

LAND AT SITE A2 TO SITE A4, CANADA WATER, SURREY QUAYS ROAD, ROTHERHITHE, LONDON SE16 (SITE CODE: CQH10): ENVIRONMENTAL ARCHAEOLOGICAL ASSESSMENT

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NON-TECHNICAL SUMMARY

CgMs Consulting Ltd commissioned Quaternary Scientific (QUEST) to carry out an environmental archaeological assessment of samples collected during a previous geoarchaeological borehole survey of land at Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London. The following report aimed to assess the potential of two borehole samples for reconstructing the environmental history of the site and its environs. Borehole Q.<BH10> came from the south of the site, and Q.<BH11> from the north of the site.

The combined results of the borehole survey and environmental archaeological assessment have demonstrated that the sub-surface sediments at the site comprise basal Shepperton Gravel overlain by a sequence of Holocene alluvial sediments (including Peat), truncated by Made Ground. The alluvial sequence appears to be slightly thicker in the northern half of the site and slopes towards the main channel of the River Thames. The assessment results (combined with previous work nearby) indicate that the Peat varies in age across the site despite being of similar composition, thickness and elevation. Peat apparently formed during the Late Bronze Age in the vicinity of borehole Q.<BH10>, during which time it appears that the local environment underwent a transition from wetland woodland to open meadow-like conditions prior to estuarine inundation. Archaeobotanical (plant) and zooarchaeological (animal) remains were notably well preserved in this borehole. Peat apparently formed between the Roman and Early Medieval Periods in the vicinity of borehole Q.<BH11>, during which time the local environment was mainly open in nature and influenced by estuarine conditions. Provisional evidence of cultural activity was recorded in both assessed boreholes.

It has been recommended that selected environmental archaeological analysis is carried out on boreholes Q.<BH10> and Q.<BH11>, together with two additional boreholes located elsewhere on the site. Specific boreholes and analytical techniques have been selected in

order to: (1) confirm that Peat accumulated at different times across the site, and elucidate the causes for this occurrence if so; (2) to produce a detailed reconstruction of the environmental history of the site and its environs, and (3) elucidate evidence for human activity.

INTRODUCTION

This report summarises the findings arising out of the environmental archaeological assessment undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London (National Grid Reference: centred on *ca.* TQ 355 796; Figure 1 and Figure 2; site code: CQH10). The site lies on the south side of the Lower Thames in Rotherhithe where the river loops northward between the Lower Pool and the Limehouse Reach. The ground within this loop forms part of the floodplain of the River Thames and is underlain by river alluvium (British Geological Survey 1:50,000 Sheet 270 South London 1998) which rests on the sands and clays of the Palaeocene Lambeth Group (formerly the Woolwich and Reading Beds). This part of Rotherhithe was developed during the 18th and 19th centuries into a complex of wet docks and wharves. Prior to this development a minor tributary of the River Thames, the Rotherhithe Mill Stream crossed the area from south to north in a poorly defined marshy valley (Barton 1992; Hawkins, 2007). Historically, most of the present site of investigation appears to have consisted of wharves rather than wet dock, but the eastern margin of the site extends into the area occupied by the Albion Dock. This dock has now been infilled but was originally excavated down to a level of approximately - 4.50m OD.

A geoarchaeological borehole investigation was recently carried out, and the resultant sedimentary logs were integrated with previous geoarchaeological (Sidell *et al.*, 2000; Batchelor and Branch, 2008) and geotechnical data (RSA Geotechnics Ltd, 2009a, b) in order to produce a model of its depositional history (Green *et al.*, 2010; Figures 3 to 7; Tables 1 and 2; Appendix 1 and 2). The resultant model indicated a rather consistent sequence of Holocene alluvial sediment across the whole site, resting on the surface of the Shepperton Gravel which slopes gently northward towards the River Thames and eastward towards the former course of the Rotherhithe Mill Stream (Figures 3 to 5). The Holocene alluvial sequence consists of a truncated upper silty clay unit and a lower sandy unit with a thinner horizon of organic sediments, including silts, sands and some thin and discontinuous peat, either separating the upper and lower units or present in the upper part of the lower unit or the lower part of the upper unit (Figures 3, 4 and 6). The thickness of all these units varies across the site but not in any distinctive topographic pattern. The relief on the surfaces

separating the stratigraphic units appears to be gently undulating and of low amplitude (generally <1.5m). The alluvial sequence as a whole appears to be slightly thicker in the northern half of the site where the surface of the underlying Shepperton Gravel is at a lower level, sloping towards the main channel of the River Thames (Figure 7). There is also a slight and less well-marked thickening of the Holocene alluvial sequence from west to east, reflecting the former presence of the Rotherhithe Mill Stream, located to the east of the present site, and on an alignment influenced by the lower level of the underlying gravel surface in this area. The valley of the Rotherhithe Mill Stream may itself have been exploited subsequently to develop the Albion Dock. Ground disturbance associated with the excavation and more recent infilling of the dock can be recognised near the eastern boundary of the present site.

The model indicates a similar alluvial sequence to other Holocene sites along the valley floor of the River Thames and its tributaries and more widely in southern and Midland England (e.g. The Staines Alluvial Deposits/ Tilbury Deposits of Gibbard 1994). The lower part of the sequence is usually of Early and/or Middle Holocene age, the upper part generally post-Neolithic in age and representing sediment derived from widespread soil erosion associated with increasingly intensive prehistoric agricultural land-use. At Canada Water to the south of the site, peat formation commenced around 4280-3690 cal yr BP (Sidell *et al.*, 2000).

Following the results of the deposit modelling exercise, a fuller investigation of the local and regional environments of the Holocene alluvial sediments was recommended to: (1) identify evidence of change or continuity through time; (2) establish whether any significant spatial variability exists across the site, and (3) detect evidence of human activity. An assessment of two cores was recommended in the first instance, from Borehole Q.<BH10> and Q.<BH11> as they contain significant alluvial and organic-rich horizons, and are located distally on the site. If the results of the assessment indicate markedly different palaeoenvironmental environments at opposite ends of the site, cores from Boreholes Q.<BH5> and Q.<BH12> will be held available for further investigation at the analysis stage.

The aim of this environmental archaeological assessment was to evaluate the potential of the sedimentary sequences for reconstructing the environmental history of the site and its environs, and specifically to address points made above. In order to achieve this aim, the environmental archaeological assessment consisted of the following techniques, as stated in the written scheme of investigation for this site (Batchelor, 2010):

1. Recording the lithostratigraphy of the selected boreholes to provide a preliminary reconstruction of the sedimentary history

2. Carrying out organic matter content determinations to enhance the results of the sedimentary descriptions
3. Radiocarbon dating of identified plant macrofossils to provide a provisional geochronological framework for the natural stratigraphic sequence
4. Assessment of the preservation and concentration of pollen grains and spores to provide a preliminary reconstruction of the vegetation history, and to detect evidence for human activities e.g. woodland clearance and cultivation
5. Assessment of the preservation and concentration of diatom frustules to provide a preliminary reconstruction of the hydrological history e.g. water quality and depth
6. Assessment of the preservation and concentration of macroscopic plant, insect and Mollusca remains from small bulk samples to provide a preliminary reconstruction of the vegetation history and general environmental context of the site.

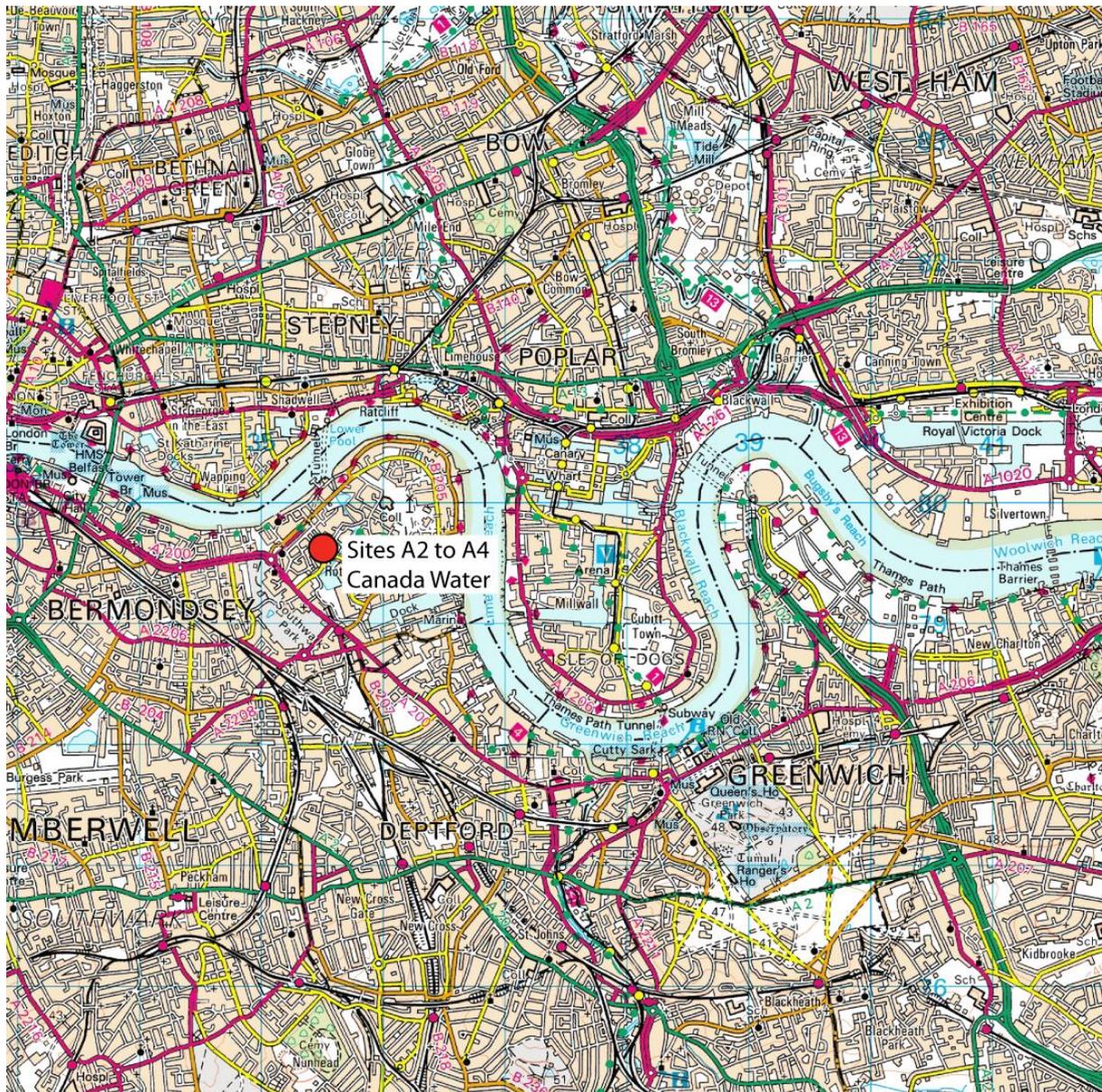


Figure 1: Location of Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

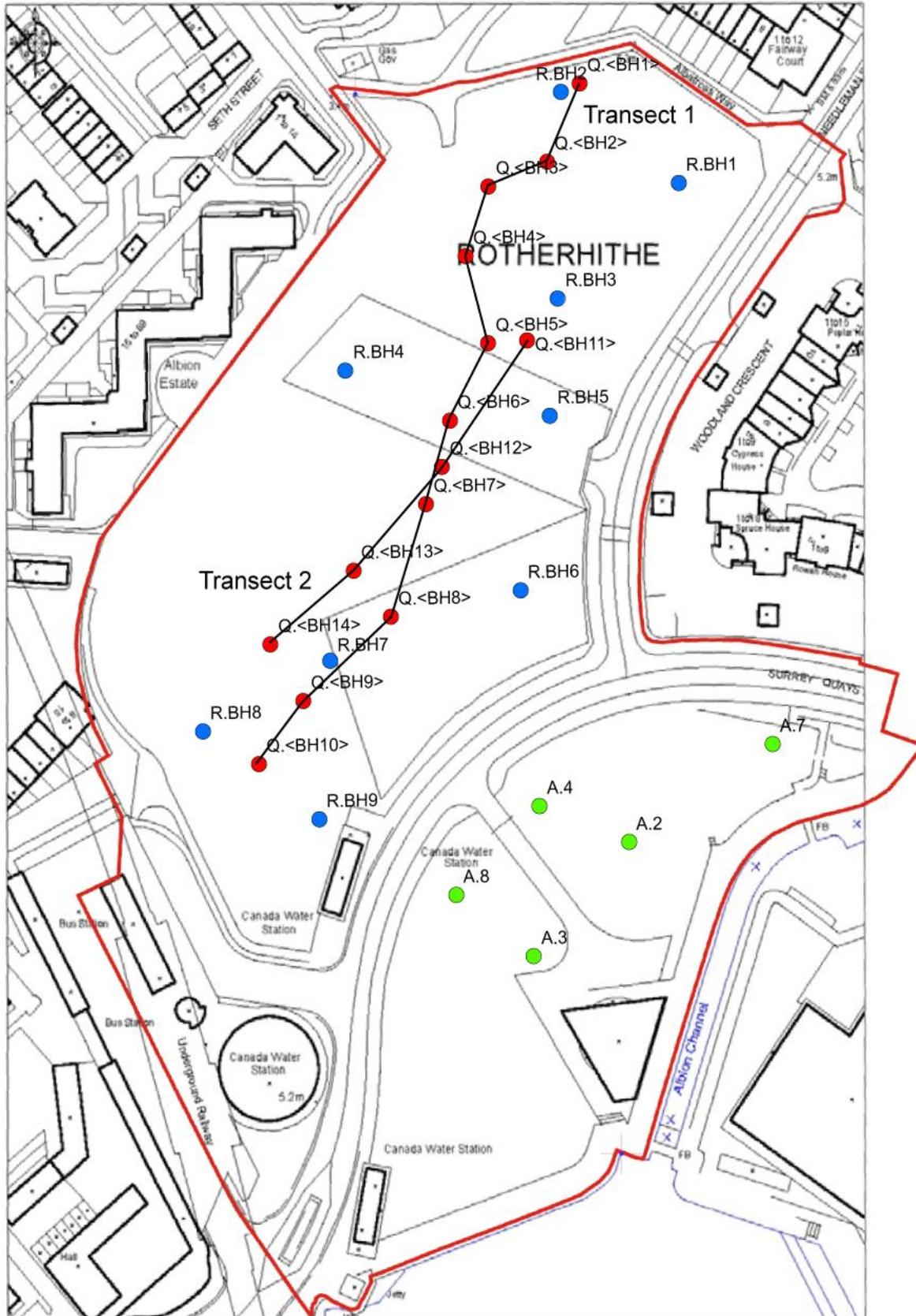


Figure 2: Canada Water borehole locations, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

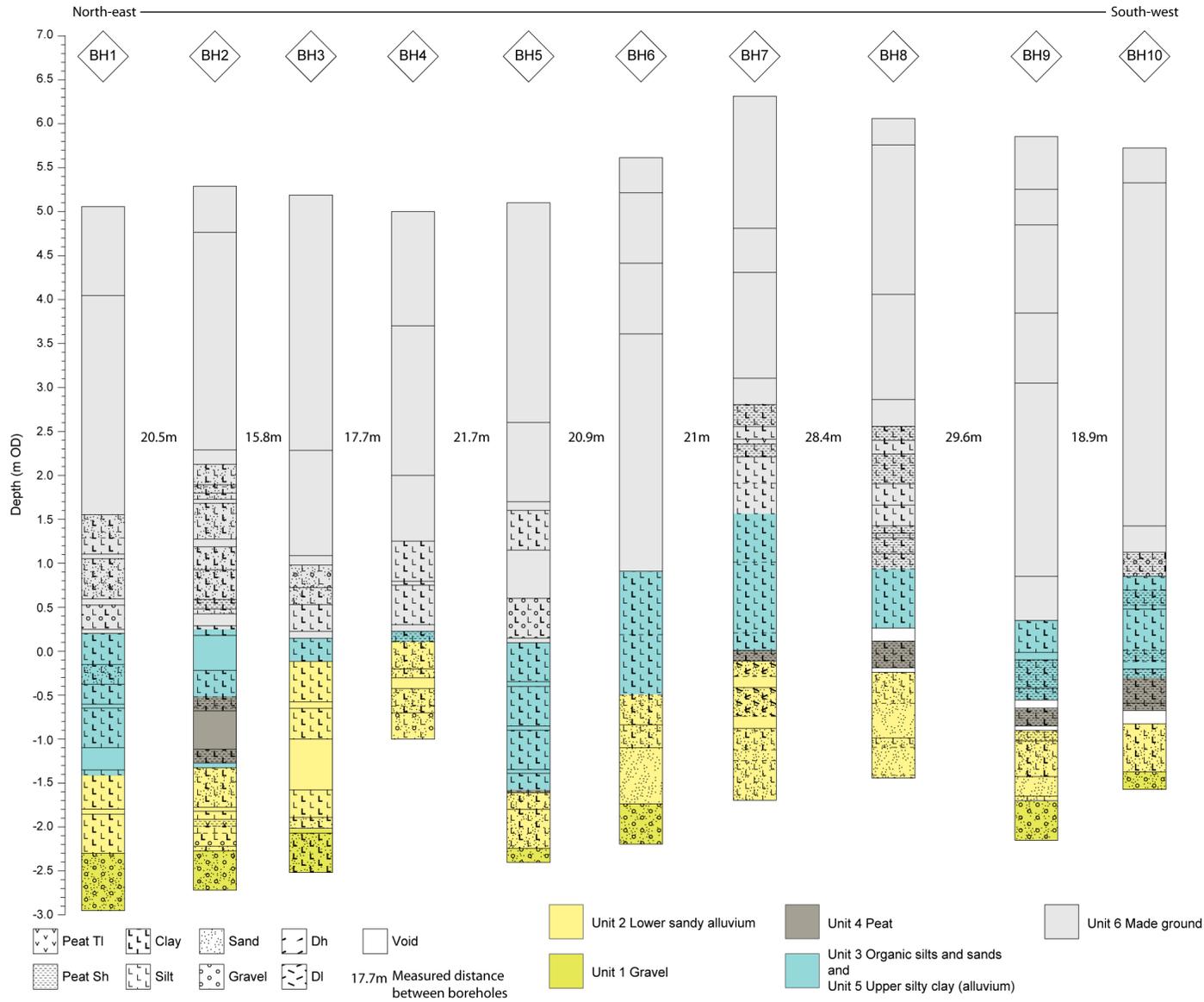


Figure 3: Lithostratigraphic diagram of Transect 1, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

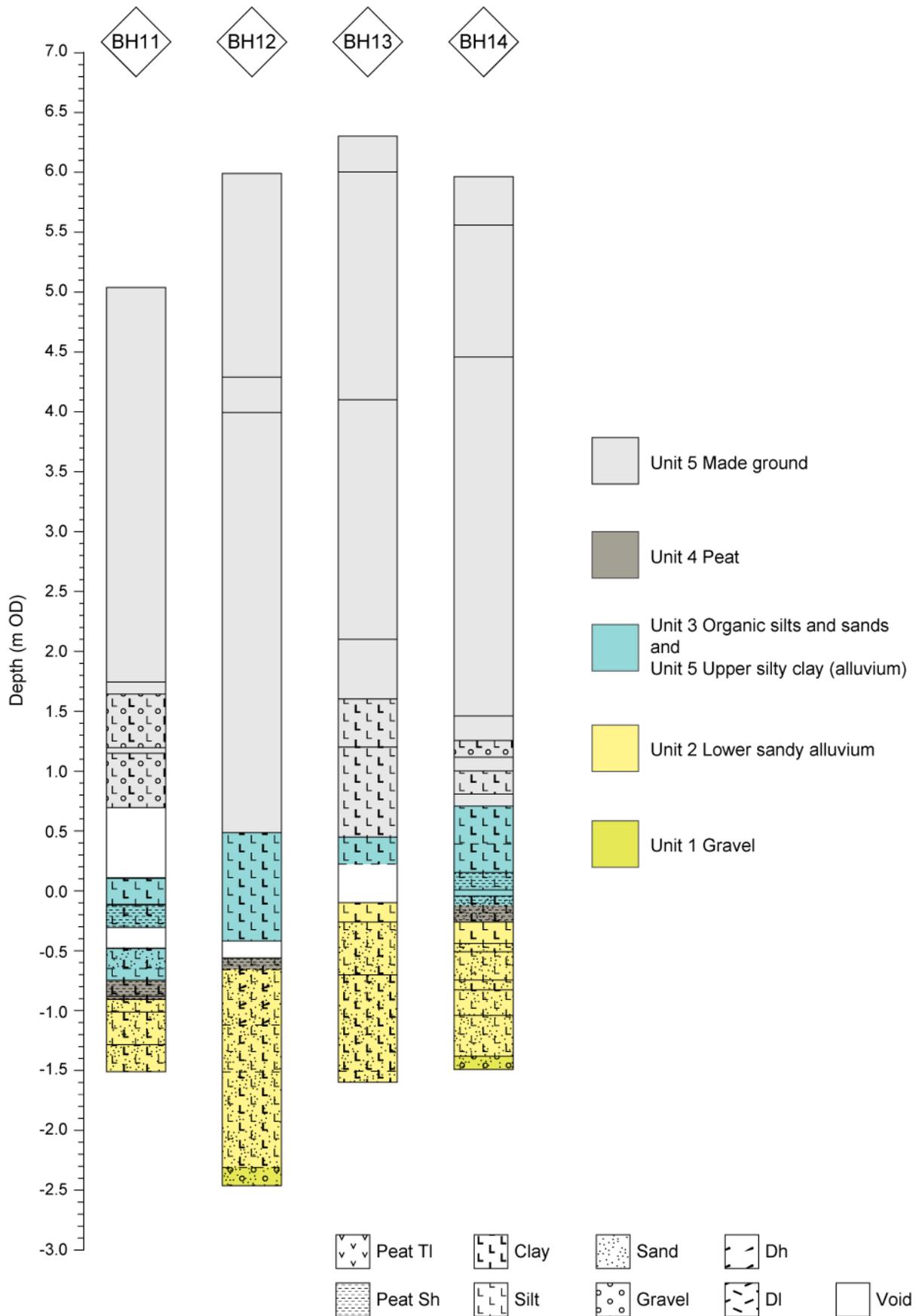


Figure 4: Lithostratigraphic diagram of Transect 2, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

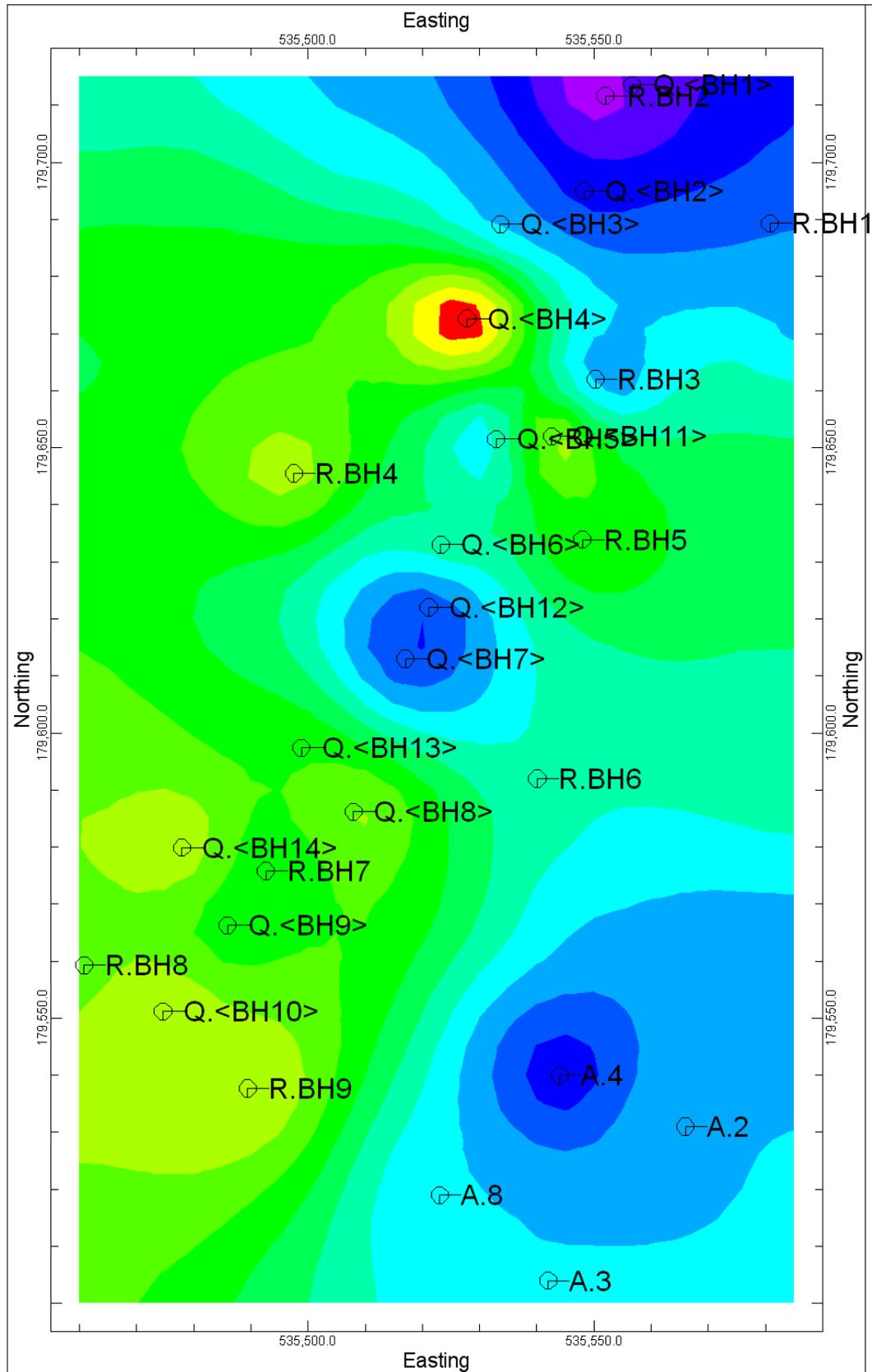


Figure 5: Modelled surface of the Shepperton Gravel (m OD); Unit 1

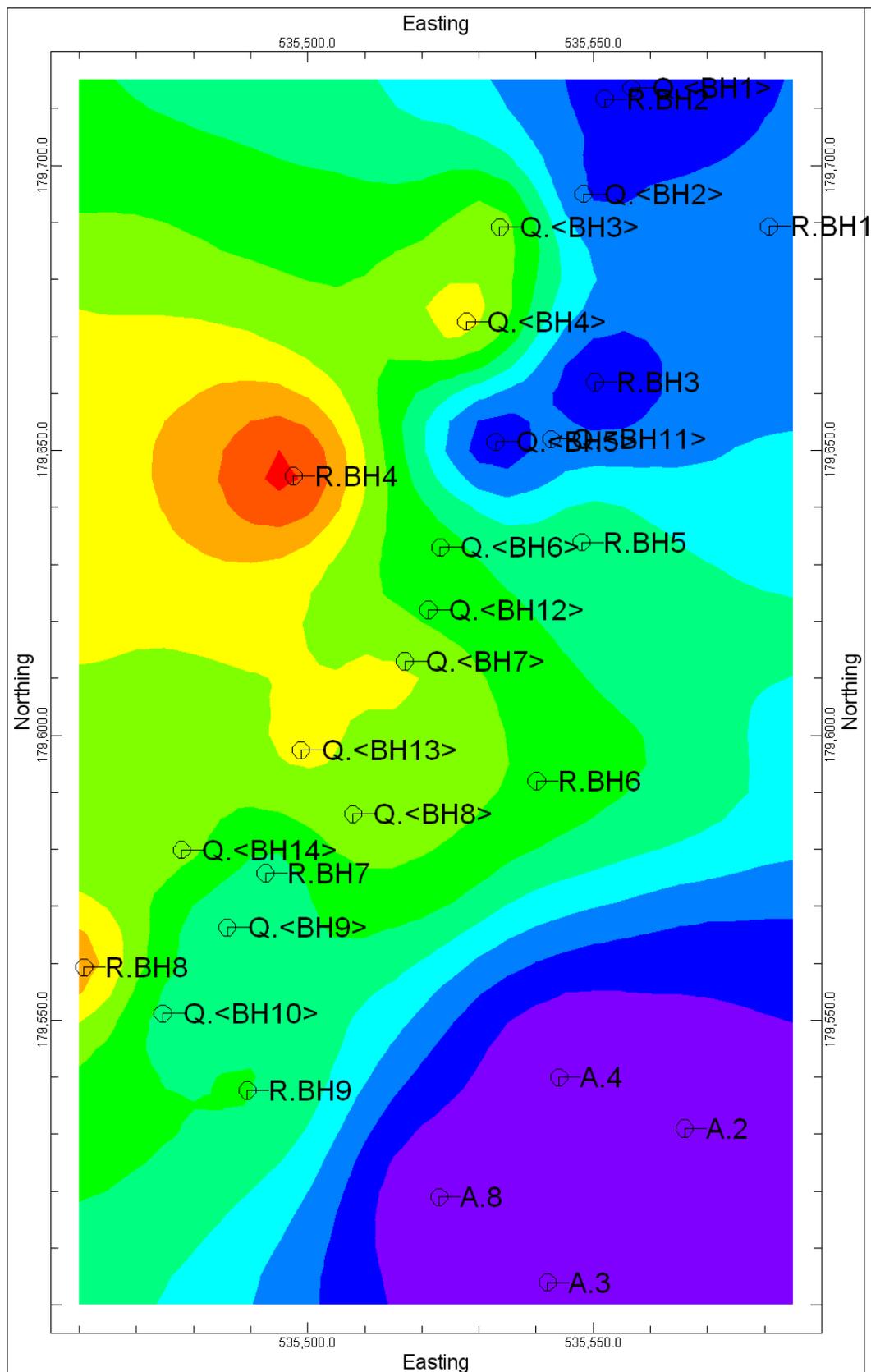


Figure 6: Modelled surface of Lower (Sandy) Alluvium (m OD); Unit 2

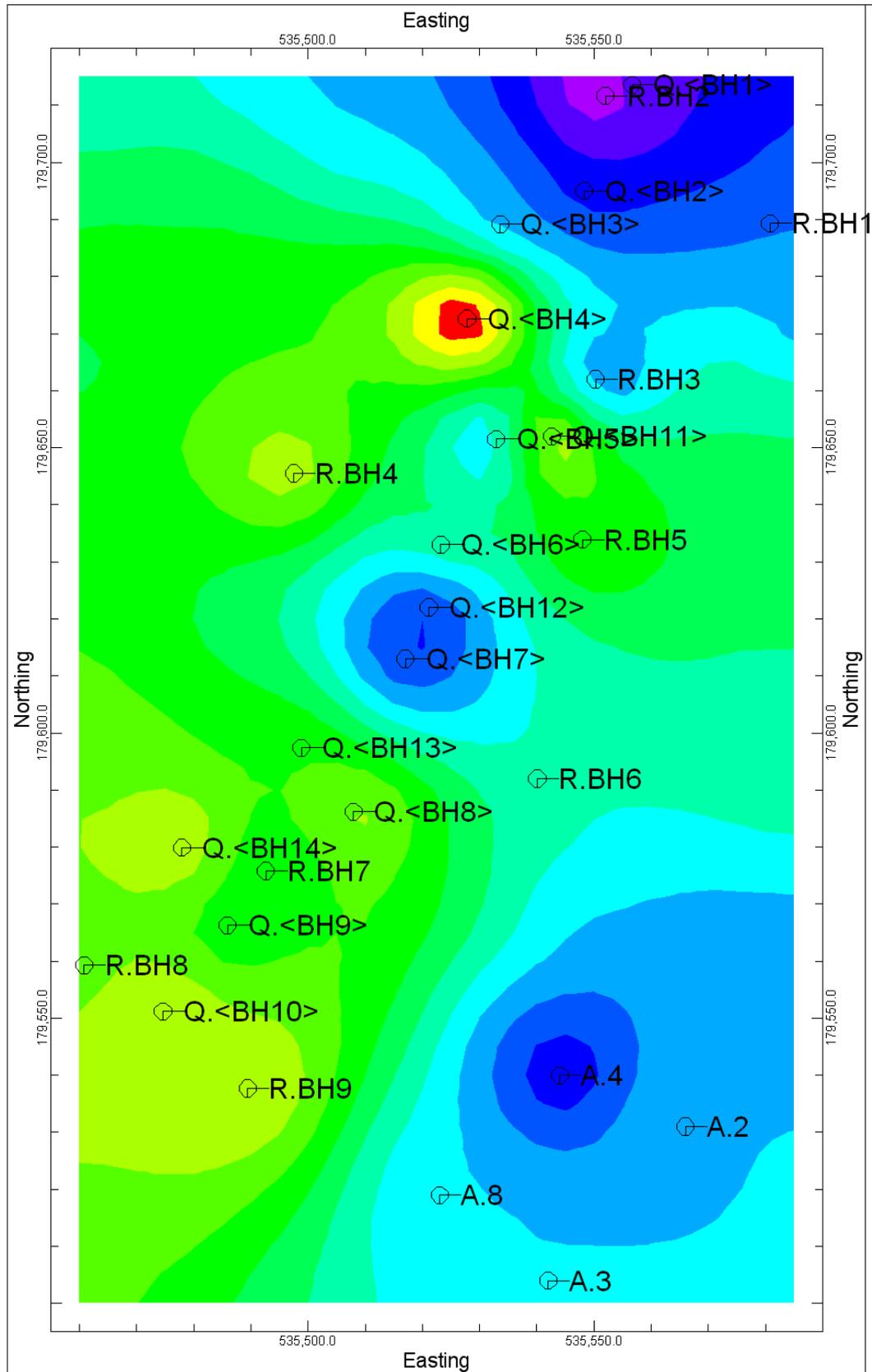


Figure 7: Modelled thickness of the Alluvium (m); Units 2, 3, 4 and 5

METHODS

Previous investigations (field investigations; lithostratigraphic descriptions and deposit modelling)

Fourteen boreholes (Q.<BH1> to Q.<BH14>) were put down at the site in March 2010 (Figure 2). Boreholes were recovered using cable percussion coring, carried out by Tony Bedford Drilling Services, and monitored by a member of Quaternary Scientific staff. The spatial attributes of each borehole were recorded (Appendix 1).

The lithostratigraphy of Boreholes Q.<BH1> to Q.<BH14> were described in the laboratory 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 results are illustrated in Figures 3 and 4, with the descriptions of selected boreholes Q.<BH10> and Q.<BH11> presented in Tables 1 and 2, and the remaining boreholes in Appendix 2.

The deposit model was based on a review of 25 borehole records incorporating the 14 new Quaternary Scientific geoarchaeological boreholes (Tables 1 and 2; Appendices 1 and 2), 9 RSA geotechnical boreholes (RSA Geotechnics Ltd, 2009a, b; Appendix 2) and 4 selected *ArchaeoScape* geoarchaeological boreholes (Batchelor and Branch, 2008; Appendix 2). Sedimentary units from the boreholes were classified into six groupings: (1) Shepperton Gravel; (2) Lower (Sandy) Alluvium; (3) Organic silts and sands; (4) Peat; (5) Upper Alluvium, and (6) Made Ground. The classified data for groups 1-6 were then input into a database with the RockWorks 2006 geological utilities software. Models of surface height (using a nearest neighbour routine) were generated for each of these stratigraphic groups (Figures 5 and 6). Thickness of the combined alluvial units was also modelled (also using a nearest neighbour routine) (Figure 7). 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 and section drawings.

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. In particular, it is important to recognise that 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. The cores from the 14 new boreholes (Q.<BH1> to Q.<BH14>) represent the most detailed record of the sediment sequences.

Organic matter determinations

Twenty-nine sub-samples from borehole Q.<BH10> and fourteen sub-samples from borehole <Q.<BH11> were taken for determination of the organic matter content (Tables 3 and 4; Figure 8). These records were important as they can identify increases in organic matter possibly associated with more terrestrial conditions. The organic matter content was determined by standard procedures involving: (1) drying the sub-sample at 110°C for 12 hours to remove excess moisture; (2) placing the sub-sample in a muffle furnace at 550°C for 2 hours to remove organic matter (thermal oxidation), and (3) re-weighing the sub-sample obtain the 'loss-on-ignition' value (see Bengtsson and Enell, 1986).

Radiocarbon dating

Two sub-samples of wood were extracted from the top (*Alnus* sp twig) and base (unidentified twig) of the peat in borehole Q.<BH10> for radiocarbon dating. No datable macrofossils (seeds/wood) were present at the top or base of the peat in borehole Q.<BH11> and thus bulk peat samples were extracted for radiocarbon dating. All four samples were submitted for AMS radiocarbon dating to Beta Analytic INC, Radiocarbon Dating Laboratory, Florida, USA. The results have been calibrated using OxCal v4.0.1 Bronk Ramsey (1995, 2001 and 2007) and IntCal04 atmospheric curve (Reimer *et al.*, 2004). The results are displayed in Table 5.

Pollen assessment

Fourteen sub-samples from borehole Q.<BH10> and seven sub-samples from borehole Q.<BH11> were extracted for an assessment of pollen content. The pollen was extracted as follows: (1) sampling a standard volume of sediment (1ml); (2) adding two tablets of the exotic clubmoss *Lycopodium clavatum* to provide a measure of pollen concentration in each sample; (3) deflocculation of the sample in 1% Sodium pyrophosphate; (4) sieving of the sample to remove coarse mineral and organic fractions (>125µ); (5) acetolysis; (6) removal of finer minerogenic fraction using Sodium polytungstate (specific gravity of 2.0g/cm³); (7) mounting of the sample in glycerol jelly. Each stage of the procedure was preceded and

followed by thorough sample cleaning in filtered distilled water. Quality control is maintained by periodic checking of residues, and assembling sample batches from various depths to test for systematic laboratory effects. Pollen grains and spores were identified using the University of Reading pollen type collection and the following sources of keys and photographs: Moore *et al* (1991); Reille (1992). The assessment procedure consisted of scanning the prepared slides, and recording the concentration and preservation of pollen grains and spores, and the principal taxa on four transects (10% of the slide) (Tables 6 and 7).

Diatom assessment

Six sub-samples from borehole Q.<BH10> and three sub-samples from Q.<BH11> were extracted for the assessment of diatoms. The diatom extraction involved the following procedures (Battarbee *et al.*, 2001):

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

Duplicate slides each having two coverslips were made from each sample and fixed in Naphrax for diatom microscopy. The coverslip with the most suitable concentration of the sample preparation was selected for diatom evaluation. A large area of this coverslip was scanned for diatoms at magnifications of x400 and x1000 under phase contrast illumination using a Leica microscope.

Diatom floras and taxonomic publications were consulted to assist with diatom identification; these include Hendey (1964), Werff & Huls (1957-1974), Hartley *et al.* (1996) and Krammer & Lange-Bertalot (1986-1991). Diatom species' salinity preferences are discussed using the classification data in Denys (1992), Vos & de Wolf (1988, 1993) and the halobian groups of Hustedt (1953, 1957: 199), these salinity groups are summarised as follows:

1. Polyhalobian: >30 g l⁻¹
2. Mesohalobian: 0.2-30 g l⁻¹
3. Oligohalobian - Halophilous: optimum in slightly brackish water
4. Oligohalobian - Indifferent: optimum in freshwater but tolerant of slightly brackish water

5. Halophobous: exclusively freshwater
6. Unknown: taxa of unknown salinity preference.

The results are displayed in Tables 8 to 11.

Macrofossil assessment

A total of twelve small bulk samples (8 from borehole Q.<BH10> and 4 from borehole Q.<BH11>) were extracted for the recovery of macrofossil remains including waterlogged plant macrofossils, waterlogged wood, insects and Mollusca. The extraction process involved the following procedures: (1) removing a sample up to 10cm in thickness; (2) measuring the sample volume by water displacement, and (3) processing the sample by wet sieving using 300µm and 1mm mesh sizes. Each sample was scanned under a stereozoom microscope at x7-45 magnifications, and sorted into the different macrofossil classes. The concentration and preservation of remains was estimated for each class of macrofossil (Tables 12 and 13).

Preliminary identifications of the archaeobotanical remains (waterlogged plant macrofossils and wood), have been made using modern comparative material and reference atlases (Cappers *et al.* 2006, Hather 2000, Schweingruber 1990, Schoch *et al.* 2004). Nomenclature used follows Stace (2005). The quantities of waterlogged seeds and wood were recorded for each sample, with identifications of the main taxa (Tables 14 to 17). Preliminary identifications of the zooarchaeological remains (insects and Mollusca) were made under a low powered stereo-microscope, and the concentration and state of preservation of each noted (Tables 18 to 20). Identification and interpretation was based on modern comparative material and reference atlases (e.g. Kloet and Hincks, 1964-77; Kenward *et al.* 1986; Kerney and Cameron, 1979; Kerney, 1999; Duff, 2008).

RESULTS AND INTERPRETATION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS AND ORGANIC MATTER CONTENT DETERMINATIONS

The results of the lithostratigraphic descriptions for boreholes Q.<BH10> and Q.<BH11> (Tables 1 and 2, and Figure 8) have been reported previously (Green et al., 2010), and as stated above indicate a sequence of Shepperton Gravel (Unit 1) overlain by Holocene Alluvium incorporating a Lower Sandy Alluvium (Unit 2), Peat (Units 4), and Upper Silty Clay Alluvium (Unit 5). The sequences were truncated by Made Ground (Unit 6). Both sequences contained a thin unit of Peat (<40cm) at slightly varying elevations (-6.40 to -6.03m OD in borehole Q.<BH10>; -5.95 to -5.78m OD in borehole Q.<BH11>).

Quantification of the organic matter content by Loss-on-Ignition allowed further detail to be added to the lithostratigraphic descriptions (Tables 3 and 4). The results revealed that organic matter values were consistently low through Units 1, 2, and 5 in both boreholes (generally <10%). The highest values were recorded within the Peat unit as expected (up to 40% in both boreholes). These results confirm the records from the sedimentary descriptions, but indicate that frequent influxes of mineral-rich sediment took place during the period of peat formation.

Table 1: Lithostratigraphic description of Borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Unit number	Description
5.73 to 5.33	0.00 to 0.40	6	Compact stone fill with brick and concrete
5.33 to 1.43	0.40 to 4.30	6	Black/brown clayey ashy fill with brick and concrete
1.43 to 1.13	4.30 to 4.60	6	Firm brown/grey silty peaty alluvial clay
1.13 to 0.85	4.60 to 4.88	6	5Y 2.5/1; Sh1, Ag1, As1, Gg1, brick+, mortar+; Black organic-rich gravelly silty clay; Made Ground?; sharp contact into:
0.85 to 0.70	4.88 to 5.03	5	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic-rich inclusions; diffuse contact into:
0.70 to 0.53	5.03 to 5.20	5	7.5 YR 2.5/1; As2, Ag1, Sh1; colour organic-rich silty clay; diffuse contact into:
0.53 to 0.48	5.20 to 5.25	5	5Y 2.5/1; As3, Ag1, Sh+; Black silty clay with organic-rich inclusions; sharp contact into:
0.48 to 0.02	5.25 to 5.71	5	5Y 3/1; As3, Ag1, Dh+; Very dark grey silty clay; diffuse contact into:
0.02 -0.22	5.71 to 5.95	5	5Y 2.5/2; As2, Ag1, Sh1, Dh+; Black organic-rich silty clay with detrital plant inclusions; diffuse contact into:
-0.22 to -0.30	5.95 to 6.03		VOID
-0.30 to -0.59	6.03 to 6.32	4	5Y 2.5/1; As2, Ag1, Sh1; Black organic-rich silty clay; sharp contact into:
-0.59 to -0.67	6.32 to 6.40	4	7.5YR 2.5/1; Sh3, Ag1, Dh+; Humo 3; Black well humified unidentifiable silty peat with detrital plant inclusions; unknown contact into:
-0.67 to -0.75	6.40 to 6.48		VOID
-0.75 to -0.99	6.48 to 6.72	2	Gley 1 4/5GY; As2, Ag1, Ga1; Dark greenish grey silty sandy clay; sharp contact into:
-0.99 to -1.37	6.72 to 7.10	2	Gley 1 4/10Y; Ga3, As1, Ag+, DI+; Dark greenish grey clayey sand with silt and detrital wood inclusions; sharp contact into:
-1.37 to -1.57	7.10 to 7.30	1	Gley 1 4/10Y; Gg3, Ga1, Ag+; Dark greenish grey sandy gravel.

Table 2: Lithostratigraphic description of Borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Unit number	Description
5.02 to 1.62	0.00 to 3.40	6	Brown soil and stone fill
1.62 to 1.17	3.40 to 3.85	6	2.5Y 2.5/1; As2 Ag1 Gg1 Ga+; Black silty gravelly clay with a trace of sand. Mortar inclusions and mollusc fragments. Made ground.
1.17 to 1.12	3.85 to 3.95		VOID
1.12 to 0.67	3.90 to 4.35	6	2.5Y 2.5/1; As2 Ag1 Gg1; Black silty gravelly clay with modern brick and mollusc fragments. Made ground.
0.67 to 0.08	4.35 to 4.94		VOID
0.08 to -0.13	4.94 to 5.15	5	5Y 3/1; As2 Ag2; Very dark grey silt and clay. Made ground? Sharp contact with:
-0.13 to -0.33	5.15 to 5.35	5	5Y 2.5/2; As2 Ag1 Sh1; colour silty clay with decomposed organic material. Made ground?
-0.33 to -0.50	5.35 to 5.52		VOID
-0.50 to -0.66	5.52 to 5.68	5	5Y 2.5/2; As2 Ag1 Ga1; Black silty sandy clay. Artificial? horizontal bedding of sand. Mollusc fragments. Made ground? Diffuse contact with:
-0.66 to -0.76	5.68 to 5.78	5	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with a trace of decomposed organic material. Sharp contact with:
-0.76 to -0.90	5.78 to 5.92	4	2.5YR 2.5/1; Sh3 As1 Ga+; Black well humified peat with some clay and a trace of sand. Sharp contact with:
-0.90 to -0.94	5.92 to 5.95	4	5Y 2.5/2; As2 Ag1 Sh1; Black silty clay with decomposed organic material.
-0.94 to -1.08	5.95 to 6.10		VOID
-1.08 to -1.18	6.10 to 6.20	2	5Y 2.5/2; As2 Ag1 Ga1; Black silty sandy clay. Sharp contact with:
-1.18 to -1.31	6.20 to 6.33	2	Various colours; Ga2 As1 Ag1; Silt and clay rounded in to pebble shaped lumps in a sandy matrix. Made ground? Sharp contact with:
-1.31 to -1.53	6.33 to 6.55	2	5Y 2.5/2; As2 Ag1 Ga1; Black silty sandy clay. Appears redeposited. Made ground?

Table 3: Results of the organic matter determinations of Borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Organic matter (%)
From	To	
0.84	0.85	9.64
0.76	0.77	8.38
0.68	0.69	10.63
0.6	0.61	8.98
0.52	0.53	10.94
0.47	0.48	7.09
0.44	0.45	5.20
0.36	0.37	5.12
0.28	0.29	5.47
0.2	0.21	6.52
0.12	0.13	6.06
0.04	0.05	5.41
-0.04	-0.03	6.42
-0.12	-0.11	8.67
-0.2	-0.19	9.53
-0.36	-0.35	8.90
-0.44	-0.43	11.30
-0.52	-0.51	12.63
-0.6	-0.59	39.00
-0.76	-0.75	5.49
-0.84	-0.83	1.36
-0.92	-0.91	1.39
-1	-0.99	1.06
-1.08	-1.07	1.09
-1.16	-1.15	1.12
-1.24	-1.23	0.87
-1.32	-1.31	1.14
-1.4	-1.39	0.90
-1.48	-1.47	0.82

Table 4: Results of the organic matter determinations of Borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Organic matter (%)
From	To	
0.07	0.08	4.93
-0.01	0	5.15
-0.09	-0.08	5.28
-0.17	-0.16	8.05
-0.57	-0.56	12.36
-0.65	-0.64	10.96
-0.73	-0.72	8.04
-0.81	-0.8	21.27
-0.89	-0.88	31.98
-1.13	-1.12	7.94
-1.37	-1.36	4.05
-1.45	-1.44	7.46
-1.53	-1.52	3.71

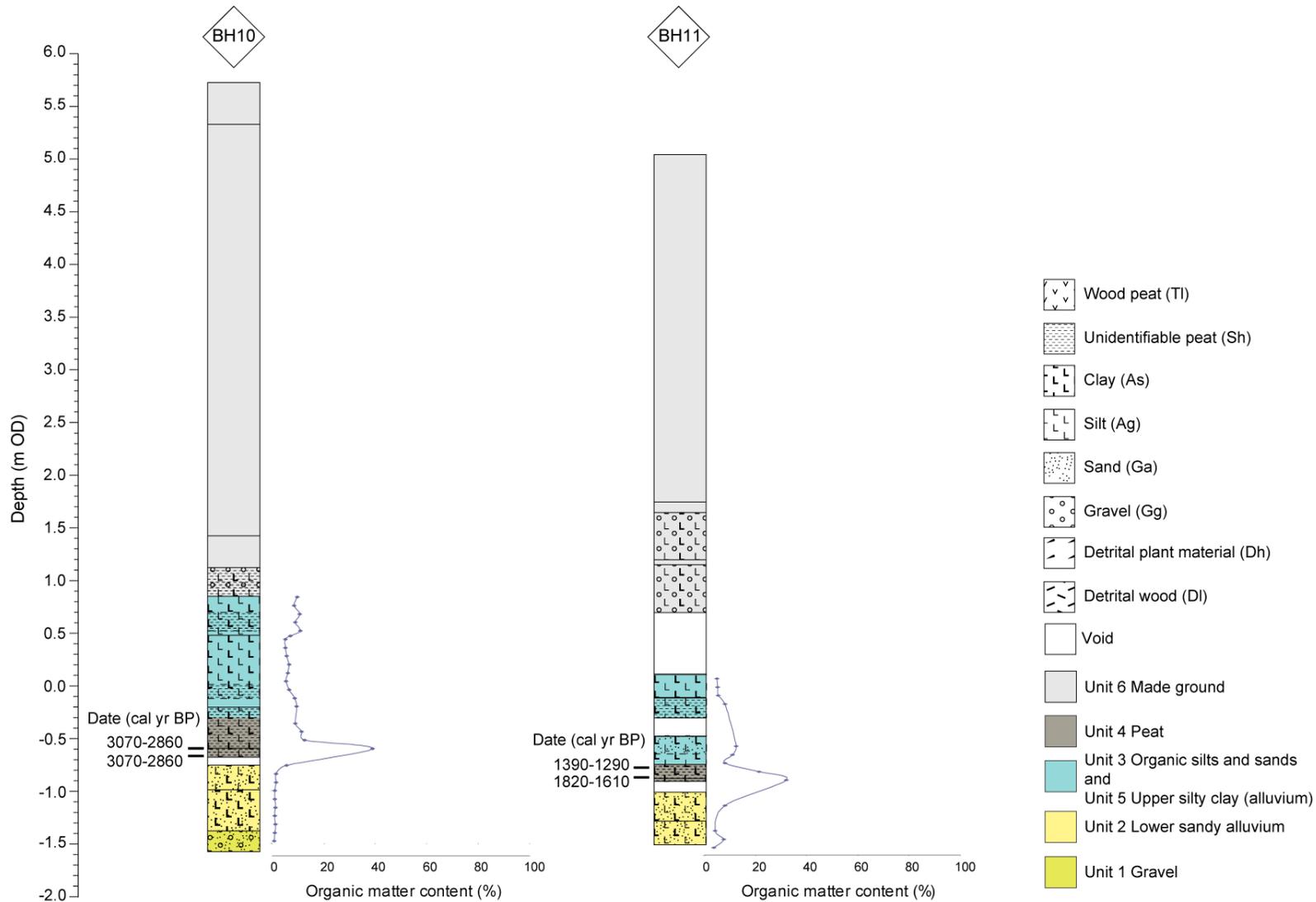


Figure 8: Results of the borehole Q.<BH10> and Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London lithostratigraphic analysis, incorporating lithostratigraphic descriptions and organic matter content, plotted with associated radiocarbon dates

RESULTS AND INTERPRETATION OF THE RADIOCARBON DATING

An unidentifiable twig from the base of the Peat in borehole Q.<BH10> (-0.66m to -0.67m OD) has been radiocarbon dated to 3070 to 2860 cal yr BP, and an *Alnus* sp. twig from the top of the Peat at -0.59m to -0.60m OD has been dated to 3070 to 2860 cal yr BP.

No datable macrofossils (seeds/wood) were present at the top or base of the Peat in borehole Q.<BH11> and thus bulk peat samples were extracted and submitted to the radiocarbon laboratory. Decayed plant remains were extracted from these samples within the radiocarbon laboratory for dating. The basal Peat sample at -0.87m to -0.88m OD has been radiocarbon dated to 1820 to 1620 cal yr BP, and the upper Peat sample at -0.78m to -0.79m OD was radiocarbon dated to 1390 to 1290 cal yr BP.

The $\delta^{13}\text{C}$ (‰) values are consistent with that expected for Peat sediment, and there is no evidence for mineral or biogenic carbonate contamination. The dates indicate that the two Peat units from boreholes Q.<BH10> and Q.<BH11> accumulated at different times. These dates may be equated with the Late Bronze Age cultural period (borehole Q.<BH10>) and Roman to Early Medieval cultural periods (borehole Q.<BH11>).

Table 5: Results of the radiocarbon dating of boreholes Q.<BH10> and Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Laboratory code / Method	Borehole number	Material and location	Depth (m OD)	Uncalibrated radiocarbon years before present (yr BP)	Calibrated age BC/AD (BP) (2-sigma, 95.4% probability)	δ ¹³ C (‰)
Beta-280902 AMS	Q.<BH10>	<i>Alnus</i> sp. twig; top of peat	-0.59 to -0.60	2850 ± 40	1120-910 cal BC (3070-2860 cal BP)	-27.3
Beta-280903 AMS	Q.<BH10>	Unidentifiable twig; base of peat	-0.66 to -0.67	2850 ± 40	1120-910 cal BC (3070-2860 cal BP)	-31.7
Beta-280904 AMS	Q.<BH11>	Decayed plant remains extracted from bulk peat within the radiocarbon laboratory; base of peat	-0.78 to -0.79	1430 ± 40	560-660 cal AD (1390-1290 cal BP)	-27.2
Beta-280905 AMS	Q.<BH11>	Decayed plant remains extracted from bulk peat within the radiocarbon laboratory; base of peat	-0.87 to -0.88	1790 ± 40	130-340 cal AD (1820-1610 cal BP)	-27.3

RESULTS AND INTERPRETATION OF THE POLLEN ASSESSMENT

Fourteen sub-samples from borehole Q.<BH10> and seven sub-samples from borehole Q.<BH11> were extracted for an assessment of pollen content.

Borehole Q.<BH10>

The results of the pollen assessment indicate that no pollen was preserved in the two samples extracted from Unit 2 (Lower Sandy Alluvium).

The pollen concentration and preservation of the five samples from Unit 4 (Peat) was moderate to excellent. The assemblage was dominated by herbaceous taxa including: Poaceae (grass family), Cyperaceae (sedge family), Apiaceae (carrot family), *Rumex* undifferentiated (dock/sorrel), Lactuceae (dandelion family), *Sinapis* type (e.g. white mustard), *Chenopodium* type (e.g. fat hen), *Aster* type (e.g. daisy), *Ranunculus* type (e.g. creeping buttercup), *Plantago lanceolata* (ribwort plantain), *Cereale* type (e.g. wheat). Tree and shrub taxa were limited, but included *Quercus* (oak), *Alnus* (alder), *Pinus* (pine), *Betula* (birch), *Salix* (willow) and *Corylus* type (e.g. hazel). Aquatic and spore taxa were common including *Typha latifolia* (bulrush) and *Sparganium* type (bur-reed); diatoms and dinoflagellate cysts were also noted. The assemblage is indicative of a wet, open environment dominated by herbaceous and aquatic vegetation. The presence of possible cereal pollen, together with ribwort plantain and fat hen is indicative of nearby human activity, although pollen taphonomic issues specifically associated with coastal lowland wetlands (e.g. determining the environment of origin) recommend caution in the interpretation of these taxa. Micro-charcoal was present in low concentrations in all samples.

The pollen assemblage from sample -0.61 to -0.62m OD towards the base of the Peat differs from the others in the Unit as it is dominantly composed of *Alnus* with some *Quercus*, *Ulmus* and *Corylus* type. This assemblage is therefore indicative of wet woodland dominated by alder, with an understorey including sedges and ferns. This change in assemblage suggests drier conditions, and definitive indicators of anthropogenic activity (e.g. cereals) were not noted.

The pollen concentration and preservation of the six samples from Unit 5 (Upper Silty Clay Alluvium) was moderate to excellent. The assemblage was dominated by herbaceous taxa including: Poaceae (grass family), Cyperaceae (sedge family), *Rumex* undifferentiated (dock/sorrel), Lactuceae (dandelion family), *Sinapis* type (e.g. white mustard), *Chenopodium* type (e.g. fat hen), *Aster* type (e.g. daisy), *Ranunculus* type (e.g. creeping buttercup), *Cereale* type (e.g. wheat). Tree and shrub taxa were limited, but included *Quercus* (oak),

Alnus (alder), *Pinus* (pine), *Fraxinus* (ash), *Salix* (willow) and *Corylus* type (e.g. hazel). Aquatic and spore taxa were common including *Typha latifolia* (bulrush), *Sparganium* type (bur-reed), *Elodea* (waterweed), *Dryopteris* type (buckler ferns), and *Sphagnum* (moss); diatoms and dinoflagellate cysts were also noted in many samples. The assemblage is indicative of a wet, open environment dominated by herbaceous and aquatic vegetation. The presence of possible cereal pollen is indicative of nearby human activity, although as stated above, pollen taphonomic issues specifically associated with coastal lowland wetlands (e.g. determining the environment of origin) recommend caution in the interpretation of these taxa. Micro-charcoal was present in all samples.

The pollen concentration of the one sample from Unit 6 (made ground) was low to moderate and preservation good. The assemblage contained *Alnus* (alder), Poaceae (grass family) and *Ranunculus* type (e.g. creeping buttercup) only.

Table 6: Results of the pollen assessment of borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Unit number	Main pollen taxa			Concentration 0 - 5	Preservation 0- 5	Microcharcoal 0 - 5
From	To		Latin name	Common name	Number			
1.22	1.21	6	<i>Alnus</i> <i>Ranunculus</i> type Poaceae <i>Lycopodium clavatum</i>	alder e.g. creeping buttercup grass family clubmoss spike	1 1 4 1	1-2	3-4	1
0.59	0.58	5	<i>Pinus</i> <i>Quercus</i> Poaceae Lactuceae Cyperaceae <i>Sinapis</i> type <i>Chenopodium</i> type <i>Typha latifolia</i> <i>Sphagnum</i> <i>Lycopodium clavatum</i> Dinoflagellate cysts	pine oak grass family dandelion family sedge family e.g. white mustard e.g. fat hen bur-reed sphagnum moss clubmoss spike	2 1 15 6 1 1 1 1 1 78 Present	5	3-4	2-3
0.35	0.34	5	cf <i>Pinus</i> <i>Chenopodium</i> type Poaceae <i>Sinapis</i> type Lactuceae <i>Ranunculus</i> type <i>Lycopodium clavatum</i>	pine e.g. fat hen grass family e.g. white mustard dandelion family e.g. creeping buttercup clubmoss spike	1 1 3 2 1 1 8	2	3-4	2
0.11	0.12	5	<i>Pinus</i> <i>Quercus</i> <i>Alnus</i> <i>Betula</i> <i>Corylus</i> type Poaceae Cyperaceae cf <i>Armeria maritima</i>	pine oak alder birch e.g. hazel grass family sedge family thrift	1 2 2 1 1 7 2 1	4-5	3	1

			<i>Rumex</i> undifferentiated <i>cf Cereale</i> type <i>Sparganium</i> type <i>Dryopteris</i> type <i>Lycopodium clavatum</i>	dock/sorrel e.g. wheat bur-reed buckler ferns clubmoss spike	1 2 1 2 38			
-0.05	-0.06	5	<i>Alnus</i> <i>Quercus</i> <i>Fraxinus</i> <i>Ulmus</i> Poaceae Cyperaceae <i>Cereale</i> type <i>Aster</i> type <i>Cirsium</i> type <i>Rumex</i> undifferentiated <i>Sinapis</i> type <i>Chenopodium</i> type <i>Dryopteris</i> type <i>Lycopodium clavatum</i> Dinoflagellate cyst	alder oak ash elm grass family sedge family e.g. wheat e.g. daisy e.g. spear thistle dock/sorrel e.g. white mustard e.g. fat hen buckler ferns clubmoss spike Present	1 2 1 2 13 3 1 1 1 1 1 2 1 2 25	4-5	3-4	1
-0.13	-0.14	5	<i>Pinus</i> <i>Quercus</i> <i>Alnus</i> <i>Tilia</i> <i>Ulmus</i> <i>Corylus</i> type <i>Salix</i> Poaceae Cyperaceae <i>Cereale</i> type Lactuceae Caryophyllaceae <i>Sparganium</i> type <i>Elodea</i> <i>Lycopodium clavatum</i>	pine oak alder lime elm e.g. hazel willow grass family sedge family e.g. wheat dandelion family pink family bur-reed waterweed clubmoss spike	1 5 2 1 1 1 1 15 7 1 6 1 2 1 43	5	4	1

			Dinoflagellate cysts Diatoms		Present Present			
-0.21	-0.22	5	<i>Alnus</i> cf <i>Quercus</i> Poaceae Cyperaceae Lactuceae <i>Artemisia</i> Aster type cf <i>Lysmachia</i> cf <i>Sinapis</i> type <i>Sparganium</i> type <i>Dryopteris</i> type <i>Lycopodium clavatum</i> Diatoms	alder oak grass family sedge family dandelion family mugwort e.g. sea aster loose strife e.g. white mustard bur-reed buckler ferns clubmoss spike	5 2 1 6 2 1 2 1 1 5 2 8	3-4	3-4	1
-0.37	-0.38	4	<i>Quercus</i> <i>Corylus</i> type <i>Salix</i> <i>Plantago lanceolata</i> cf <i>Cereale</i> type <i>Sinapis</i> type Lactuceae <i>Anthemis</i> type <i>Typha latifolia</i> <i>Dryopteris</i> type <i>Pteridium aquilinum</i> <i>Polypodium vulgare</i> Diatoms	oak e.g. hazel willow ribwort plantain e.g. wheat e.g. white mustard dandelion family e.g. stinking chamomile bulrush buckler ferns bracken polypody	3 1 1 1 3 2 1 1 1 3 1 1 Present	3	4	1
-0.45	-0.46	4	<i>Pinus</i> <i>Alnus</i> <i>Quercus</i> <i>Betula</i> Poaceae Cyperaceae cf <i>Ambrosia</i> type	Pine Alder oak birch grass family sedge family ragweed	2 5 3 1 17 2 1	5	4	1

			<i>Aster</i> type <i>Cereale</i> type <i>Artemisia</i> type <i>Chenopodium</i> type <i>Ranunculus</i> type <i>Rumex</i> undifferentiated Lactuceae <i>Sinapis</i> type <i>Sparganium</i> type <i>Typha latifolia</i> <i>Dryopteris</i> type <i>Lycopodium clavatum</i> Diatoms	e.g. sea aster e.g. wheat mugwort e.g. fat hen e.g. creeping buttercup dock/sorrel dandelion family e.g. white mustard bur-reed bulrush buckler ferns clubmoss spike	3 2 1 2 1 1 3 1 1 1 1 20 Present			
-0.53	-0.54	4	<i>Pinus</i> <i>Quercus</i> Poaceae Cyperaceae <i>Sinapis</i> type cf <i>Cereale</i> type Lactuceae Apiaceae <i>Aster</i> type <i>Rumex</i> undifferentiated <i>Sparganium</i> type <i>Typha latifolia</i> <i>Dryopteris</i> type <i>Sphagnum</i> <i>Lycopodium clavatum</i> Diatoms	Pine Oak Grass family Sedge family e.g. white mustard e.g. wheat dandelion family carrot family e.g. sea aster dock/sorrel bur-reed bulrush buckler ferns sphagnum moss clubmoss spike	3 2 15 2 2 3 6 1 1 1 3 1 4 1 37 Present	5	3-4	1
-0.61	-0.62	4	<i>Alnus</i> <i>Quercus</i> <i>Ulmus</i> <i>Corylus</i> type Cyperaceae <i>Dryopteris</i> type	alder oak elm e.g. hazel sedge family buckler ferns	53 2 1 1 2 2	5	4-5	0

			<i>Lycopodium clavatum</i>		3			
-0.66	-0.67	4	<i>Quercus</i>	oak	1	3	3-4	3
			Poaceae	grass family	9			
			Cyperaceae	sedge family	1			
			Lactuceae	dandelion family	3			
			<i>Galium</i> type	e.g. bedstraw	1			
			<i>Cereale</i> type	e.g. wheat	2			
			<i>Dryopteris</i> type	buckler ferns	1			
			<i>Lycopodium clavatum</i>	clubmoss spike	31			
			Diatoms		Present			
			Dinoflagellate cysts		Present			
-0.93	-0.94	2	<i>Lycopodium clavatum</i>	clubmoss spike	34	0	-	1
-1.17	-1.18	2	<i>Lycopodium clavatum</i>	clubmoss spike	49	0	-	0

Key:

Concentration: 0 = 0 grains; 1 = 1-75 grains, 2 = 76-150 grains, 3 = 151-225 grains, 4 = 226-300, 5 = 300+ grains per slide

Preservation: 0 = none, 1 = very poor, 2 = poor, 3 = moderate, 4 = good, 5 = excellent

Charcoal: 0 = none, 1 = negligible, 2 = occasional, 3 = moderate, 4 = frequent, 5 = abundant

Borehole Q.<BH11>

The results of the pollen assessment indicate that pollen was either preserved in low concentrations or was absent from the three samples extracted from Unit 2 (Lower Sandy Alluvium). The taxa included *Alnus* (alder), *Quercus* (oak), Poaceae (grass family), Cyperaceae (sedge family), cf *Cereale* type (e.g. wheat) and *Dryopteris* type (buckler ferns).

The pollen concentration and preservation of the one sample from Unit 4 (Peat) was low to moderate. The assemblage consisted of 2 *Alnus* (alder) grains, one grain of *Quercus* (oak), *Corylus* type (e.g. hazel), Cyperaceae (sedge family), Lactuceae (dandelion family), *Chenopodium* type (e.g. fat hen), *Aster* type (e.g. daisy), *Ranunculus* type (e.g. creeping buttercup), and four grains of *Dryopteris* type (buckler ferns). The limited assemblage is indicative of a damp, open environment, possibly representing alder carr woodland. Micro-charcoal was present in low concentrations in all samples.

The pollen concentration and preservation of the three samples taken from Unit 5 (upper silty clay alluvium) was moderate to excellent. The assemblage was dominated by herbaceous taxa including: Poaceae (grass family), Cyperaceae (sedge family), Lactuceae (dandelion family), *Sinapis* type (e.g. white mustard), *Chenopodium* type (e.g. fat hen), *Aster* type (e.g. daisy) cf *Armeria* type (thrift) and cf *Cereale* type (e.g. wheat). Tree and shrub taxa were limited, but included *Quercus* (oak), *Alnus* (alder), *Pinus* (pine), *Tilia* (lime), cf *Betula* (birch) and *Corylus* type (e.g. hazel) Aquatic taxa were not recorded, although diatom and dinoflagellate cysts were noted. The assemblage is indicative of a wet, open environment dominated by herbaceous and aquatic vegetation. The presence of possible cereal pollen is indicative of nearby human activity, although as stated above, pollen taphonomic issues specifically associated with coastal lowland wetlands (e.g. determining the environment of origin) recommend caution in the interpretation of these taxa. The possible presence of *Armeria maritima* may also indicate the nearby growth of saline taxa. Micro-charcoal was present in all samples.

Table 7: Results of the pollen assessment of borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Unit number	Main pollen taxa			Concentration 0 - 5	Preservation 0- 5	Microcharcoal 0 - 5
From	To		Latin name	Common name	Number			
-0.01	-0.02	5	<i>Pinus</i>	pine	3	5	4-5	0
			<i>Quercus</i>	oak	5			
			<i>Alnus</i>	alder	1			
			<i>Tilia</i>	lime	1			
			Poaceae	grass family	10			
			Cyperaceae	sedge family	3			
			cf <i>Cereale</i> type	e.g. wheat	2			
			<i>Anthemis</i> type	e.g. stinking chamomile	1			
			<i>Chenopodium</i> type	e.g. fat hen	1			
			<i>Sinapis</i> type	e.g. white mustard	1			
			Lactuceae	dandelion family	2			
			Cf <i>Armeria maritima</i>	thrift	1			
			<i>Dryopteris</i> type	buckler ferns	1			
			<i>Sphagnum</i>	sphagnum moss	2			
			<i>Pteridium aquilinum</i>	bracken	3			
			<i>Lycopodium clavatum</i>	clubmoss spike	20			
			Dinoflagellate cysts		Present			
-0.25	-0.26	5	<i>Pinus</i>	Pine	1	3	3-4	1-2
			<i>Quercus</i>	Oak	1			
			Poaceae	Grass family	1			
			<i>Aster</i> type	e.g. sea aster	1			
			<i>Sinapis</i> type	e.g. white mustard	9			
			Lactuceae	dandelion family	3			
			<i>Dryopteris</i> type	buckler ferns	3			
			<i>Pteridium aquilinum</i>	bracken	2			
			<i>Lycopodium clavatum</i>	clubmoss spike	40			
			cf Dinoflagellate cysts		1			
-0.57	-0.58	5	<i>Pinus</i>	Pine	1	4	4	1
			<i>Alnus</i>	Alder	5			
			<i>Quercus</i>	Oak	2			

			<i>cf Betula</i> <i>Corylus</i> type Poaceae Cyperaceae <i>cf Cereale</i> type <i>Lycopodium clavatum</i> Diatoms	Birch e.g. hazel grass family sedge family e.g. wheat clubmoss spike	1 6 4 2 1 20 Present			
-0.89	-0.90	4	<i>Alnus</i> <i>Quercus</i> <i>Corylus</i> type Cyperaceae <i>Chenopodium</i> type <i>Ranunculus</i> type Lactuceae <i>Dryopteris</i> type <i>Lycopodium clavatum</i>	alder oak e.g. hazel sedge family e.g. fat hen e.g. creeping buttercup dandelion family buckler ferns clubmoss spike	2 1 1 1 1 1 1 4 10	2	4	1
-1.11	-1.12	2	<i>Alnus</i> <i>Dryopteris</i> type <i>Lycopodium clavatum</i>	alder buckler fern clubmoss spike	1 1 3	1	4	1
-1.37	-1.38	2	<i>Lycopodium clavatum</i>	clubmoss spike	1	0	-	1
-1.53	-1.54	2	<i>Quercus</i> <i>Alnus</i> Poaceae Cyperaceae <i>cf Cereale</i> type <i>Dryopteris</i> type <i>Lycopodium clavatum</i>	oak alder grass family sedge family e.g. wheat buckler ferns clubmoss spike	1 2 3 5 1 2 12	2	3	1

Key:

Concentration: 0 = 0 grains; 1 = 1-75 grains, 2 = 76-150 grains, 3 = 151-225 grains, 4 = 226-300, 5 = 300+ grains per slide

Preservation: 0 = none, 1 = very poor, 2 = poor, 3 = moderate, 4 = good, 5 = excellent

Charcoal: 0 = none, 1 = negligible, 2 = occasional, 3 = moderate, 4 = frequent, 5 = abundant

RESULTS AND INTERPRETATION OF THE DIATOM ASSESSMENT

Sub-samples were taken from borehole Q.<BH10> (six samples) and Q.<BH11> (three samples) for the assessment of diatoms. Diatoms were present in all samples from both boreholes. The results of Q.<BH10> are displayed in Tables 8 and 9, and Q.<BH11> are displayed in Tables 10 and 11.

The diatom assemblages at -0.12 to -0.13m OD (Unit 5) in Q.<BH10> and -0.73 to -0.74m OD in Q.<BH11> (Unit 5) have moderate or high numbers of diatoms and the assemblages are, at least in part, moderately well preserved with moderately high species diversity. Only in these two samples is there good potential for percentage diatom counting and analysis. In the remaining seven samples in Q.<BH10> and Q.<BH11> there are low or extremely low numbers of diatoms and the assemblages are very poorly preserved and have low species diversity. In three samples in Q.<BH10> there is no further potential for diatom analysis; in two samples there is low potential for further analysis; and in two samples (Q.<BH10> -0.36 to -0.37m OD (Unit 4) and Q.<BH11> -0.77 to -0.78m OD (Unit 4)) there is only some potential to make a low sum percentage count to characterise the assemblage in further detail.

A significant feature of all nine diatom assemblages assessed from Q.<BH10> and Q.<BH11> is the presence of marine or estuarine diatom taxa such as the estuarine planktonic species *Cyclotella striata*, the mesohalobous benthic diatom *Nitzschia navicularis*, the marine planktonic diatom *Paralia sulcata* and non-planktonic polyhalobous species *Rhaphoneis surirella*. The presence and, in some samples, the common occurrence of these marine and marine-brackish diatoms indicates either an estuarine environment (e.g. Q.<BH11> -0.77 to -0.78m OD (Unit 4)) and in other samples, discounting the possibility of reworking of estuarine sediments, a habitat subject at least to some tidal flooding. In the sample in Q.<BH10> at -0.12 to -0.13m OD (Unit 5) where the epiphytic freshwater diatom *Cocconeis placentula* is common along with some freshwater halophiles (*Rhoicosphaenia curvata*, *Cyclotella meneghiniana*, *Melosira varians*), the common occurrence of *Cyclotella striata* with presence of marine diatoms (*Paralia sulcata*, *Rhaphoneis surirella*) and benthic marine brackish taxa (*Nitzschia navicularis*, *Diploneis didyma*) clearly indicates the influence of tidal water.

Table 8: Summary diatom assessment results borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Unit number	Diatom concentration	Quality of preservation	Diversity	Assemblage type	Potential for % count
From	To						
0.04	0.03	5	Extremely low	Very poor	Low	bk mar fw	None
-0.12	-0.13	5	Moderate	Poor to Moderate	Moderate	fw hal bk mar	Good
-0.36	-0.37	4	Low	Very poor	Moderate	fw hal bk	Some
-0.41	-0.42	4	Extremely low	Very poor	Low	hal bk	None
-0.52	-0.53	4	Low	Very poor/poor	Low to moderate	bk hal fw mar	Low
-0.76	-0.77	2	Extremely low	Extremely poor	Low	bk fw	None

Key: Environment: fw – freshwater, aero- aerophilous, bk – brackish, mar – marine, hal – halophilous)

Table 9: Summary diatom assessment results borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Unit number	Diatom concentration	Quality of preservation	Diversity	Assemblage type	Potential for % count
From	To						
-0.73	-0.74	5	High	Moderate to poor	Moderate	bk fw mar	Good
-0.77	-0.78	4	Low	Poor	Low	bk mar fw aero	Some
-0.93	-0.94	4	Low	Poor	Low	bk fw aero	Low

Key: Environment: fw – freshwater, aero- aerophilous, bk – brackish, mar – marine, hal – halophilous)

Table 10: Taxa identified during the diatom assessment, borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Diatom taxon	Sample depth (m OD)					
	0.04 to 0.03	-0.12 to -0.13	-0.36 to -0.37	-0.41 to -0.42	-0.52 to -0.53	-0.76 to -0.77
Unit number	5	5	4	4	4	2
Polyhalobous						
Paralia sulcata	cf1	1			1	cf1
Rhaphoneis sp.	cf1					
Rhaphoneis surirella		1				
Mesohalobous						
Cyclotella striata	1	2	2	cf1	2	
Diploneis didyma	1	1				1
Nitzschia filiformis					1	
Nitzschia navicularis	1	1		1		
Surirella ovalis					1	
Mesohalobous to Oligohalobous Halophilous						
Cyclotella meneghiniana		1	2		1	
Nitzschia levidensis					1	
Oligohalobous Halophilous to Indifferent						
Melosira varians		1				
Rhoicosphaenia curvata		2	1	1		
Oligohalobous Indifferent						
Amphora libyca			1			
Amphora ovalis					1	
Aulacoseira granulata						1
Cocconeis placentula & var.		3	1		1	1
Cymatopleura solea			1			
Cymbella affinis		1				
Cymbella lanceolata			1			
Cymbella sinuata					1	
Diatoma vulgare			1			
Ellerbeckia arenaria						
Fragilaria brevistriata		1				
Fragilaria mesolepta			1			
Fragilaria pinnata		1			1	
Gomphonema angustatum & var. productum		1				
Navicula capitata		1				
Navicula elginensis			1			
Pinnularia borealis			1			
Stauroneis smithii					1	
Synedra ulna	1		1			
Oligohalobous Indifferent to Halophobous						
Cocconeis pediculus		1				
Unknown Salinity Group						
Cymbella sp.			1			
Diploneis sp.	1			1	1	
Fragilaria sp.					1	
Gomphonema sp.		1				
Gyrosigma sp.	1				1	1
Inderminate centric sp.	1			1		1
Navicula sp.		1	1		1	

Unknown diatom fragment				1		1
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Table 11: Taxa identified during the diatom assessment, borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Diatom taxon	Sample depth (m OD)		
	-0.73 to -0.74	-0.77 to -0.78	-0.93 to -0.94
Unit number	5	4	4
Polyhalobous			
Cymatosira belgica	1		
Paralia sulcata		1	
Podosira stelligera		1	
Rhaphoneis amphiceros		1	
Rhaphoneis surirella		2	
Polyhalobous to Mesohalobous			
Actinoptychus undulatus			1
Mesohalobous			
Cyclotella striata	3	3	3
Diploneis interrupta			1
Nitzschia granulata	1	1	
Nitzschia navicularis	1		1
Surirella ovalis	1		
Oligohalobous Indifferent			
Cocconeis placentula & var.	1		
Cymbella sinuata	1		
Ellerbeckia arenaria			1
Fragilaria construens	1		
Fragilaria construens var. venter	1		
Fragilaria pinnata	1		1
Navicula elginensis	1		
Pinnularia major		cf1	1
Unknown Salinity Group			
Fragilaria sp.			1
Inderminate centric sp.		1	
Thalassiosira sp.	1		
Unknown naviculaceae		1	1

RESULTS AND INTERPRETATION OF THE MACROFOSSIL ASSESSMENT

A total of twelve small bulk samples (8 from borehole Q.<BH10> and 4 from borehole Q.<BH11>) were extracted for the recovery of macrofossil remains including waterlogged plant macrofossils, waterlogged wood, insects and Mollusca (Tables 12 and 13). The samples were focussed on the organic-rich sections of each borehole only.

Borehole Q.<BH10>

The results of an initial assessment indicated that borehole Q.<BH10> contained no charred plant remains (charcoal or wood), bone, magnetic particles or artefacts. Waterlogged plant remains (wood and seeds) were present in moderate to low quantities within all the samples assessed. Whole Mollusca were recorded in low quantities in five of the eight samples assessed, and unidentifiable fragments were present in all but one sample. Insects were recorded in low quantities in five of the eight samples assessed.

Borehole Q.<BH11>

The results of an initial assessment indicated that borehole Q.<BH11> contained no charred plant remains (charcoal or wood), bone, magnetic particles or artefacts. Waterlogged plant remains (wood and seeds) were present in moderate to low quantities within all the samples assessed. Whole Mollusca were absent, but unidentifiable fragments were present in one sample. Insects were recorded in low quantities in two of the four samples assessed.

Table 12: Results of the macrofossil assessment of borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD) / Unit number	Borehole No.	Volume sampled (l)	Size of context sampled (%)	Volume processed (l)	Volume remaining	Fraction (e.g. flot, residue, >300µm)	Charred					Waterlogged		Mollusca		Bone			Insects	Magnetic particles	Artefacts		
							Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Seeds	Chaff	Wood	Seeds	Whole	Fragments	Large	Small	Fragments					
0.63 to 0.53 / 5	Q.<BH10>	0.3	80	0.3	0.0	>1mm	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
						>300µm	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-
0.02 to -0.08 / 5	Q.<BH10>	0.4	80	0.4	0.0	>1mm	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-
						>300µm	-	-	-	-	-	-	1	1	2	-	-	-	1	-	-	-	-
-0.08 to -0.18 / 5	Q.<BH10>	0.4	80	0.4	0.0	>1mm	-	-	-	-	-	1/2	1	-	1	-	-	-	-	-	-	-	-
						>300µm	-	-	-	-	-	-	1	1	2	-	-	-	1	-	-	-	-
-0.18 to -0.21 / 5	Q.<BH10>	0.2	80	0.2	0.0	>1mm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						>300µm	-	-	-	-	-	-	1	-	1	-	-	-	1	-	-	-	-
-0.30 to -0.40 / 4	Q.<BH10>	0.3	80	0.3	0.0	>1mm	-	-	-	-	-	1	1	-	2	-	-	-	-	-	-	-	-
						>300µm	-	-	-	-	-	1	1	1	3	-	-	-	1	-	-	-	
-0.40 to -0.50 / 4	Q.<BH10>	0.5	80	0.5	0.0	>1mm	-	-	-	-	-	2	2	1	1	-	-	-	1	-	-	-	
						>300µm	-	-	-	-	-	-	2	-	2	-	-	-	2	-	-	-	
-0.50 to -0.60 / 4	Q.<BH10>	0.5	80	0.5	0.0	>1mm	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	
						>300µm	-	-	-	-	-	1	1	-	1	-	-	-	1	-	-	-	
-0.60 to -0.67	Q.<BH10>	0.4	80	0.4	0.0	>1mm	-	-	-	-	-	1/2	1/2	-	-	-	-	-	-	-	-	-	

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

The results of the macrofossil rapid assessment indicated that waterlogged plant macrofossils (seeds and wood) were present in all the samples assessed, and thus underwent a more detailed assessment. The results of the borehole Q.<BH10> waterlogged plant macrofossil (seeds and wood) assessment are displayed in Tables 14 and 15; the Q.<BH11> results are displayed in Tables 16 and 17.

Borehole Q.<BH10>

The results of the waterlogged plant macrofossil assessment indicate that seeds were preserved in moderate to high concentrations throughout Unit 4 (peat). In the basal sample (-0.60m to -0.67m OD), the assemblage was dominated by seeds of tree and shrub taxa including *Alnus* (alder), *Sambucas* sp. (elder), *Rubus* sp. (bramble), and possibly *Ilex* sp. (holly). This assemblage indicates the growth of wet woodland and shrubs within the vicinity of borehole Q.<BH10>. The remaining seed assemblage from Unit 4 is dominated by herb and some shrub taxa including: *Rubus* (bramble), *Carex* sp. (various sedges), *Ranunculus* sp. (buttercup), *Chenopodium* sp. (e.g. fat hen), *Silene/Stellaria* sp. (e.g. campion/stitchwort), *Cirsium/Carduus* sp. (thistles) and *Sonchus* sp. (sow thistles) and *Verbascum/Scrophularia* sp (mullein/figwort). This assemblage is indicative of a transition towards an open damp herbaceous community.

The concentration of the seeds in the samples from Unit 5 (upper silty clay alluvium) was very low in samples between -0.18 and 0.02m OD (containing single seeds of *Chenopodium* sp (e.g. fat hen)), and high in sample 0.63m to 0.53m OD. The uppermost sample was dominated by herbaceous seeds including *Ranunculus* cf. *sceleratus* (celery leaved buttercup), *Chenopodium* sp. (e.g. fat hen), *Salvia/Galeopsis* sp. (mint/nettle), cf. *Persicaria* sp. (smartweed), *Rumex/Polygonum* sp. (dock/sorrel/knotweed) and *Rubus* sp. (bramble). This assemblage is indicative of open conditions dominated by herbaceous taxa.

Seed taxa definitively indicative of human activity or saline conditions were not noted during the assessment of samples from borehole Q.<BH10>.

The results of the waterlogged wood assessment indicate that of the small quantity fragments only a few were identifiable. These included *Alnus* sp. (alder), *Corylus/Alnus* sp. (hazel/alder), *Salix/Populus* sp. (willow/poplar) and Rosaceae cf *Rosa* (rose) within Unit 4 (peat), and *Corylus/Alnus* sp. (hazel/alder) in Unit 5 (upper silty clay alluvium).

Table 14: Results of the waterlogged plant macrofossil (seeds) assessment of borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Sample depth (m OD)	Unit number	Latin name	Common name	Number
0.63 to 0.53	5	<i>Rubus</i> sp.	e.g. bramble	1
		<i>Chenopodium</i> sp.	e.g. fat hen	5
		<i>Rumex/Polygonum</i> sp.	dock/sorrel/knotweed	2
		Asteraceae family	e.g. sea aster	4
		<i>Salvia/Galeopsis</i> sp.	mint/nettle	11
		cf. <i>Persicaria</i> sp.	smartweed	1
		<i>Ranunculus</i> cf. <i>sceleratus</i>	cf celery leaved buttercup	55
0.02 to -0.08	5	<i>Chenopodium</i> sp.	e.g. fat hen	1
-0.08 to -0.18	5	<i>Chenopodium</i> sp.	e.g. fat hen	1
-0.30 to -0.40	4	<i>Chenopodium</i> sp.	e.g. fat hen	3
		<i>Carex</i> sp.	e.g. bottle sedge	3
		<i>Carex</i> cf. <i>pilulifera</i>	cf pill sedge	3
-0.40 to -0.50	4	<i>Verbascum/Scrophularia</i> sp.	mullein/figwort	14
		<i>Sonchus</i> sp.	sow thistles	2
		<i>Taraxacum</i> sp.	dandelion	1
		<i>Cirsium/Carduus</i> sp.	thistles	1
		<i>Chenopodium</i> sp.	e.g. fat hen	4
		<i>Silene/Stellaria</i> sp.	e.g. campion/stitchwort	2
		<i>Carex</i> sp.	e.g. bottle sedge	22
<i>Ranunculus</i> sp.	buttercup	8		
-0.50 to -0.60	4	<i>Rubus</i> sp.	e.g. bramble	1
		<i>Chenopodium</i> sp.	e.g. fat hen	1
		<i>Carex</i> sp.	sedge	1
		<i>Carex</i> sp. utricle	sedge	3
		Unknown (cf. <i>Ilex</i> ?)	(cf. holly?)	1
-0.60 to -0.67	4	<i>Alnus</i> sp.	alder	5
		<i>Sambucus</i> sp.	elder	1
		Unknown (cf. <i>Ilex</i> ?)	(cf. holly?)	3
		<i>Rubus</i> sp.	e.g. bramble	10

Table 15: Results of the waterlogged plant macrofossil (wood) assessment of borehole Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Sample depth (m OD)	Unit number	Latin name	Common name	Number
0.63 to 0.53	5	Fragments too small to identify	-	-
0.02 to -0.08	5	Fragments too small to identify	-	-
-0.08 to -0.18	5	<i>Corylus avellana/Alnus glutinosa</i> (all very compressed and distorted, difficult to obtain clean sections so not identified to species)	hazel/alder	3
-0.40 to -0.50	4	Rosaceae. cf <i>Rosa</i> sp.	cf rose	2
		Cf <i>Salix/Populus</i> sp.	cf willow/poplar	3
-0.50 to -0.60	4	cf. <i>Salix/Populus</i> sp.	cf willow/poplar	1
		<i>Corylus/Alnus</i> sp	hazel/alder	1
		<i>Alnus</i> sp. (radiocarbon dated)	alder	1
-0.60 to -0.67	4	<i>Alnus glutinosa</i>	alder	1

		Fragments too small to identify	-	-
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Borehole Q.<BH11>

The results of the waterlogged plant macrofossil assessment indicate that seeds were preserved in low to high concentrations through Unit 4 (peat). The assemblage in all three samples was dominated by herbaceous taxa including: *Silene/Stellaria* sp. (e.g. campion/stitchwort), *Chenopodium* type (e.g. fat hen), *Cirsium/Carduus* sp. (thistles), *Rumex/Polygonum* sp. (dock/sorrel/knotweed) and *Sonchus* sp. (sow thistles). The assemblage is indicative of open conditions dominated by herbaceous taxa.

The results of the waterlogged wood assessment indicate that of the small quantity fragments none were identifiable.

Table 16: Results of the waterlogged plant macrofossil (seeds) assessment of borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Sample depth (m OD)	Unit number	Latin name	Common name	Number
-0.76 to -0.78	4	<i>Chenopodium</i> sp.	e.g. fat hen	5
		<i>Silene/Stellaria</i> sp.	e.g. campion/stitchwort	25
		<i>Sonchus</i> sp.	sow thistle	1
		<i>Cirsium/Carduus</i> sp.	thistle	9
		<i>Rumex/Polygonum</i> sp.	dock/sorrel/knotweed	3
-0.86 to -0.88	4	<i>Silene/Stellaria</i> sp.	e.g. campion/stitchwort	5
		<i>Chenopodium</i> sp.	e.g. fat hen	7
		Asteraceae family	e.g. sea aster	5
-0.88 to -0.93	4	<i>Silene/Stellaria</i> sp.	e.g. campion/stitchwort	2

Table 17: Results of the waterlogged plant macrofossil (wood) assessment of borehole Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Sample depth (m OD)	Unit number	Latin name	Common name	Number
-0.78 to -0.86	4	Fragments too small to identify	-	-
-0.88 to -0.93	4	Wood anatomy too poorly preserved to identify		1

RESULTS AND INTERPRETATION OF THE INSECT ASSESSMENT

The results of the macrofossil rapid assessment indicated that insects were recorded in low quantities in seven of the eight samples assessed from borehole Q.<BH10> and two of the four samples assessed from Q.<BH11>. These samples underwent a more detailed assessment, the results of which are displayed in Tables 18 and 19.

Borehole Q.<BH10>

The samples from borehole Q.<BH10> (Table 16) generally contained too few insect remains to allow a detailed reconstruction of the local conditions. Combined, the assemblages from all samples simply indicate the presence of standing fresh water. The exception to this was sample -0.40 to -0.50m OD (Unit 4; Peat) which contained a sufficient diversity to allow a more detailed reconstruction of the environment at that time. The faunal assemblage from the sample indicates an interesting mixture of terrestrial and aquatic taxa. The ground beetles (Carabidae) identified from the assemblage include *Clivina fossor*, a predator that lives on damp, open ground, burrowing in clayey soil to find prey. *Trechus quadristriatus* is also an open-ground species, but it prefers dry, sandy substrates. *Bembidion biguttatum* lives in swamps and damp grasslands, and is often riparian.

The rove beetle (Staphylinae) fauna from the assemblage also includes riparian and upland taxa. *Arpedium quadrum* lives in the same habitats as *Bembidion biguttatum*. *Bibloporus bicolour* is a woodland predator, living under the rotting bark of oak (*Quercus*), beech (*Fagus*), elm (*Ulmus*), and some conifers. *Anotylus rugosus* preys on maggots in dung, rotting vegetation, and mouldering leaves. The leaf beetle (Chrysomelidae) fauna includes two aquatic leaf beetle taxa: *Plateumaris* that lives on reeds in shallow fresh water, and *Prasocuris phellandrii*, that feeds on a variety of aquatic plants that grow in shallow, still waters. *Lema cyanella* feeds on thistles and other plants in damp to dry meadows.

The weevil (Curculionidae and Eirrhinidae) fauna also includes both terrestrial and aquatic taxa. The larvae of *Tournotaris bimaculatus* develop in the stems of *Typha latifolia* (bulrush). The adults live in the riparian zone, feeding on a variety of emergent vegetation, including sedges, reeds, and rushes. *Tanysphyrus lemnae* feeds on duckweed (*Lemna*) in still, shallow water. Finally, *Sitona suturalis* feeds on vetches (*Vicia* spp.) in meadows and woodland margins.

Taken together, the fauna indicates upland environments with old-growth deciduous woodland and meadows that range from dry to moist. There is no indication of running water,

but pools, ponds or lakes of freshwater were surrounded by rich riparian and emergent vegetation.

Borehole Q.<BH11>

The two samples from borehole Q<BH11> (Table 17) contained too few insect remains to allow a reconstruction of the local conditions. However, *Hydrobius fuscipes* only lives in fresh (not brackish) water, and thus this fauna indicates freshwater conditions within the local vicinity.

Table 18: Results of the insect assessment of boreholes Q.<BH10>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Taxon	Depth (m OD)						
	0.02 to -0.08	-0.08 to -0.18	-0.18 to -0.21	-0.30 to -0.40	-0.40 to -0.50	-0.50 to -0.60	-0.60 to -0.67
Unit number	5	5	4	4	4	4	4
COLEOPTERA							
<u>Carabidae</u>							
<i>Clivina fossor</i> (L.)					1		
<i>Trechus quadristriatus</i> Schr.					1		
<i>Bembidion biguttatum</i> (F.)					1		
<i>Bembidion</i> spp.					1		
<i>Pterostichus</i> sp.					1		
<u>Helophoridae</u>							
<i>Helophorus nubilus</i> F.					1		
<i>Helophorus</i> spp.	1		1		1	1	1
<u>Hydrophilidae</u>							
<i>Hydrobius fuscipies</i> (L.)							
<i>Cercyon</i> sp.			1		1		
<i>Megasternum concinnum</i> (Marsh.)					1		
<u>Staphylinidae</u>							
<i>Arpedium quadrum</i> (Grav.)					1		
<i>Bibloporus bicolour</i> (Denny)			1				
<u>Aleocharinae</u> sp. indet.					1		
<i>Anotylus rugosus</i> (Fab.)					1		
<i>Lathrobium</i> spp.	1			1	1		
<i>Xantholinus</i> sp.				1			
<u>Elateridae</u>							
Genus et sp. indet.					1		
<u>Latridiidae</u>							
<i>Corticaria</i> sp.		1					
<u>Chrysomelidae</u>							
<i>Plateumaris</i> sp.				1			1

<i>Lema cyanella</i> (L.)						1	
<i>Prasocuris phellandrii</i> (L.)						1	
<u>Apionidae</u>							
<i>Apion</i> sp.						1	
<u>Eirrhinidae</u>							
<i>Tournotaris bimaculatus</i> (F.)						1	
<u>Curculionidae</u>							
<i>Tanysphyrus lemnae</i> (Payk.)						1	
<i>Sitona suturalis</i> Steph.						1	
Genus et sp. indet.	1					1	
TRICHOPTERA							
<u>Limnephilidae</u>							
Genus et sp. indet.		1	1	1		1	1
DIPTERA							
<u>Chironomidae</u>							
Genus et sp. indet.		1	1				

Table 19: Results of the insect assessment of boreholes Q.<BH11>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Taxon	Depth (m OD)	
	-0.76 to -0.78	-0.78 to -0.84
Unit number	4	4
COLEOPTERA		
<u>Carabidae</u>		
<i>Pterostichus</i> sp.	1	
<u>Hydrophilidae</u>		
<i>Hydrobius fuscipies</i> (L.)		1

RESULTS AND INTERPRETATION OF THE MOLLUSCA ASSESSMENT

The results of the macrofossil rapid assessment indicated that Mollusca were recorded in low quantities in five of the eight samples assessed, and unidentifiable fragments were present in all but one sample from Q.<BH10>. Whole Mollusca were absent, but unidentifiable fragments were present in one sample from Q.<BH11>. The five samples from Q.<BH10> underwent a more detailed assessment, the results of the which are displayed in Tables 20.

Borehole Q.<BH10>

The results of the Mollusca assessment indicate that small numbers of *cf Valvata cristata/piscinalis* were recorded in four of the samples. These species are all indicative of freshwater conditions. *Cf Pelecypoda* (bivalves) were recorded in the lowermost sample.

Table 20: Results of the Mollusca assessment of borehole Q.<BH10> Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)		Unit number	Mollusca species	Number	Environment
From	To				
0.02	-0.08	5	<i>cf Valvata cristata</i> Unidentified	1 7	Freshwater -
-0.08	-0.18	5	<i>cf Valvata piscinalis</i> <i>cf Valvata cristata</i>	1 1	Freshwater Freshwater
-0.30	-0.40	4	<i>cf Valvata cristata</i> Unidentified	1 1	Freshwater -
-0.40	-0.50	4	<i>Cf Pelecypoda</i> (bivalve)	11	Varied

DISCUSSION AND CONCLUSIONS

The aim of the environmental archaeological assessment was to evaluate the potential of the sedimentary sequences for reconstructing the environmental history of the site and its environs, and specifically to: (1) identify evidence of change or continuity through time; (2) establish whether any significant spatial variability exists across the site, and (3) to detect evidence of human activity. An assessment of two cores was carried out from boreholes Q.<BH10> and Q.<BH11> as they contained significant alluvial and organic-rich horizons, and were located distally on the site.

The results of the lithostratigraphic descriptions indicate that boreholes Q.<BH10> and Q.<BH11> contain the same sequence of deposits with Shepperton Gravel overlain by a sequence of Holocene alluvial sediments (including Peat), truncated by Made Ground. The Peat was thin in both boreholes (<40cm), located at a similar elevation (-6.40 to -6.03m OD in borehole Q.<BH10>; -5.95 to -5.78m OD in borehole Q.<BH11>), and of similar organic composition (up to 40% organic-rich) indicating frequent influxes of mineral-rich sediment during its formation. Significantly however, the results of the radiocarbon dating indicate that the two peat units are different in age; peat formation apparently commenced and ceased between 3070-2860 cal BP (Late Bronze Age) in borehole Q.<BH10> and between 1820-1610 and 1390-1290 cal BP (Roman to Medieval Period) in borehole Q.<BH11>. It is also significant that the base of the peat in the Jubilee Line Canada Water sequence to the south of the site is dated to 4280-3690 cal yr BP (Sidell *et al.*, 2000). Combined these radiocarbon dated sequences indicate the formation of different peat units that become progressively younger from north to south across the site, and towards the position of the present day River Thames. The processes that led to the formation of these apparently different aged peats are at present unknown, but the following possibilities are suggested:

- (1) The Peat units have formed within individual, small depositional basins across the site at different times. The fact that the Lower Sandy Alluvium (Unit 2) rises between boreholes Q.<BH10> and Q.<BH11> supports this suggestion (Figure 6).
- (2) A small tributary channel to the Thames may have traversed the site. The different Peat units could thus represent the infill of abandoned channels as the watercourse migrated over time.
- (3) If a small watercourse did traverse the site, it is possible that Peat was scoured from upstream and deposited within pockets of the undulating Upper Sandy Alluvium further downstream (Figure 6).
- (4) The radiocarbon dated wood macrofossils and decayed plant macrofossils were derived from an external source. The high mineral content of the Peat indicates it was subject to frequent inwash events, and thus the plant remains may be detrital. However the

consistency of the dates in Q.<BH10> and correct stratigraphic order of the dates in Q.<BH10> suggests this was not the case.

In order to resolve which is the most likely explanation for the formation of the differently aged peat units, further geochronological investigations of the assessment boreholes and other collected boreholes will be necessary (see recommendations below).

Q.<BH10>

The combined results of the archaeobotanical (pollen, waterlogged wood and seeds) and zooarchaeological (diatoms, insects and Mollusca) records from borehole Q.<BH10> indicate that little can be said about the environmental conditions during the deposition of Unit 2 (Lower Sandy Alluvium), other than that the diatom record indicates the presence of fresh and brackish water conditions.

However, during the accumulation of the Peat (Unit 4), the pollen, waterlogged plant macrofossil and insect records indicate the initial growth of wetland woodland dominated by alder with some oak, elm, elder, hazel and bramble, before a transition towards open, possibly meadow-like conditions dominated by herbaceous and aquatic taxa. During the period of peat formation, the insect and Mollusca records indicate the local presence of standing freshwater (e.g. ponds), surrounded by rich riparian and emergent vegetation, and the diatom record indicates that the site was subject to fresh, and brackish water inundation. At this time (3070-2860 cal BP; Late Bronze Age) the Lower Thames Valley was experiencing an increase in the rate of relative sea level rise, and thus a saline (estuarine) influence at the site is not unexpected.

During the deposition of Unit 5 (Upper Clayey Alluvium), the combined records indicate the presence of wet and open conditions dominated by herbaceous and aquatic vegetation. The diatom and Mollusca records indicate a combination of freshwater, brackish and marine taxa indicative of deposition in an estuarine environment. Throughout the period of Peat and Upper Clayey Alluvium accumulation, the pollen record indicates possible human activity within the local area.

The sequence from Q.<BH10> is similar to that recorded at the Jubilee Line Canada Water site, despite the dates not being contemporaneous. Alder woodland dominated the wetland, and mixed deciduous woodland dominated the dryland during the early stages of Peat formation, prior to a transition towards wetter and more open conditions according to the pollen record. The diatom record indicates that the area was subject to estuarine inundation from the Late Bronze Age/Early Iron Age until the Post-Medieval period (Sidell *et al.*, 2000).

Q.<BH11>

The archaeobotanical and zooarchaeological assemblage is more limited in borehole Q.<BH11>, and thus only a tentative environmental reconstruction can be made. No waterlogged plant macrofossils (seeds and wood), insects or diatoms were preserved in Unit 2 (Lower Sandy Alluvium), but a limited pollen assemblage suggests the local growth of wetland trees, shrubs and herbs.

During the accumulation of the Peat (Unit 4) and Upper Silty Alluvium (Unit 5), the pollen and plant macrofossil assemblage indicates a damp and open environment dominated by herbaceous vegetation. The diatom and insect records indicate a combination of fresh, brackish and marine water conditions, suggestive of an estuarine influence. Throughout the period of Peat and Upper Clayey Alluvium accumulation, the pollen record indicates possible human activity within the local area.

The limited sequence from Q.<BH11> appears to have similarities to the upper part of the sequences from borehole Q.<BH10> and the Jubilee Line site (Sidell *et al.*, 2000). However, there is no indication of wetland woodland or mixed deciduous woodland at the base of the sequence, which would reflect the later date of this sequence.

RECOMMENDATIONS

The results of the environmental archaeological assessment have revealed that archaeobotanical and zooarchaeological remains are sufficiently well preserved in the sedimentary sequences of boreholes Q.<BH10> and Q.<BH11> to reconstruct the environmental history of the site and its environs, and thus further work is justified. It is recommended that this environmental archaeological analysis should consist of:

- (1) Pollen analysis on the Q.<BH10> sequence to enhance our understanding of the environmental changes through the Peat and Upper Clayey Alluvium units, and to confirm the identification of anthropogenic (*Cereale* type) and saline (*Armeria maritima*) indicators
- (2) Identification of the unknown and uncertain plant macrofossil taxa in boreholes Q.<BH10> and Q.<BH11>
- (3) Identification of the unknown and uncertain Mollusca in borehole Q.<BH10>
- (4) Diatom analysis of those horizons with a suitable concentration and preservation of remains
- (5) One radiocarbon date from the centre of each peat unit in boreholes Q.<BH10> and Q.<BH11> to confirm the results of the assessment rangefinder radiocarbon dates

In addition, the most significant finding made during the Canada Water assessment was the differently aged peat horizons across the site. In order to resolve the most likely explanation for their formation, further environmental archaeological investigations of two further boreholes is recommended. Both boreholes are different to those previously reserved for further analysis (boreholes Q.<BH5> and Q.<BH12>), but have been selected for very specific reasons:

- (1) Q.<BH2> is located further north of Q.<BH11>, and investigations are recommended to see if the peat continues to become younger towards the position of the present day Thames.
- (2) Q.<BH9> is located nearby to the Q.<BH10> and Jubilee Line Canada Water site (Sidell *et al.*, 2000); investigations are recommended within this borehole to see how the dates compare.

On both boreholes, a full environmental investigation is recommended to incorporate radiocarbon dating (top and base of Unit 4), pollen, diatoms, waterlogged plant macrofossils (seeds and wood), insects and Mollusca.

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APPENDIX 1: BOREHOLE DETAILS

QUEST borehole details, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Quest borehole number	Easting	Northing	Height at surface (m OD)
Q.<BH1>	535556.669	179713.64	5.05
Q.<BH2>	535548.29	179694.953	5.28
Q.<BH3>	535533.579	179689.228	5.18
Q.<BH4>	535527.778	179672.58	5.00
Q.<BH5>	535532.938	179651.507	5.10
Q.<BH6>	535523.23	179633.025	5.61
Q.<BH7>	535517.021	179612.997	6.31
Q.<BH8>	535507.862	179586.165	6.06
Q.<BH9>	535485.889	179566.27	5.85
Q.<BH10>	535474.559	179551.176	5.74
Q.<BH11>	535542.577	179652.01	5.02
Q.<BH12>	535521.077	179621.989	5.99
Q.<BH13>	535498.79	179597.408	4.30
Q.<BH14>	535477.921	179579.946	5.96

RSA borehole details, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London (RSA Geotechnics Ltd, 2009a, b)

RSA borehole/test-pit number	Easting	Northing	Height at surface (m OD)
R.BH1*	535580.8	179689.34	5.47
R.BH2	535551.96	179711.73	5.28
R.BH3	535550.34	179662.03	5.49
R.BH4	535497.5	179645.49	5.69
R.BH5	535548.01	179633.92	5.73
R.BH6*	535540.09	179592.04	6.49
R.BH7	535492.61	179575.77	5.75
R.BH8	535460.8	179559.34	5.76
R.BH9	535489.35	179537.69	5.93

* - Borehole not included in the deposit modelling process – see geological context for explanation

Estimated ArchaeoScape borehole details (Batchelor and Branch, 2008)

ArchaeoScape borehole number	Easting	Northing	Height at surface (m OD)
A.2	535566	179531	ca. 5.9
A.3	535542	179504	ca. 6.3
A.4	535544	179540	ca. 5.75
A.7*	535602	179554	ca. 5.9
A.8	535523	179519	ca. 5.3

* - Borehole not included in the deposit modelling process – see geological context for explanation

APPENDIX 2: QUATERNARY SCIENTIFIC BOREHOLE RECORDS

Lithostratigraphic description of Borehole Q.<BH1>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.05 to 4.05	0.00 to 1.00	Dark brown topsoil and stone fill
4.05 to 1.55	1.00 to 3.50	Grey soil and stone fill
1.55 to 1.30	3.50 to 3.75	5Y 4/2; As2 Ag1 Ga1; Dark greyish brown silty sandy clay. Sand lenses. Made ground. Diffuse contact with:
1.30 to 1.10	3.75 to 3.95	5Y 3/1; As3 Ag1 DI+; Very dark grey silty clay with traces of detrital material. Made ground.
1.05 to 0.60	4.00 to 4.45	5Y 2.5/1; As2 Ag1 Ga1 Sh+ Dh+; Black silty, sandy clay with traces of detrital herbaceous material and decomposed organic material. Pocket of peat (Sh3 Th ² 1) at 0.75 to 0.73. Made ground.
0.55 to 0.25	4.50 to 4.80	5Y 2.5/1; As 2 Ag1 Gg1; Black silty gravelly clay with modern brick fragments and charcoal. Made ground.
0.20 to -0.15	4.85 to 5.20	5Y 3/1; As3 Ag1 Ga+; Very dark grey silty clay with a trace of sand.
-0.15 to -0.37	5.20 to 5.42	5Y 4/1; As2 Ga1 Ag1; Dark grey sandy silty clay. Sharp contact with:
-0.37 to -0.60	5.42 to 5.65	5Y 3/2; As3 Ag1 Ga+; Very dark grey silty clay with a trace of sand.
-0.65 to -1.10	5.70 to 6.15	5Y 3/2; As3 Ag1 Dh+ Ga+; Dark olive grey silty clay with traces of detrital herbaceous material and sand.
-1.35 to -1.80	6.40 to 6.85	5Y 2.5/2; As3 Ag1 Ga+; Black silty clay with a trace of sand. Sandy beds at -1.49 and -1.55m OD.
-1.85 to -2.30	6.90 to 7.35	5Y 3/1; As3 Ag1 DI+ Ga+; Very dark grey silty clay with traces of detrital herbaceous material and sand. Sand-sized mollusc fragments throughout.
-2.30 to -2.95	7.35 to 8.00	5Y 3/1; Gg3 Ga1 Ag+; Very dark grey slightly silty sandy gravel.

Lithostratigraphic description of Borehole Q.<BH2> Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.28 to 4.78	0.00 to 0.50	Brown topsoil and stone fill
4.78 to 2.28	0.50 to 3.00	Brick and concrete rubble
2.18 to 2.13	3.10 to 3.15	VOID
2.13 to 1.89	3.15 to 3.39	5Y 4/1; As2 Ga1 Ag1 Dh+; Dark grey silty sandy clay. Made ground. Sharp contact with:
1.89 to 1.87	3.39 to 3.41	5Y 4/4; Ga3 As1; Olive clayey sand. Made ground. Diffuse contact with:
1.87 to 1.80	3.41 to 3.48	5Y 5/1; As2 Ag1 Ga1; Grey silty sandy clay. Made ground. Sharp contact with:
1.80 to 1.73	3.48 to 3.55	5Y 4/2; As2 Ag1 Ga1 Dh+; Olive grey silty sandy clay. Made ground.
1.68 to 1.74	3.60 to 3.66	VOID
1.74 to 1.28	3.66 to 4.00	5Y 4/2; As2 Ag1 Ga1 Dh+; Dark greyish brown silty sandy clay. Made ground.
1.28 to 1.33	4.00 to 4.05	VOID

1.18 to 0.93	4.10 to 4.35	5Y 4/2; Ga2 As2 Dh+; Olive grey sand and clay. Made ground.
0.93 to 0.59	4.35 to 4.69	5Y 2.5/1; As2 Ga2; Black sandy clay. Made ground
0.59 to 0.48	4.69 to 4.80	5Y 2.5/1; As3 Sh1; Black clay with decomposed organic material. Coal and modern brick inclusions. Made ground
0.88 to 0.43	4.80 to 4.85	5Y 2.5/2; As2 Ag1 Ga1; Black silty sandy clay with concrete 0.48 to 0.43. Mortar and brick throughout. Made ground.
0.28 to -0.17	5.00 to 5.45	2.5Y 2.5/1; As4 Ag+ Sh+; Black clay with a trace of silt.
-0.22 to -0.52	5.50 to 5.80	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with traces of decomposed organic material. Diffuse contact with:
-0.52 to -0.64	5.80 to 5.92	5Y 2.5/2; As2 Ag1 Sh1; Black silty clay with decomposed organic material. Diffuse contact with:
-0.64 to -0.67	5.92 to 5.95	2.5YR 2.5/1; Sh2 Ag1 As1; Black well humified disintegrated organic material with silt and clay
-0.82 to -1.12	6.10 to 6.40	VOID
-1.12 to -1.27	6.40 to 6.55	5Y 2.5/2; Sh2 As2; Black well humified disintegrated organic material and clay.
-1.33 to -1.77	6.60 to 7.05	5Y 3/2; As2 Ag1 Ga1 DI+; Dark olive grey silty sandy clay with a trace of detrital wood. Large wood macrofossil -1.38 to -1.58.
-1.82 to -1.91	7.10 to 7.19	5Y 3/2; As3 Ag1 Ga+; Dark olive grey silty clay with a trace of sand. Sharp contact with:
-1.91 to -1.99	7.19 to 7.27	2.5YR 2.5/1; Sh3 TI ¹ ; Black well humified disintegrated organic material and wood peat. Diffuse contact with:
-1.99 to -2.07	7.27 to 7.35	5Y 3/2; As3 Ag1 Ga+; Dark olive grey silty clay with a trace of sand. Diffuse contact with:
-2.07 to -2.22	7.35 to 7.50	5Y 2.5/2; As2 Ag1 Gg1 Ga+; Black silty gravelly clay. Sharp contact with:
-2.22 to -2.27	7.50 to 7.55	5Y 4/2; Ga2 As2 Ag+; Olive grey clay and sand with a trace of silt.
-2.27 to -2.72	7.55 to 8.00	5Y 3/1; Gg3 Ga1 Ag+; Very dark grey slightly silty sandy gravel.

Lithostratigraphic description of Borehole Q.<BH3> Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.18 to 2.28	0.00 to 2.90	Dark grey brown soil and stone fill
2.28 to 1.08	2.90 to 4.10	Yellow green gravel and sand
0.98 to 0.73	4.20 to 4.45	5Y 2.5/2; Gg2 Ga1 Ag1; Black sandy silty gravel. Mottled 5Y 4/3 olive. Clasts 5 to 25mm. Made ground. Sharp contact with:
0.73 to 0.53	4.45 to 4.65	2.5Y 2.5/1; As2 Ag1 Ga1 Sh+; Black silty sandy clay with slag? inclusions. Made ground.
0.68 to 0.23	4.50 to 4.95	2.5Y 2.5/1; As3 Ag1 Ga+ Gg+; Black silty clay with traces of sand and gravel. Clasts 2-3mm. Made ground.
0.18 to 0.15	5.00 to 5.03	VOID
0.15 to -0.12	5.03 to 5.30	5Y 3/1; As3 Ag1 Sh+; Very dark grey silty clay with traces of decomposed organic material. Mollusc fragments.
-0.12 to -0.57	5.30 to 5.75	Gley 2 2.5/10G; As2 Ag2 Ga+; Greenish black clay and silt with traces of sand.
-0.62 to -0.65	5.80 to 5.83	VOID
-0.65 to -1.00	5.83 to 6.18	Gley 1 3/5GY; As2 Ag2 Ga+; Very dark greenish grey silt and

		clay with traces of sand. Mollusc fragments.
-1.00 to -1.07	6.18 to 6.25	VOID
-1.57 to -1.89	6.75 to 7.07	5Y 2.5/2; As3 Ag1 Dh+ Ga+; Black clay with some gravel and traces of detrital herbaceous material and sand. Sharp contact with:
-1.89 to -2.02	7.07 to 7.20	5Y 2.5/2; As3 Ga1 Dh+; Black sandy clay with traces of detrital herbaceous material.
-2.07 to -2.52	7.25 to 7.70	5Y 2.5/1; As2 Ag1 Ga1 Gg+; Black silty sandy clay with a trace of gravel.

Lithostratigraphic description of Borehole Q.<BH4> Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.00 to 3.70	0.00 to 1.30	Brown soil and stone fill
3.70 to 2.00	1.30 to 3.00	Yellow gravel and sand with some clay, trace of peat at 3.00m
1.25 to 0.80	3.75 to 4.20	2.5Y 3/1; As3 Ag1 Sh+; Very dark grey silty clay with a trace of decomposed organic material.
0.80 to 0.75	4.20 to 4.25	2.5Y 3/1; As3 Ag1 Sh+; Very dark grey silty clay with a trace of decomposed organic material.
0.75 to 0.30	4.25 to 4.70	5Y 2.5/1; As3 Ag1 Ga+ Dh+; Black silty clay with traces of detrital herbaceous material and sand.
0.25 to 0.23	4.75 to 4.77	VOID
0.23 to 0.11	4.77 to 4.89	2.5Y 3/1; As2 Ag1 Sh1 DI+; Very dark grey silty clay with decomposed organic material and detrital wood. Diffuse contact with:
0.11 to -0.20	4.89 to 5.20	Gley 1 3/10GY; As2 Ga1 Ag1 DI+ Dh+; Very dark greenish grey silty sandy clay with detrital wood and herbaceous material.
-0.20 to -0.30	5.20 to 5.30	Gley 1 3/10GY; As2 Ga1 Ag1 DI+ Dh+; Very dark greenish grey silty sandy clay with detrital wood and herbaceous material.
-0.43 to -0.63	5.43 to 5.63	Gley 1 2.5/10Y; As2 Ag1 Ga1 Gg+; Greenish black silty sandy clay. Diffuse contact with:
-0.63 to -0.70	5.63 to 5.70	Gley 1 4/5GY; Ga2 Ag1 As1; Dark greenish grey silty clayey sand.
-0.70 to -1.00	5.70 to 6.00	Gley 1 4/5GY; Ga2 Ag1 Gg1; Dark greenish grey silty sand with gravel.

Lithostratigraphic description of Borehole Q.<BH5>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.10 to 2.60	0.00 to 2.50	Grey topsoil and brick
2.60 to 1.70	2.50 to 3.40	Brown clayey soil and stone fill
1.60 to 1.15	3.50 to 3.95	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with a trace of decomposed organic material.
0.60 to 0.15	4.50 to 4.95	5Y 2.5/2; Gg2 As1 Ag1; Black silty clayey gravel. Clasts 20-50mm. Some mollusc fragments.
0.10 to -0.35	5.00 to 5.45	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with a trace of decomposed organic material.

-0.40 to -0.85	5.50 to 5.95	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with a trace of decomposed organic material.
-0.90 to -1.35	6.00 to 6.45	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with a trace of decomposed organic material.
-1.35 to -1.39	6.45 to 6.49	VOID
-1.39 to -1.59	6.49 to 6.69	5Y 2.5/1; As3 Ag1 Sh+; Black silty clay with a trace of decomposed organic material. Diffuse contact with:
-1.59 to -1.61	6.69 to 6.71	2.5YR 2.5/1; Sh2 As1 Ag1; Black well humified peat with silt and clay. Sharp contact with:
-1.61 to -1.80	6.71 to 6.90	Gley 1 4/5GY; Ga2 Ag1 As1 DI+; Dark greenish grey silty clayey sand.
-1.80 to -2.25	6.90 to 7.35	5Y 2.5/2; Ga2 As1 Ag1 Gg+; Black clayey silty sand with a trace of gravel.
-2.25 to -2.40	7.35 to 7.50	5Y 2.5/2; Ga2 Gg2; Black sand and gravel.

Lithostratigraphic description of Borehole Q.<BH6>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.61 to 5.21	0 to 0.40	Concrete/brick and stone fill
5.21 to 4.41	0.40 to 1.20	Brown mottled clay fill with brick
4.41 to 3.61	1.20 to 2.00	Brownish black ashy clay fill with brick
3.61 to 0.91	2.00 to 4.70	Brownish grey mottled silty clay with brick
0.91 to 0.19	4.70 to 5.42	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; diffuse contact into:
0.19 to -0.50	5.42 to 6.11	5Y 3/2; As3, Ag1, Sh+, DI+; Dark olive grey silty clay with organic and detrital wood inclusions; diffuse contact into:
-0.50 to -0.84	6.11 to 6.45	Gley 1 3/10Y; Ga2, Ag1, As1, DI+, Dh+; Very dark greenish grey silty clayey sand with detrital wood and plant inclusions; diffuse contact into:
-0.84 to -1.10	6.45 to 6.71	Gley 1 3/10Y; Ga2, Ag1, As1, DI+, Dh+, Gg+; Very dark greenish grey silty clayey sand with gravel, detrital wood and plant inclusions; sharp contact into:
-1.10 to -1.74	6.71 to 7.35	5Y 4/2; Ga4, Ag+, Dh+; Olive grey sand with silt and detrital plant inclusions; diffuse contact into:
-1.74 to -2.19	7.35 to 7.80	5Y 4/2; Ga3, Gg1, Ag+; Olive grey gravelly sand with silt inclusions.

Lithostratigraphic description of Borehole Q.<BH7>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
6.31 to 4.81	0 to 1.50	Compact brown clay fill with brick and concrete
4.81 to 4.31	1.50 to 2.00	Black ash and brick fill
4.31 to 3.11	2.00 to 3.20	Brown sand and gravel fill
3.11 to 2.81	3.20 to 3.50	Firm brown/grey silty alluvial clay
2.81 to 2.56	3.50 to 3.75	5YR 2.5/1; Sh2, As1, Ag1, DI/TI+; Black very organic-rich silty clay with detrital wood inclusions; sharp contact into:
2.56 to 2.41	3.75 to 3.90	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; sharp contact into:
2.41 to 2.36	3.90 to 3.95	2.5YR 2.5/1; Humo 3; Black well humified unidentifiable silty

		peat; Redeeposited?;
2.36 to 2.21	3.95 to 4.10	5YR 2.5/1; Sh2, Ag1, As1, Dh+; Black very organic-rich silty clay with detrital plant inclusions; sharp contact into:
2.21 to 1.91	4.10 to 4.40	5Y 3/1; As3, Ag1, Sh+, mortar+; Very dark grey silty clay with organic and mortar inclusions; diffuse contact into:
1.91 to 1.01	4.40 to 5.30	2.5Y 2.5/1; As3, Ag1, Sh, brick+, mortar+; Black silty clay with organic, brick and mortar inclusions; diffuse contact into:
1.01 to 0.21	5.30 to 6.10	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; diffuse contact into:
0.21 to 0.01	6.10 to 6.30	5Y 3/2; As4, Ag+, Sh+; Dark olive grey clay with silt and organic inclusions; sharp contact into:
0.01 to -0.06	6.30 to 6.37	7.5YR 2.5/1; Sh2, As1, Ag1; Black very organic-rich silty clay; sharp contact into:
-0.06 to -0.29	6.37 to 6.60	5Y 2.5/2; Ga1, Ag1, As1, DI1, Sh+, Dh+; Black silty sandy clay with detrital wood and with organic and detrital plant inclusions; diffuse contact into:
-0.29 to -0.41	6.60 to 6.72	VOID
-0.41 to -0.74	6.72 to 7.05	Gley 1 4/5GY; Ga1, Ag1, As1, DI1, Sh+, Dh+, Gg+; Dark greenish grey silty sandy clay with detrital wood and with organic, detrital plant and gravel inclusions; diffuse contact into:
-0.74 to -0.87	7.05 to 7.18	VOID
-0.87 to -1.12	7.18 to 7.43	Gley 1 4/5GY; Ga2, As1, Ag1; Dark greenish grey silty clayey sand; diffuse contact into:
-1.12 to -1.24	7.43 to 7.55	Gley 1 4/5GY; Ga4, Ag+; Dark greenish grey sand with silt inclusions; diffuse contact into:
-1.24 to -1.69	7.55 to 8.00	Gley 1 4/5GY; Ga3, Ag1, As+, DI+; Dark greenish grey silty sand with clay and detrital wood inclusions.

Lithostratigraphic description of Borehole Q.<BH8>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
6.06 to 5.76	0 to 0.30	Compact brick and concrete fill
5.76 to 4.06	0.30 to 2.00	Brown mottled clay fill with concrete and brick
4.06 to 2.86	2.00 to 3.20	Brown sand and gravel fill
2.86 to 2.56	3.20 to 3.50	Soft/firm brown silty peaty alluvial clay (suspected fill)
2.56 to 2.40	3.50 to 3.66	5Y 2.5/2; Sh2, Ag1, As1; colour very organic-rich silty clay; sharp contact into:
2.40 to 2.24	3.66 to 3.82	5Y 3/2; Ag2, As2, Sh+; Very dark grey silty clay with organic inclusions; sharp contact into:
2.24 to 2.12	3.82 to 3.94	7.5YR 2.1/1; Sh2, As1, Ag1, DI+; colour very organic-rich silty clay with detrital wood inclusions; diffuse contact into:
2.12 to 1.90	3.94 to 4.16	7.5YR 2.1/1; Sh2, As1, Ag1, Ga+, Dh+; colour very organic-rich silty clay with sand and detrital plant inclusions; sharp contact into:
1.90 to 1.66	4.16 to 4.40	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; sharp contact into:
1.66 to 1.43	4.40 to 4.63	7.5YR 2.5/1; Sh2, Ag1, As1, Dh+; Black very organic-rich silty clay with detrital plant inclusions; sharp contact into:
1.43 to 1.34	4.63 to 4.72	5Y 3/1; Ag2, As1, Sh1; Very dark grey organic-rich clayey silt; sharp contact into:
1.34 to 1.29	4.72 to 4.77	7.5YR 2.5/1; Sh2, Ag1, As1, Dh+; Black very organic-rich silty

		clay with detrital plant inclusions; sharp contact into:
1.29 to 1.11	4.77 to 4.95	5YR 3/1; Ag2, As1, Sh1; Very dark grey organic-rich clayey silt; Redeposited Alluvium?; sharp contact into:
1.11 to 0.94	4.95 to 5.12	7.5YR 2.5/1; As1, Ag1, Sh1, Gg1, mortar+, brick+; Black organic rich silty clay and gravel with brick and mortar inclusion; Made Ground?; diffuse contact into:
0.94 to 0.26	5.12 to 5.80	5Y 2.5/1; As3, Ag1, Sh+; Black silty clay with organic-rich inclusions; unknown contact into:
0.26 to 0.11	5.80 to 5.95	VOID
0.11 to -0.19	5.95 to 6.25	7.5YR 2.5/1; As2, Ag1, Sh1, Dl+, Dh+; Black organic-rich silty clay with detrital wood and plant inclusions; unknown contact into:
-0.19 to -0.24	6.25 to 6.30	VOID
-0.24 to -0.59	6.30 to 6.65	5Y 4/2; Ga3, Ag1; Olive grey silty sand; diffuse contact into:
-0.59 to -0.99	6.65 to 7.05	5Y 4/2; Ga4, Ag+; Olive grey sand with silt inclusions; sharp contact into:
-0.99 to -1.09	7.05 to 7.15	5Y 4/2; Ga3, Ag1; Olive grey silty sand; diffuse contact into:
-1.09 to -1.41	7.15 to 7.47	2.5Y 2.5/1; Ga4, Ag+, Gg+; Black sand with silt and gravel inclusions; diffuse contact into:
-1.41 to -1.44	7.47 to 7.50	2.5Y 2.5/1; Ga2, Gg2; Black sandy gravel.

Lithostratigraphic description of Borehole Q.<BH9>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.85 to 5.25	0 to 0.60	Compacted clayey stone and brick rubble fill
5.25 to 4.85	0.60 to 1.00	Concrete
4.85 to 3.85	1.00 to 2.00	Brown mottled clay fill with brick and concrete
3.85 to 3.05	2.00 to 2.80	Brown clay fill with brick
3.05 to 0.85	2.80 to 5.00	Brown sand and gravel fill
0.85 to 0.35	5.00 to 5.50	Firm brown/grey peaty silt
0.35 to -0.01	5.50 to 5.86	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; unknown contact into:
-0.01 to -0.10	5.86 to 5.95	VOID
-0.10 to -0.42	5.95 to 6.27	2.5 3/1; As2, Sh1, Ag1; Very dark grey organic-rich silty clay; sharp contact into:
-0.42 to -0.55	6.27 to 6.40	2.5Y 3/1; Sh1, Ag1, As1, Dh1; Very dark grey organic-rich silty clay with detrital plant remains; unknown contact into:
-0.55 to -0.65	6.40 to 6.50	VOID
-0.65 to -0.85	6.50 to 6.70	7.5YR 2.5/1; Sh2, Ag1, As1; Black very organic-rich silty clay; unknown contact into:
-0.85 to -0.90	6.70 to 6.75	VOID
-0.90 to -1.03	6.75 to 6.88	2.5Y 3/1; Ga2, Sh1, Ag1, Dl+; Very dark grey organic-rich silty sand with detrital wood inclusions; sharp contact into:
-1.03 to -1.43	6.88 to 7.28	Gley 1 4/10Y; Ga2, Ag1, As1, Dl+, Dh+, Gg+; Dark greenish grey sand (with some bedding) with silt and clay, and with traces of gravel, detrital wood and plant remains; sharp contact into:
-1.43 to -1.65	7.28 to 7.50	Gley 1 4/10Y; Ga4, Gg+; Dark greenish grey sand with gravel inclusions; sharp contact into:
-1.65 to -1.70	7.50 to 7.55	Gley 1 4/5GY; Ga3, Ag1; Dark greenish grey silty sand.
-1.70 to -2.15	7.55 to 8.00	Gley 1 4/5GY; Gg3 Ga1 Ag+; Dark greenish grey sandy

		gravel with a trace of silt.
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Lithostratigraphic description of Borehole Q.<BH12>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.99 to 4.29	0 to 1.70	Compact stone and clay fill with concrete and brick
4.29 to 3.99	1.70 to 2.00	Brown sand and gravel fill
3.99 to 0.49	2.00 to 5.50	Grey/brown silty alluvial clay fill with brick
0.49 to -0.42	5.50 to 6.41	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusion; sharp contact into:
-0.42 to -0.39	6.41 to 6.44	2.5YR 2.5/1; Sh3, Ag1, As+, Th+; Humo 3; Black well humified silty unidentifiable peat with herbaceous peat inclusions.
-0.39 to -0.56	6.44 to 6.55	VOID
-0.56 to -0.66	6.55 to 6.65	10YR 3/1; Sh2, Ag1, As1, Ga+, Dl+, Dh+; Very dark grey organic-rich silty clay with sand, detrital wood and detrital plant inclusions; diffuse contact into:
-0.66 to -1.12	6.65 to 7.17	Gley 1 4/10Y; Ga1, As1, Ag1, Dh1, Sh+; Dark greenish grey silty clayey sand with detrital plant remains and with organic inclusions; diffuse contact into:
-1.12 to -1.51	7.17 to 7.50	Gley 1 4/10Y; Ga2, As1, Ag1, Dh+; Dark greenish grey Dark greenish grey silty clayey sand with detrital plant inclusions; diffuse contact into:
-1.51 to -2.31	7.50 to 8.30	Gley 1 4/10Y; Ga2, As1, Ag1, Dh+, Dl+; Dark greenish grey silty clayey sand with detrital wood and plant inclusions; diffuse contact into:
-2.31 to -2.46	8.30 to 8.45	Gley 1 4/10Y; Ga3, Gg1; Dark greenish grey gravelly sand.

Lithostratigraphic description of Borehole Q.<BH13>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
6.30 to 6.00	0 to 0.30	Compact stone/brick and concrete fill
6.00 to 4.10	0.30 to 2.20	Brown mottled clayey brick and concrete fill
4.10 to 2.10	2.20 to 4.00	Brown sand and gravel fill
2.10 to 1.60	4.00 to 4.50	Firm brown mottled silty alluvial clay (suspected fill)
1.60 to 1.20	4.50 to 5.10	5YR 3/1; As3, Ag1, Gg+, Sh+, Dl+; Very dark grey silty clay with gravel, organic and detrital wood inclusions; sharp contact with
1.20 to 0.90	5.10 to 5.40	2.5Y 2.5/1; As2, Sh1, Gg1, brick+, slag+, shell fragments+; Black organic-rich gravelly clay with brick, slag and shell fragment inclusions; Made Ground?; unknown contact into:
0.90 to 0.45	5.40 to 5.85	5YR 3/1; As3, Ag1, Sh+, brick+, mortar+; Very dark grey silty clay with organic, brick and mortar inclusions; Made Ground?; unknown contact into:
0.45 to 0.23	5.90 to 6.07	5YR 3/1; As3, Ag1, Sh+, CaCO ₃ +; Very dark grey silty clay with organic inclusions and calcium carbonate nodules at 6.00 to 6.04m bgs; diffuse contact into:
0.23 to -0.10	6.07 to 6.40	VOID
-0.10 to -0.26	6.40 to 6.56	2.5Y 3/2; As3, Ag1, Sh+, Dh+, Ga+; Very dark greyish brown silty clay with organic, detrital wood and sand inclusions;

		unknown contact into:
-0.26 to -0.70	6.56 to 7.00	5Y 3/2; Ga2, Ag1, As1, Dh+, Gg+, Ag+; Dark olive grey clayey silty sand; sharp contact into:
-0.70 to -1.50	7.00 to 7.80	5Y 3/2; Ga3, As1, shell+, Dh+; Dark olive grey clayey sand with small shell fragments and detrital wood inclusions; diffuse contact into:
-1.50 to -1.60	7.80 to 7.90	5Y 3/2; Ga3, As1, shell+, Dh+, Gg+; Dark olive grey clayey sand with small shell fragments, detrital wood and gravel inclusions; diffuse contact into:

Lithostratigraphic description of Borehole Q.<BH14>, Site A2 to Site A4, Canada Water, Surrey Quays Road, Rotherhithe, London

Depth (m OD)	Depth (bgs)	Description
5.96 to 5.66	0 to 0.30	Compact stone, brick and concrete
5.66 to 4.46	0.30 to 1.50	Brown mottled silty clay fill with concrete and brick
4.46 to 1.46	1.50 to 4.50	Brown sand and gravel fill
1.46 to 1.26	4.50 to 4.70	Firm grey/black silty alluvial clay
1.26 to 1.12	4.70 to 4.84	2.5Y 2.5/1; As2, Ag1, Gg1; Black silty gravelly clay; Made Ground?; unknown contact into:
1.12 to 1.00	4.84 to 4.96	VOID
1.00 to 0.81	4.96 to 5.15	5YR 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; sharp contact into:
0.81 to 0.71	5.15 to 5.25	5YR 3/1; Gg3, Ga1; Very dark grey sandy gravel; Fall in?; sharp contact into:
0.71 to 0.39	5.25 to 5.57	5Y 3/1; As3, Ag1, Sh+; Very dark grey silty clay with organic inclusions; diffuse contact into:
0.39 to 0.16	5.57 to 5.80	5Y 2.5/1; As3, Ag1, Sh+; Black silty clay with organic inclusions; sharp contact into:
0.16 to 0.01	5.80 to 5.95	7.5YR 2.5/1; Sh2, Ag1, As1; Black very organic-rich silty clay; unknown contact into:
0.01 to -0.04	5.95 to 6.00	VOID
-0.04 to -0.26	6.00 to 6.22	2.5Y 2.5/1; Ga1, Sh1, Ag1, As1, Dh+, DI+; Black organic-rich silty sandy clay; sharp contact into:
-0.26 to -0.44	6.22 to 6.40	5Y 2.5/1; As3, Ag1, Ga+, DI+; Black silty clay with sand and detrital wood inclusions; sharp contact into:
-0.44 to -0.51	6.40 to 6.45	Gley 1 3/10Y; As2, Ag1, Ga1; Very dark greenish grey silty sandy clay; diffuse contact into:
-0.51 to -0.74	6.45 to 6.70	Gley 1 3/10Y; Ga3, Ag1, As+; Very dark greenish grey silty sand with clay inclusions; sharp contact into:
-0.74 to -0.83	6.70 to 6.79	Gley 1 4/10Y; As2, Ag1, Ga1; Very dark greenish grey silty sandy clay; diffuse contact into:
-0.83 to -1.04	6.79 to 7.00	Gley 1 3/10Y; Ga3, Ag1, As+, DI+; Very dark greenish grey silty sand with clay inclusions; diffuse contact into:
-1.04 to -1.37	7.00 to 7.33	Gley 1 3/10Y; Ga3, Ag1, As+, DI+, Gg+; colour silty sand with clay and gravel inclusions; diffuse contact into:
-1.37 to -1.49	7.33 to 7.45	Gley 1 3/10Y; Ga2, Gg2; colour sandy gravel.