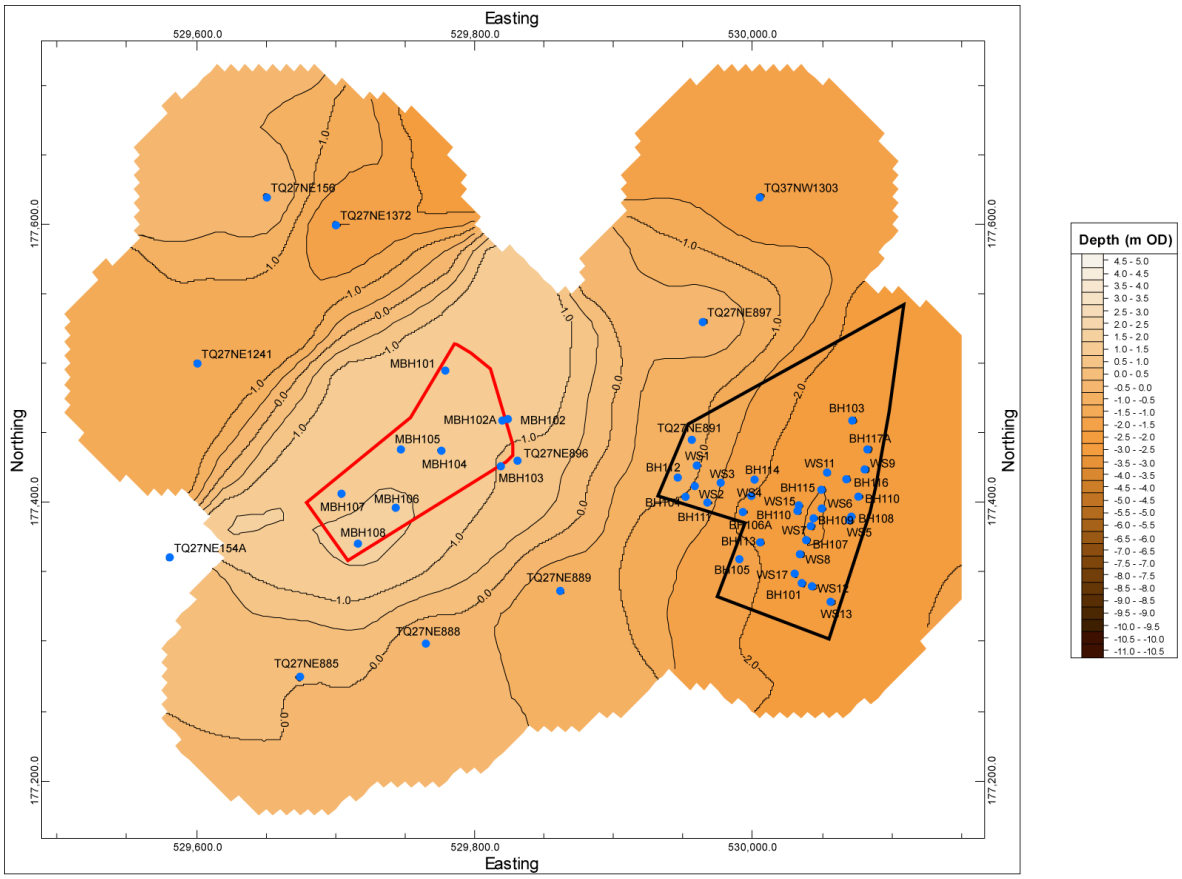

Figure 3: Top of the Gravel (m OD)

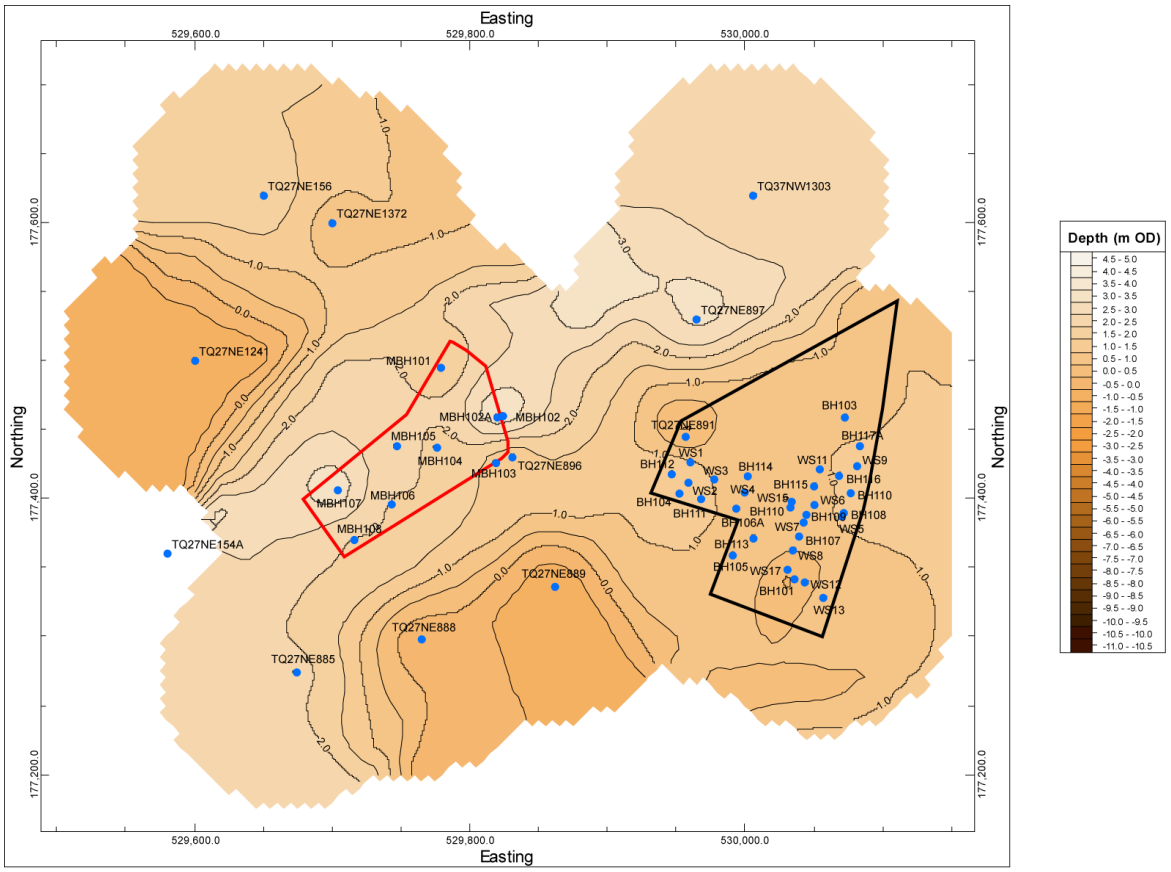

Figure 4: Top of the Alluvium / Base of the Made Ground (m OD)

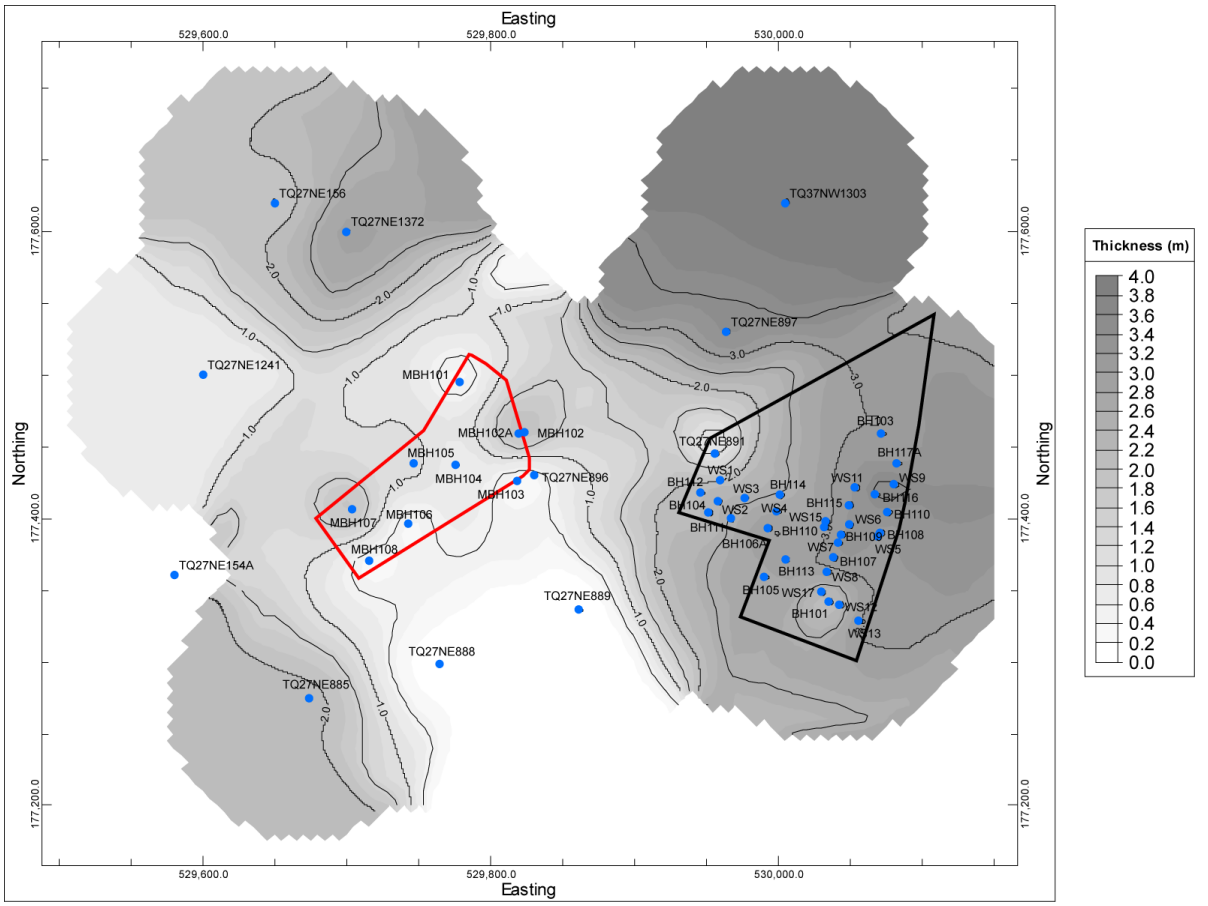

Figure 5: Thickness of the Alluvium (m)

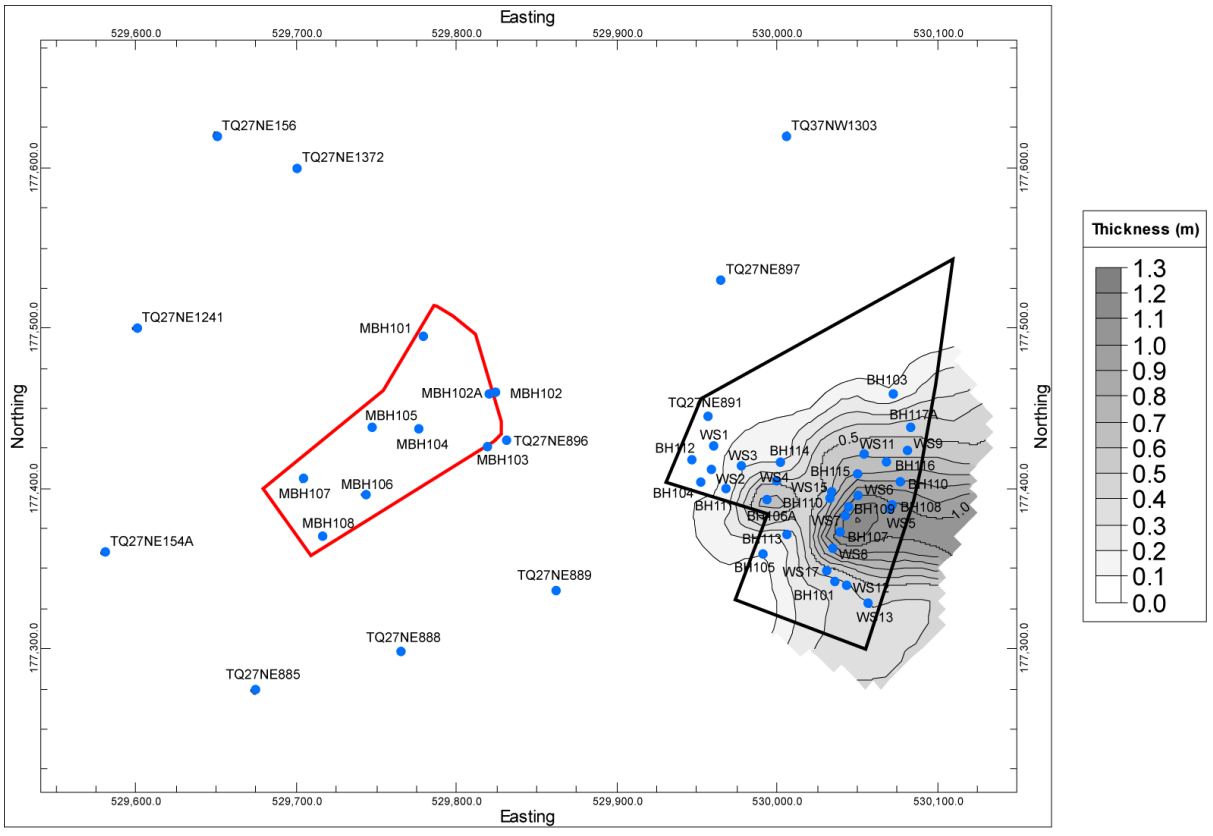

Figure 4: Thickness of the Peat (m)

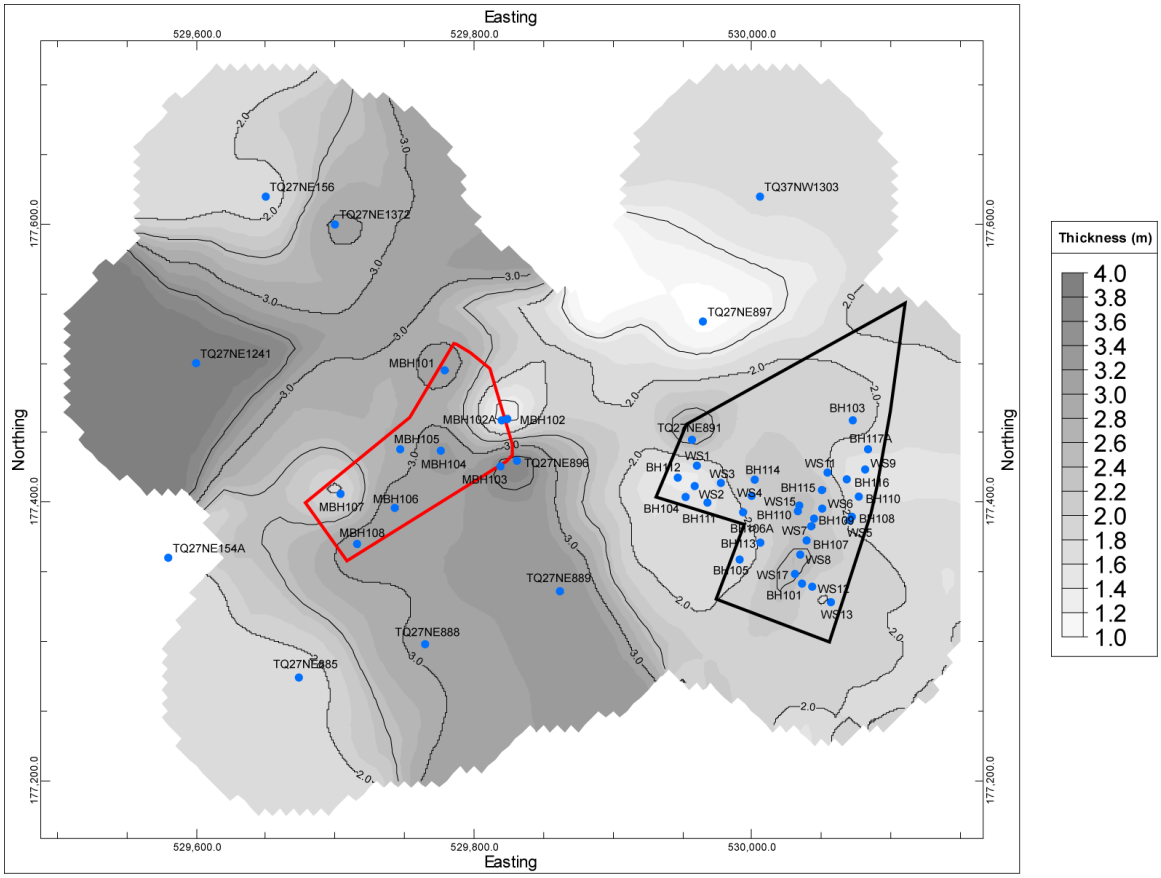

Figure 7: Thickness of the Made Ground (m)

DISCUSSION AND CONCLUSIONS

The aim of the geoarchaeological investigations at the 40-42 Ponton Road site was to (1) clarify the nature of the sub-surface stratigraphy, in particular the presence and thickness of Alluvium and Peat across the site, and (2) to evaluate the potential of the sedimentary sequences for reconstructing the environmental history of the site and its environs. In order to achieve this aim, a programme of deposit modelling of the surface elevation and thickness of the major stratigraphic units at the site was carried out, incorporating geotechnical borehole descriptions and records from those boreholes monitored in the field.

Previous geoarchaeological investigations in the Battersea area (Dawson *et al*., 2009; Morley, 2009; Corcoran *et al*., 2007; Branch *et al*., 2010) have revealed that a number of channels, bisecting areas of higher gravel 'islands' (eyots), existed in the Battersea area during the Late Devensian/early Holocene. The existing models for this area indicate that the 40-42 Ponton Road site lies within the area of low-lying Late Devensian/early Holocene topography identified as the Battersea Channel. However, the results of the deposit modelling indicate that the Gravel surface in the area of the site generally lies at between 1.2 and 1.7m OD, with a surface in one borehole towards the northeastern area of the site of 0.34m OD. Given the elevation and nature of the Gravel it is interpreted as the Kempton Park Gravel of Gibbard (1985), representing either a north-easterly extension of the eyot recorded to the southwest or a separate gravel high (eyot) in this area. Similar Gravel surfaces of between 1 and 2m OD were recorded towards the centre and south of the Tideway Wharf site (Green & Young, 2011) *ca*. 300m to the west (Figure 1); here the Gravel surfaces fell towards the northeast and northwest to between -1 and -2m OD and in places to below -3m OD. The area of higher Gravel recorded here was considered to represent the eastern end of the more southerly of the two gravel eyots underlying the Battersea area (Green & Young, 2011).

In the wider area of the present deposit model the Gravel surface falls to below 0m OD to the southeast, below -1.5m OD towards the northwest and northeast, and to below -2.5m OD in the eastern part of the Wandsworth Road & Pascal Street site, where the Gravel is probably equivalent to the Shepperton Gravel of Gibbard (1985), deposited during the Late Devensian (*ca*. 10-15,000 years BP) in a channel that at this time was either part of or was tributary to the Battersea Channel (Young *et al*., 2013).

Within the mapped area of the Battersea Channel *ca*. 1km to the south at the 120-146 Stewarts Road site (Figure 1; Morley, 2009), the Gravel surface was recorded at between *ca*.

-2.8 and -3.0m OD, whilst at the Battersea Power Station site (Dawson *et al*., 2009; Branch *et al*., 2010), west of the present site and within what is thought to be a separate subsidiary channel, the Shepperton Gravel surface was recorded at between *ca*. -2.0 and -3.0m OD. South of Battersea Power Station, beyond the margins of the smaller subsidiary channel identified here the Gravel surface rises to between *ca*. -1.0 and 2.0m OD on the surface of the eyot to the south (Dawson *et al*., 2009).

At the 40-42 Ponton Road site the Gravel is overlain by variable thicknesses (0.2-2.2m) of generally coarse-grained, mineral-rich Alluvium, typical of deposition within a fluvial environment. The surface of this unit is highly variable across the site, lying at between 3.66 and 0.54m OD (average = 2.3m OD), most likely as a result of variable extents of truncation by the overlying Made Ground (present in thicknesses of between 1 and 4.3m). In the tidal reaches of the Thames, the upper part of the Alluvium represents evidence of the combined effects of rising sea level, leading to regular estuarine flooding, and an increase in sediment supply produced by soil erosion associated with the intensification of land-use from the Neolithic period onward. The overall effect of Holocene floodplain sedimentation has been to bury progressively the uneven surface of the Shepperton Gravel, and in places the Kempton Park Gravel. There is no evidence within the Alluvium at the 40-42 Ponton Road site for any Peat or organic horizons such as those recorded at the Wandsworth Road and Pascal Street (Young *et al*., 2013), 120-146 Stewarts Road (Morley, 2009) or Battersea Power Station (Branch *et al*., 2010) sites.

RECOMMENDATIONS

In the absence of any Peat or organic horizons in the boreholes at the 40-42 Ponton Road site no further geoarchaeological or environmental archaeological investigations are recommended. From an archaeological perspective, it is of note that the Gravel high recorded in the area of the site would have represented an area of higher, drier ground above the level of the surrounding floodplain that might have been an attractive area of land for Prehistoric societies.

ACKNOWLEDGEMENTS

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