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INTRODUCTION

This report summarises the findings arising out of the geoarchaeological deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at Vauxhall Cross, London Borough of Lambeth (National Grid Reference: centred on TQ 30270 77870; site code: VXX14; Figure 1). Quaternary Scientific were commissioned by RPS Planning and Development to undertake the geoarchaeological investigation. The site is located on the southern bank of the River Thames floodplain, approximately 150m from the modern waterfront (Figure 1). The site is mapped by the British Geological Society (BGS) as lying on Kempton Park Gravels resting on London Clay bedrock (1:50,000 Sheet 270 South London 1998). No boreholes have been put down on the site itself, but previous boreholes immediately to the west along Wandsworth Road indicate a sequence of Made Ground and possibly a thin layer of inorganic coarse-grained alluvium overlying Kempton Park Gravel.

However, previous geoarchaeological investigations to the west and southwest of the site (Dawson *et al*., 2009; Morley, 2009/2010; Corcoran *et al*., 2007; Branch *et al*., 2010; Young *et al*., 2012; Young & Green, 2013) 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. Vauxhall Cross is located immediately downstream of the confluence of with one of these subsidiary channels (the Battersea Channel) with the River Thames (Figure 1). The same recent geoarchaeological investigations indicate that the Battersea 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, 2009/2010).

During recent geotechnical investigations carried out by RPS Planning & Development, a total of four cable percussion boreholes (8m depth) and seven window samples (5m depth)

were put down across the site (Figure 2). The aim of this report is to produce a model of the sub-surface stratigraphy of the site using a combination of the recent geotechnical investigation monitored by Quaternary Scientific, and existing borehole records held by the British Geological Survey (http://www.bgs.ac.uk/data/boreholescans/home.html) resulting from previous investigations both on and immediately adjacent to the site. This model will be used to provide a reconstruction of the site's former landscape and its evolution through time, as well as its potential utilisation by prehistoric people. In addition, this landscape will be placed in context with other areas in the region of the Battersea Channel. Finally, this report will provide recommendations on the suitability for further geoarchaeological investigations.

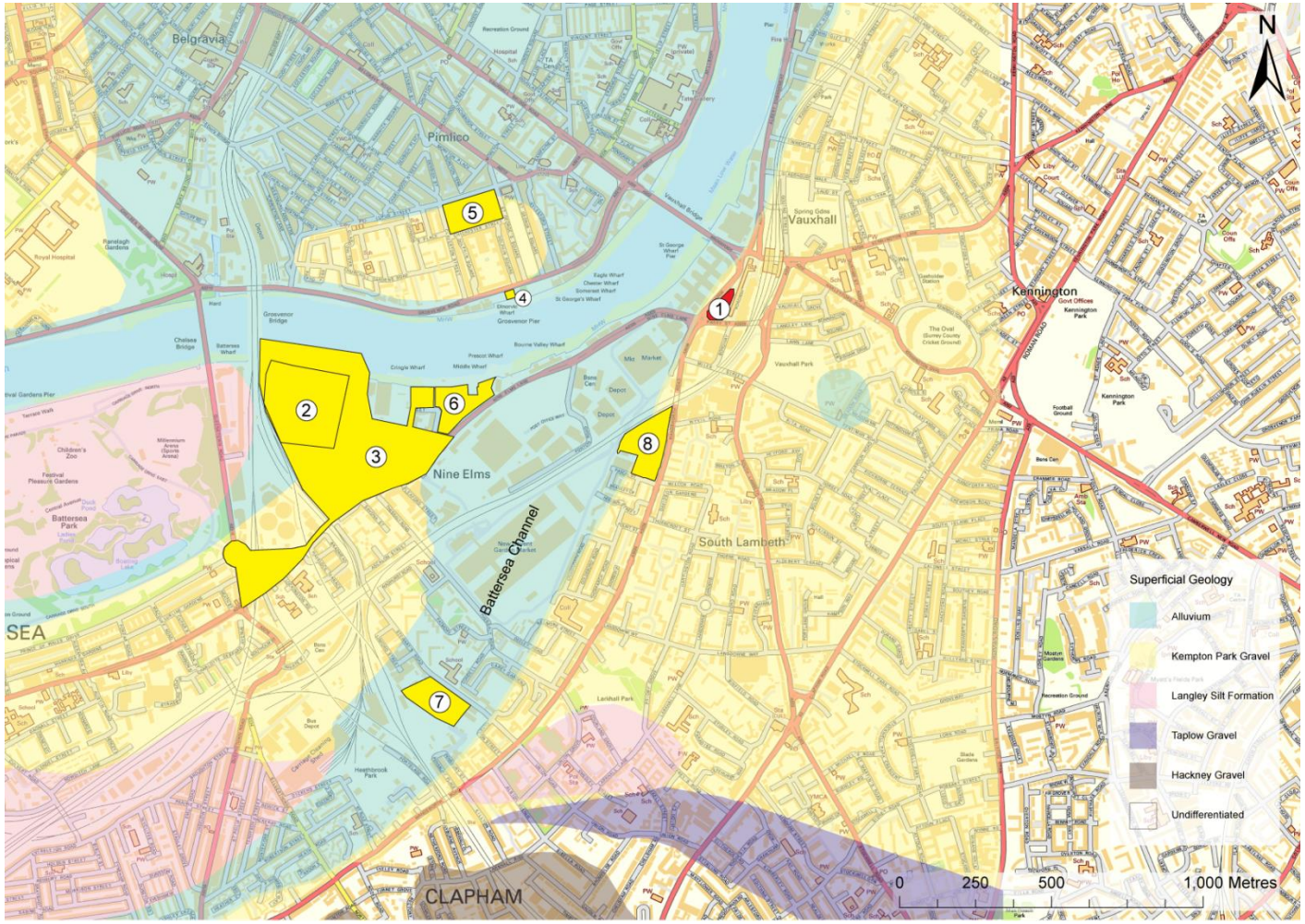

Figure 1: Location of (1) Vauxhall Cross; (2) Battersea Power Station (Branch *et al*., 2010; Young *et al*., 2012); (3) Battersea Power Station (Dawson *et al*., 2009); (4) 135 Grosvenor Road, Pimlico (Green & Young, 2012); (5) Lupus Court (Green, 2008); (6) Tideway Wharf (Green & Young, 2011); (7) 102-104/120-146 Stewarts Road (Morley, 2009/2010) and (8) Wandsworth Road and Pascal Street, Nine Elms (Young and Green, 2013). 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 [2014]*

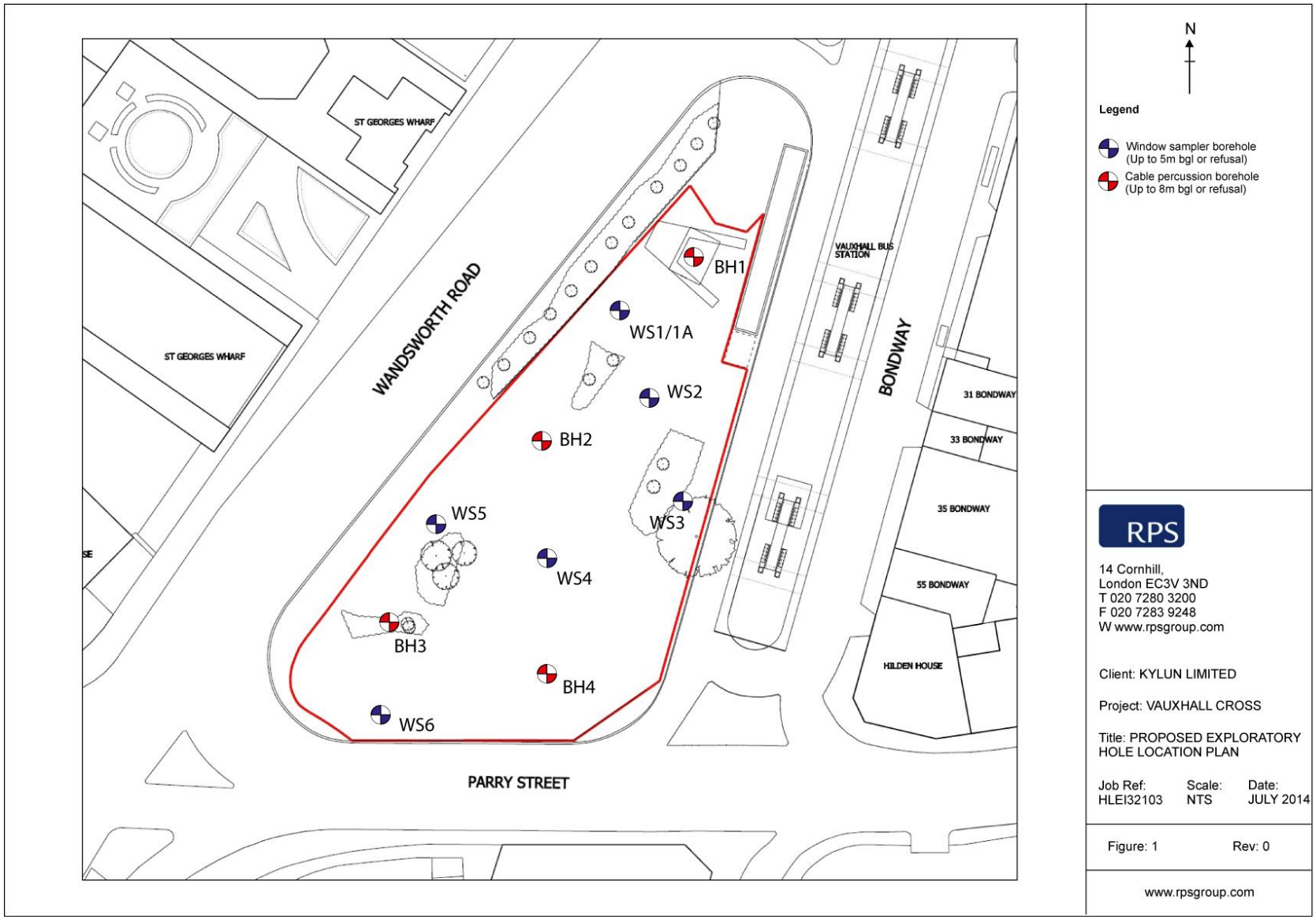

Figure 2: Vauxhall Cross, Vauxhall, London Borough of Lambeth and location of the geotechnical boreholes

METHODS

Fieldwork

Four cable percussion boreholes (8m depth) and seven window samples (5m depth) were put down across the site by RPS Planning & Development. The spatial co-ordinates of each borehole were recorded (Table 1; Figure 2). Each borehole was monitored and described in the field by Quaternary Scientific. All descriptions were made 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) (Troels-Smith, 1955). The procedure involved: (1) cleaning the samples with a spatula or scalpel blade and distilled water to remove surface contaminants; (2) recording the physical properties, most notably colour 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 recordings made in the field were made by observation in combination with discussion with the on-site drilling team, therefore the depths and thicknesses of the units may be subject to some imprecisions. The results of the geoarchaeological borehole descriptions are displayed in Tables 2 to 10.

Table 1: Vauxhall Cross borehole locations

Borehole number	Easting	Northing	Depth (m OD)
BH1	530289.919	177902.525	5.51
BH2	530261.070	177877.984	5.35
BH3	530243.804	177851.737	6.62
BH4	530268.645	177855.020	5.62
WS1	530276.027	177892.743	5.35
WS2	530286.152	177884.742	5.45
WS3	530283.410	177868.328	5.22
WS4	530268.532	177868.587	5.56
WS5	530251.935	177861.475	5.45
WS6	530242.926	177836.230	3.45

RESULTS AND INTERPRETATION OF THE DEPOSIT MODELLING

The results of the field-based lithostratigraphic descriptions are displayed in Tables 2 to 10 and Figure 3. The lowermost unit recorded in three of the four cable percussion boreholes was London Clay (BH1 to BH3). This unit had an upper surface ranging between -1.25 and -2.55m OD. Overlying the London Clay in these three boreholes, and marking the lowermost recorded sediments in BH4, WS4, WS5 and WS6 was a thick horizon of sand and sub-angular to sub-rounded flint gravels. These deposits are representative of the Kempton Park Gravel, laid down on the valley floor within a high energy braided river system during the Devensian period. The upper (possibly reworked) surface of this unit is recorded between

3.82 (BH3) and 1.42m OD (BH4); an amplitude of 2.40m. The Kempton Park Gravel/reworked Kempton Park Gravel is overlain and most likely truncated by a thick sequence of Made Ground deposits to the present day surface. This sedimentary sequence is analogous to that recorded towards the west of the site along Wandsworth Road, where only a possible thin layer of inorganic coarse-grained alluvium was recorded separating the Kempton Park Gravel from the overlying Made Ground deposits.

On the basis of the nature of the sedimentary sequence, it has been decided that the creation of a series of topographic surface and thickness deposit models would not be appropriate for the Vauxhall Cross site as it could lead to misleading interpretations. In particular, a false topographic model for the surface of the Kempton Park Gravel is likely to be produced as a consequence of truncation. The highly variable surface of the Kempton Park Gravel in combination with it being overlain by Made Ground deposits suggests that this is a highly probable scenario.

CONCLUSION AND RECOMMENDATIONS

The aim of the fieldwork and deposit modelling exercise was to provide a reconstruction of the site's former landscape and its evolution through time, as well as its potential utilisation by prehistoric people. The results indicate a sequence of London Clay overlain by Kempton Park Gravels capped and probably truncated by Made Ground. The potential for recovering archaeological or palaeoenvironmental evidence of human activity and the evolution of the landscape during the Holocene would therefore appear to be highly unlikely on this site. No further work is recommended.

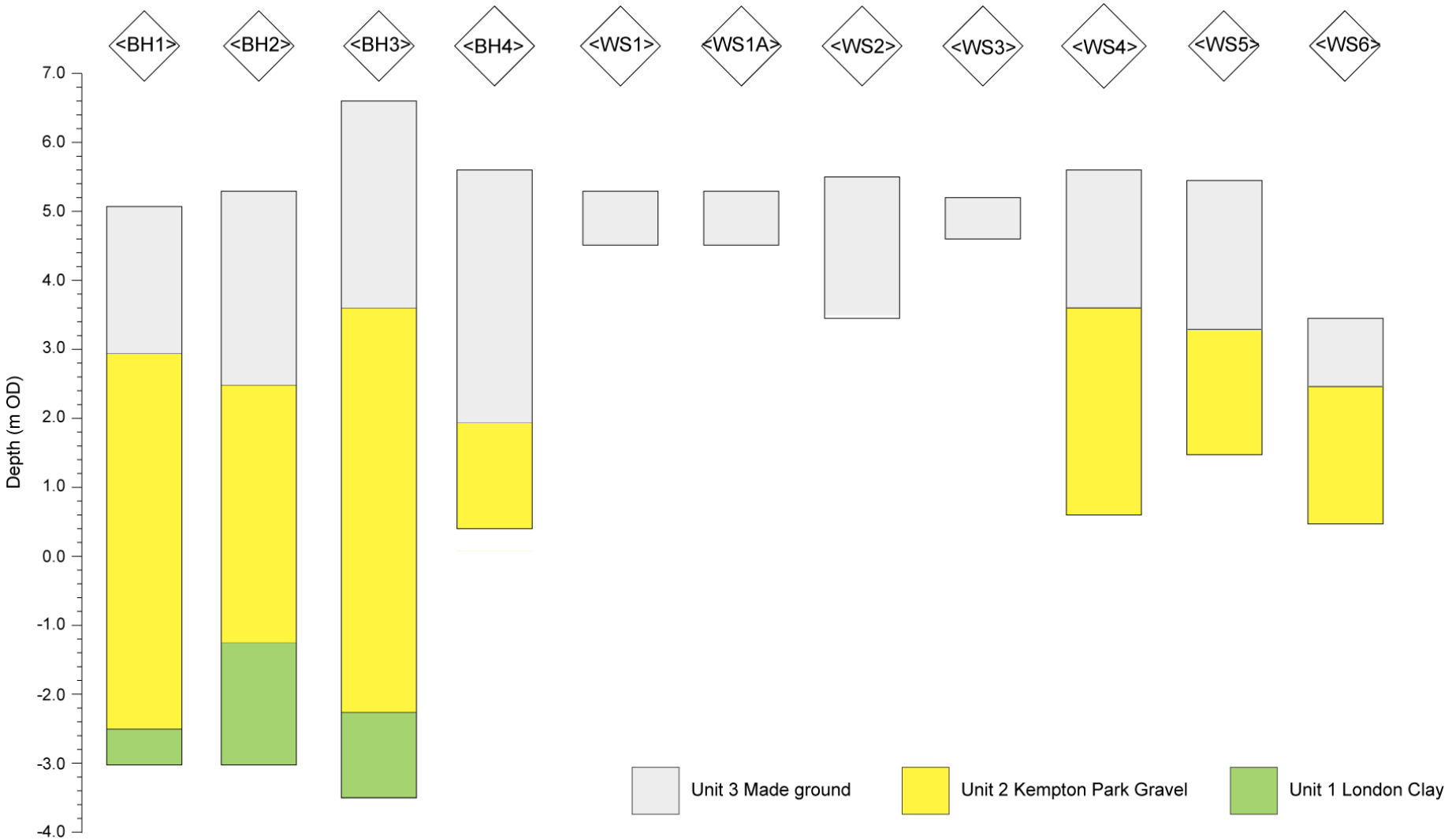

Figure 3: Borehole transect, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Table 2: Lithostratigraphic description of BH1, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	**Base**	**Top**	**Base**		
0	0.20	5.05	4.85	Turf over dark yellowish brown Loose gravel of angular to subrounded flint pebbles and occasional angular concrete cobbles with some friable sandy silt matrix and with some roots and plant remains. Gg(min)3 Ag1 Gg(maj)+Ga+ Th+	Made Ground
0.20	0.50	4.85	4.55	Pale yellowish grey loose silty fine sand with frequent inclusions. Inclusions are subrounded to subangular very poorly sorted fine pebble to cobble sized of flint, red brick, slate, concrete and plastic. Rare rootlets. Ag2 Ga1 Gg(min)1 Gg(maj)+ Th+	
0.50	1.65	4.55	3.40	Greyish brown soft to firm sandy silt/clay with possible faint laminations? with occasional gravel of subrounded to angular pebbles and rare cobbles of flint, concrete, brick. Rare cobble sized concretion of partially corroded waste metal (off cuts or swarf?). As1 Ag1 Ga1 Gg(min)1	
1.65	2.10	3.40	2.95	NO RECOVERY (pushed concrete boulder down hole)	
2.10	2.80	2.95	2.25	Dark orange brown soft silty clayey sand (medium to coarse) with frequent subangular to subrounded gravel of flint pebbles. With occasional pockets dark ashy sandy clay and rare brick and concrete pebbles. (reworked gravel) Gs2 Ag1 Gg(min)1	Reworked Kempton Park Gravel
2.80	7.30	2.25	-2.25	Soft to firm matrix-supported gravel of subangular to subrounded flint pebbles in a slightly clayey coarse sand matrix. Gg(min)2 Gs2 As+	Kempton Park Gravel
7.30		-2.55		London Clay	London Clay

Table 3: Lithostratigraphic description of BH2, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	**Base**	**Top**	**Base**		
0	0.60	5.35	4.75	Grass over loose pale grey silty sand with frequent subrounded to angular brick pebbles, occasional fragments of concrete and clear glass and some rounded flint pebbles. (Ga2 Ag1 Gg(min)1 Th+)	Made Ground
0.60	2.80	4.75	2.55	Mid reddish brown brick rubble consisting of cobble sized fragments of red frogged brick in a silty sandy matrix with mortar and coal fragments. (Gg(min)2 Gg(maj)1 Gs1 Ag+)	
2.80	3.00	2.55	2.35	Dark orangey brown clayey sand with some subrounded to subangular flint pebbles.	Reworked Kempton

				(Gs2 As1 Gg(min)1) ?Possibly reworked Kempton Park Gravel Fm.	Park Gravel
3.00	6.60	2.35	-1.25	Mid orange coarse sandy gravel. Gravel is poorly sorted of subangular to rounded flint granules and pebbles, rare cobbles, in a coarse sand matrix. (Gg(min)2 Gs2 Gg(maj)+ As+)	Kempton Park Gravel
6.60		-1.25		London Clay	London Clay

Table 4: Lithostratigraphic description of BH3, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		**Depth (m OD)**		**Geotechnical description**	**Stratigraphic interpretation**
Top	**Base**	**Top**	**Base**		
0	0.40	6.62	6.22	Turf over dark greyish brown loose silty sand with frequent inclusions of subangular to subrounded granules pebbles and rare cobbles of brick, tabular slate pebbles, rare angular coal pebbles, rare glass and clay pipe fragments. Gs2 Ag1 Gg(min)1 Gg(maj)+ Th+	Made Ground
0.40	0.55	6.22	6.07	Dark yellowish brown loose silty sand with very frequent subangular yellow stock brick fragments (pebble to cobble sized) and frequent subangular pebble and granule sized clay pipe, flint, slate, brick and mortar fragments. Rare subangular coal pebbles and rare metal (?roof lead?) pebble. Gs3 Gg(maj)1 Ag+ Gg(min)+ Th+	
0.55		6.07		Hit in-situ structural remains at 0.55m - edge of brick foundation running approx E-W. pit apparently struck southern exterior edge of structure. Yellow stock bricks in overlying stratum apparently were bonded in with structural remains, therefore at least 3-4 courses extant. Brick is yellow frogged brick with hard cement bonding material. Possible N-S return of wall visible at the surface c.2.5m to the E. Foundation of C19/20 building. Gg(maj)4	
0	2.80	6.62	3.82	As above (dark brownish grey loose silty sand with subangular to surrounded brick slate and occasionally flint pebbles. Becoming dark orangey brown towards base with frequent subangular flint pebbles. Gs3 Gg(min)1 Ag+ Gg(maj)+ Th+ Dl+	Made Ground
2.80	6.80	3.82	-1.38	Poorly sorted subangular to subrounded flint pebbles. Gg(min)3 Gs1 Gg(maj)+	Kempton Park Gravel
6.80	8.00	-1.38		London Clay	London Clay

Table 5: Lithostratigraphic description of BH4, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)	**Depth (m OD)**	**Geotechnical description**	**Stratigraphic interpretation**

Top	Base	Top	Base		
0	0.40	5.62	5.22	Grass over light greyish brown friable silty sandy topsoil with frequent subrounded to subangular flint, concrete, brick pebbles, rare concrete cobbles, rare plastic bag fragments, frequent fine rootlets and occasional woody root fragments. (Ga2 Ag1 Gg(min)1 Gg(maj)+ Th+)	Made Ground
0.40	0.90	5.22	4.72	Pale reddish grey loose silty sand with very frequent brick dust, and subrounded brick granules and pebbles and very frequent angular red brick and tile pieces up to cobble size. Frequent subrounded to subangular flint pebbles. At c.0.65m a thick band of yellowish sandy brick rubble, some fabric mesh and plastic sheeting. Rare boulder size bonded stock brick (frogged) fragments (cement mortar). (Gs2 Gg(maj)2 Gg(min)+ Ag+) (C20th Demolition rubble).	
0.90	1.30	4.72	4.32	Concrete cobbles. (Gg(maj)4)	
1.30	2.70	4.32	2.92	As 0.40-0.90m (Gs2 Gg(maj)2 Gg(min)+ Ag+)	
2.70	3.45	2.92	2.17	Very dark brown soft sandy silt/clay with frequent subrounded brick and mortar pebbles and single pebble sized fragment of C18 “metropolitan slipware” pottery, some small fragments of slate and some small sherds of white glazed pot (C19th refuse/?garden soil?). (Ag2 Ga1 Gg(min)1 As+)	
3.45	3.70	2.17	1.92	Orangey brown firm clayey sand with subangular flint pebbles. (Redeposited Kempton Park Gravel??) (Gs3 As1 Gg(min)+)	
3.70	4.20	1.92	1.42	Very dark brown/black soft sandy silt/clay with frequent subrounded fine pebble sized flint and frequent charcoal flecks, occasional small shreds of white glazed (C19th) pot and single cobble sized glazed tile fragment (C19th refuse/?garden soil?). (Ag2 Ga1 Gg(min)1 As+)	
4.20		1.42		Orange stiff sandy silt/clay with frequent subrounded flint pebbles, occasional pockets (?lenses?) of orangey brown coarse sand (As2 Ga1 Gg(min)+). Becoming coarse sandy flint gravel by c.4.30m (Gs2 Gg(min)2 Gg(maj)+).	Kempton Park Gravel

Table 6: Lithostratigraphic description of WS1, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	Base	Top	Base		
0	0.15	5.35	5.20	Grass over very dark brown loose sandy silt/clay frequent fine rootlets throughout occasional flint and brick fine pebbles and granules. (As1 Ag1 Ga1 Gg(min)1 Th+) Diffuse to:	Made Ground
0.15	0.60	5.20	4.75	0.15-0.60 Very dark yellowish brown sandy silt/clay with some fine flint and brick	

				gravel and rare coal fragments. (Ag2 As1 Ga1 Gg(min)+) Diffuse to:	
0.60	0.90	4.75	4.45	Very dark greyish brown to black sandy silt/clay with frequent coal, clinker and brick granules and fine subangular pebbles. Some fine rootlets. WS1 refused at 0.90m. (Ag1 As1 Ga1 Gg(min)1 Th+)	

Table 7: Lithostratigraphic description of WS1A, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	Base	Top	Base		
0	0.15	5.35	5.20	Turf over dark orangey brown clayey sandy silt with occasional subrounded flint pebbles. (Ag3 Ga1 As+ Gg(min)+ Th+) sharp to:	Made Ground
0.15	0.60	5.20	4.75	Pale yellowish brown loose silty sand with frequent subrounded to subangular flint and brick pebbles and granules. (Ga3 Gg(min)1 Ag+ Th+) Grading into:	
0.60	0.90	4.75	4.45	As above but with very frequent subrounded flint pebbles. (I.e. grading into reworked top of gravels?). WS1A refused at 0.90m (Ga2 Gg(min)2 Ag+ Th+)	

Table 8: Lithostratigraphic description of WS2, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	Base	Top	Base		
0	0.20	5.45	5.25	Turf over mid yellowish brown sandy gravel. Gravel is rounded to subrounded flint pebbles. (Gg(min)2 Gs1 Ag1 Th+) Grading into:	Made Ground
0.20	0.40	5.25	5.05	Yellow matrix-supported gravel of rounded flint pebbles in a yellow coarse sand matrix. Textile mat at base. (Gg(min)2 Gs2 Ga+ Ag+) Sharp to:	
0.40	0.80	5.05	4.65	Red and yellow bricks and concrete recovered as loose cobbles and pebbles of bricks with some coarse sand matrix and concrete granules. (Gg(maj)2 Gg(min)2 Gs+) Unknown to:	
0.80	0.90	4.65	4.55	?subangular flint gravel? WS2 refused at 0.90m cutting shoe destroyed. (Gg(min)3 Gg(maj)1 Gs+)	

Table 9: Lithostratigraphic description of WS3, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	Base	Top	Base		
0	0.25	5.22	4.97	Grass over very dark brown slightly sandy silt/clay with abundant roots and	Made Ground

				occasional, becoming frequent towards base, concrete and brick subrounded fine pebbles and granules. (Ag2 As1 Ga1 Gg(min)+ Th+) Sharp to:	
0.25	0.35	4.97	4.87	Pale yellowish grey matrix supported gravel of subrounded flint pebbles in a pale yellow medium to coarse sand matrix. (Gg(min)2 Gs2 Ag+) Sharp to:	
0.35	0.60	4.87	4.62	Dark blueish grey loose gravel of asphalt pebbles with some concrete fine pebbles and rare metal fragments (nail). Plastic sheeting at base. (Gg(min2) Gg(maj)2) WS3 refused at 0.60.	

Table 10: Lithostratigraphic description of WS4, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		**Depth (m OD)**		**Geotechnical description**	**Stratigraphic interpretation**
Top	**Base**	**Top**	**Base**		
0	0.20	5.56	5.36	Turf over dark greyish brown firm sandy silt/clay with frequent subangular concrete and brick fine pebbles and granules and occasional rounded flint pebbles. (Ag2 As1 Gg(min)1 Gs+ Th+) Diffuse to:	Made Ground
0.20	0.90	5.36	4.66	Light grey to dark greyish brown loose sandy brick gravel. Gravel consists of subangular pebbles and cobbles of red and yellow brick in a grey ashy sand matrix with occasional coal, clinker, slate and decayed wood fragments. (Gg(min)2 Gs2 As+ Dl+) Sharp to:	
0.90	1.00	4.66	4.56	Light yellowish grey loose sandy concrete gravel (cobbles and pebbles of concrete) some brick granules. (Gg(min)3 Gs1)	
1.00	1.70	4.56	3.86	Black firm sandy silt/clay with occasional brick granules, charcoal and rounded flint pebbles, rare oyster/mussel shell fragments. Becoming soft and sandier towards base. (Ag2 As1 Ga1 Gg(min)+) Grading into:	
1.70	2.00	3.86	3.56	Dark orangey brown friable silty sand. (Gs2 Ga1 Ag1 Gg(min)+) Reworked top of Kempton Park Gravel Fm?	
2.00	2.20	3.56	3.36	No recover- slump of reddish grey sand and brick frags.	
2.45	3.30	3.36	2.26	Compact mid brownish orange clayey coarse sand with occasional flint pebbles (recovered as angular, likely broken by sampler). (Gs3 Gg(min)1 Gg(maj)+). Diffuse to:	Kempton Park Gravel
3.30	3.70	2.26	1.86	Loose orangey brown gravel of broken subangular flint pebbles (Gg(min)4 Gs+ Ga+ Gg(maj)+). Diffuse to:	
3.70	5.00	1.86	0.56	Loose brownish orange coarse sand with occasional subrounded flint pebbles. (Gs4 Gg(min)+) End of WS4.	

Table 11: Lithostratigraphic description of WS5, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	Base	Top	Base		
0	0.70	5.45	4.75	Pale yellowish grey friable silty sand with frequent subangular to rounded fine flint and brick pebbles and granules. Green plastic sheeting at base. (Ga2 Ag1 Gg(min)1) Sharp to:	Made Ground
0.70	1.20	4.75	4.25	Dark greyish brown loose coarse sandy ashy brick and concrete gravel. Brick fragments recovered as subangular pebbles and cobbles, frequent mortar and concrete granules occasional flint pebbles. (Gg(min)3 Gs1) Sharp to:	
1.20	1.80	4.25	3.65	Compact very dark greyish brown very silty coarse sand with occasional subrounded fine pebbles and granules of flint, brick, coal and bone. (Gs3 Gg(min)1 Ag+) Grading into:	
1.80	2.20	3.65	3.25	Loose dark orangey brown medium sand with occasional subrounded flint pebbles and rare CBM and charcoal flecks. (Gs4 Ag+ Gg(min)+) Reworked top of Kempton Park Gravel Fm? Diffuse to:	
2.20	2.40	3.25	3.05	Loose brownish orange coarse sandy flint gravel. Gravel recovered as angular to subangular flint pebbles. (Gg(min)2 Gs2). Diffuse to:	Kempton Park Gravel
2.40	2.55	3.05	2.90	Dark orange brown very firm fine sandy silt/clay. (Ag2 Ga2) Diffuse to:	
2.55	2.80	2.90	2.65	Light orangey yellow loose coarse sand with occasional rounded flint pebbles. (Gs3 Gg(min)1) Diffuse to:	
2.80	3.00	2.65	2.45	Dark orange brown stiff sandy silt/clay with rare angular flint pebbles. (Ag2 Ga2 Gg(min)+)	
3.00	3.20	2.45	2.25	No recovery - slump	
3.20	4.00	2.25	1.45	Loose orange brown coarse sand with subangular to subrounded flint pebbles. Becoming clayey and stiff towards base. (Gs3 Gg(min)+ As+) End of WS5.	

Table 12: Lithostratigraphic description of WS6, Vauxhall Cross, Vauxhall, London Borough of Lambeth

Depth (m BGS)		Depth (m OD)		Geotechnical description	Stratigraphic interpretation
Top	Base	Top	Base		
0	0.20	3.45	3.25	Grass over light greyish brown silty sand with frequent subangular brick pebbles and rare subrounded flint pebbles. (Ga2 Ag1 Gg(min)1 Th+) Diffuse to:	Made Ground
0.20	0.34	3.25	3.11	Light yellowish grey loose coarse sand with frequent concrete and brick granules. (Gs3 Gg(min)1 Ag+) Diffuse to:	

0.34	0.60	3.11	2.85	Dark greyish brown loose very sandy silt/clay with frequent subrounded red brick pebbles and rare cobbles frequent subangular flint pebbles. (Ag2 Ga1 Gg(min)1) Grading into:	
0.60	1.00	2.85	2.45	Dark orangey brown soft silty coarse sand with some very dark brown patches (organic?? Remnants of root holes??). (Gs3 Ag1 Sh+)	
1.00	3.00	2.45	0.45	Mid orangey brown firm clayey sand with frequent subrounded to angular flint pebbles, rare flint cobbles. Some thick Bands of lighter yellow coarse sand and bands of dense flint gravel. (Gs2 As1 Gg(min)1). WS6 refused at 3.00m.	Kempton Park Gravel

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