A REPORT ON THE GEOARCHAEOLOGICAL BOREHOLE INVESTIGATIONS AND DEPOSIT MODELLING ON LAND AT CANNING TOWN REGENERATION AREA 7/1C, LONDON BOROUGH OF NEWHAM (NGR: TQ 539610 181443)

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INTRODUCTION

This report summarises the findings arising out of the deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at Canning Town Regeneration Area 7/1C, London Borough of Newham (National Grid Reference: TQ 539610 181443; Figure 1). Previous geotechnical site-investigation works by RSA Geotechnics Ltd (2010) and geoarchaeological investigations in the present study have resulted in a total of three geoarchaeological boreholes, nine geotechnical boreholes and six trial pits being put down at the site between May 2010 and April 2012.

The site is in the lower valley of the River Lea to the east of the river and close to the confluence of the Lea with the River Thames. The western boundary of the site is only ca. 150m from the present-day channel of the Lea at a point where the river, known here as Bow Creek, follows a very convoluted meandering course. The mouth of Bow Creek, at its confluence with the Thames, lies about 0.6km to the south of the site. The modern ground surface within the site was recorded between 1.83m and 2.60m OD with a mean value for eight readings of 2.07m OD. However, these levels are the product of ground-raising associated with the introduction of made ground and an average thickness of 1.87m of made ground is present across the site. The top of the natural alluvium was recorded between -0.1m and 0.48m OD, with an average value for eight records of 0.22m OD. The British Geological Survey (1:50,000 Sheet 257 Romford 1996) shows the site underlain by Alluvium, described as comprising mainly sand, silt and clay with some gravel, resting on London Clay bedrock. In fact, the Holocene alluvium of the Lower Thames and its tributaries is almost everywhere underlain by Late Devensian Late Glacial Gravels (in the Thames valley, the Shepperton Gravel of Gibbard, 1985, 1994; in the Lea valley, the Lea Valley Gravel of Gibbard, 1994), and this gravel is widely recorded in boreholes in the vicinity of Canning Town (see below).

The site lies within the area that has been investigated in the Lea Valley Mapping Project (Corcoran *et al.,* 2011). In this project the Lea Valley has been divided into Landscape Zones

characterised by their Holocene landscape history based largely on sedimentary evidence derived from borehole records. The Canning Town site is close to the southern, downstream, end of Landscape Zone LZ1.1a which '…represents the deepest part of the floodplain of the Lea at its southernmost extent...'.

Corcoran *et al.,* (2011 p.48) describe the deposit characteristics of Landscape Zone LZ1.1 in the following terms:

'The alluvial deposits are commonly clayey and generally ca. 4m thick, with some silts and sands within the alluvium but with only very occasional evidence of peat. The surface of the floodplain gravel (Lea Valley Gravel) undulates between ca. -3 and -5m OD. The deposit sequence is consistent with in-channel sediments, suggesting that the zone has always been an area of active channels. Consequently marginal marshland and wetland deposits did not develop across the zone, and where such environments did take hold, channel activity and river scour are likely to have eroded these deposits.'

In discussing the archaeological and palaeoenvironmental potential of Landscape Zone LZ1.1, Corcoran *et al.* (2011 p.49) note that although borehole data is good for this part of the lower Lea valley (their Figure 15 indicates between 40 and 50 borehole records within their Landscape Zone LZ1.1a), '…only four archaeological interventions have taken place, leading to a lack of cultural evidence in general and contributing to the lack of dating evidence available for the zone.'

Although Corcoran *et al.* (2011) believe that the chance of significant archaeological or palaeoenvironmental evidence surviving in their Landscape Zone LZ1.1 is low, it should be noted that such evidence has been recorded at localities within a half kilometre radius from the present site, e.g. at Dock Road (GLHER/ELO7446) immediately to the south of the Canning Town site, where a radiocarbon date from organic material in alluvial silts indicated deposition in the Late Neolithic or Early Bronze Age; and at Fords Park Road (GLHER/ELO10265) ca. 0.5km directly to the east of the Canning Town site where evidence of Mesolithic and Bronze age occupation was identified on an upstanding 'island' of sandy sediment. It should also be recognised that although the examination of the borehole evidence by Corcoran *et al.* (2011) appears to have been thoroughly comprehensive (in total over 2000 BGS borehole records were incorporated into the Lea Valley Mapping Project database), the distribution of these boreholes is very uneven (see Corcoran *et al.* 2011 Figure 15) relative to the scale of the variability that characterises the Holocene alluvial sequence and the surface of the Lea Valley and Shepperton Gravels on which it rests.

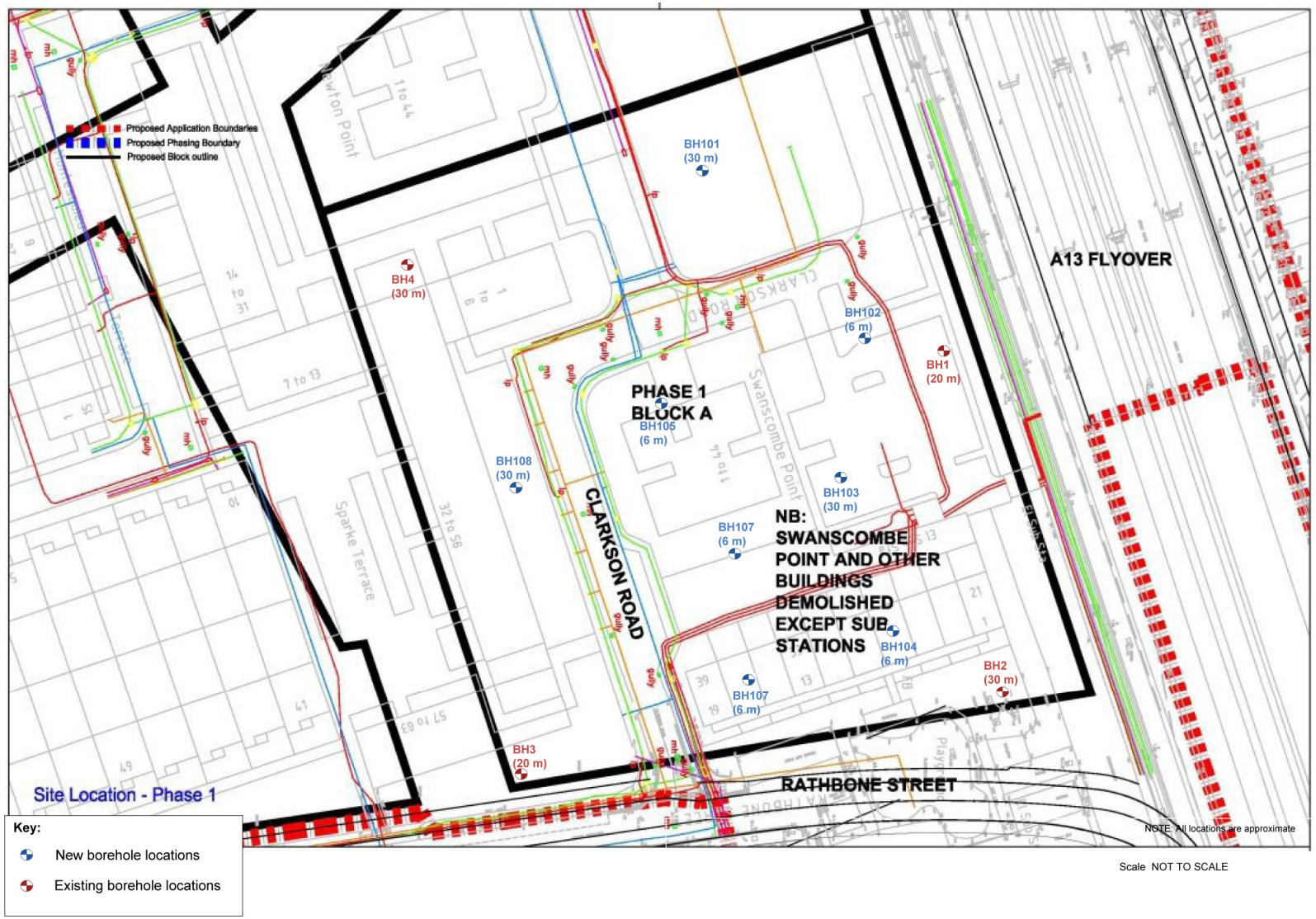

Figure 1: Approximate locations of the twelve geoarchaeological/geotechnical boreholes at Canning Town Regeneration Area 7/1C (Trial Pits TP1 to TP6 and BGS boreholes used in the deposit model not shown). Reproduced from RPS (2010).

METHODS

Lithostratigraphic descriptions

The lithostratigraphy of boreholes (BH101, BH104A and BH107) was 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) (Tröels-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 displayed in Tables 1 to 3.

Deposit modelling

The deposit model was based on the three geoarchaeological boreholes described in the laboratory, sediment logs from an additional 9 geotechnical boreholes and six trial pits (RPS, 2010) put down within the site during the present investigation, supplemented by logs from nine historic boreholes within or close to the site and available from the BGS archive.

Sedimentary units from the boreholes were classified into three groupings: (1) Lea Valley Gravel; (2) Holocene Alluvium and (3) Made Ground. The classified data for groups 1-3 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 the Lea Valley Gravel and Holocene Alluvium (Figures 2 and 3). The thickness of the Holocene Alluvium was also modelled (also using a nearest neighbour routine) (Figure 4).

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. In particular, it is important to recognise that two 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 three boreholes

described in the laboratory (BH101, BH104A and BH107) represent the most detailed record of the sediment sequences.

RESULTS AND INTERPRETATION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS AND DEPOSIT MODELLING

Only four stratigraphic units could be recognised in the sediments underlying the site:

Unit 4: Made Ground
Unit 3: Holocene Alluvium
Unit 2: Lea Valley Gravel
Unit 1: London Clay

Deposit Modelling

Modelling of Unit 3 (Holocene Alluvium) is based on sediment logs from three geoarchaeological boreholes, nine geotechnical boreholes and six trial pits put down within the site during the present investigation, supplemented by logs from nine historic boreholes within or close to the site and available from the BGS archive. Some of these BGS logs are recorded in less detail than those from the recent geotechnical boreholes and in the following account specific values for OD height and unit thickness are based exclusively on data from the geotechnical boreholes. The arrangement of Unit 3 (Holocene Alluvium) has been modelled as two contoured surfaces representing the contacts at the top of the Holocene alluvium and the top of the Lea Valley Gravel (base of the Holocene Alluvium). The surface of the Lea Valley Gravel (Figure 2) appears to be highest across the south of the site, rising there to -0.5m OD. Further north within the site the gravel surface is uneven between -1.22m (Borehole BH106) and -2.81m OD (Borehole BH107), there are however no topographic features recognisable as relief elements such as bars or channels that typically characterise the surface of the Late Glacial gravels elsewhere in the Thames valley. In the wider view the gravel surface falls away to the SW towards the axis of the valley and the modern channel of the Lea.

The surface of the Holocene Alluvium (Figure 3) is more even that the surface of the Lea Valley Gravel and lies mainly between 0.2m and 0.8m OD, generally slightly higher in the southern half of the site. These levels are probably close to the level of the natural floodplain in this part of the Thames valley, and there are no obvious signs of significant truncation of the alluvial sequence prior to the emplacement of the made ground. Pedological features are recorded in the upper part of several of the Holocene alluvial sequences (see below). The contours of the alluvial surface show that an important effect of Holocene sedimentation has

been to infill any depressions in the underlying gravel surface and eventually to bury it completely and create a generally level floodplain surface. It follows that the thickness of the Holocene alluvium can be expected to vary in relation to the topographic inequalities of the underlying gravel. That this is the case is shown in Figure 4 which maps the thickness of the alluvium, showing however that the variation across the site in the thickness of the alluvium is not large. Greater thicknesses, from 1.5m to 2.5m are generally in the northern half of the site, and notably in Boreholes BH103 and BH107, which record the lowest points in the surface of the Lea Valley Gravel (respectively -2.65m and -2.81m OD) and the thickest Holocene alluvial sequence (respectively 2.5m and 2.4m). Near the southern boundary of the site where the Lea Valley Gravel rises closer to the modern ground surface, the alluvium is thinner, generally less than 1.5m.

Table 1: Lithostratigraphic description of borehole BH101, Canning Town Regeneration Area 7/1C, London Borough of Newham.

Depth (m)	Depth (m OD)	Description
1.90 to 2.40	0.12 to -0.38	10YR 5/2; Ag2 As2; greyish brown silt and clay with iron staining throughout. Diffuse contact in to:
2.40 to 3.50	-0.38 to -1.48	2.5Y 3/1; Ag4 As+ Dl+ Dh+; very dark grey silt with traces of clay, detrital wood and detrital herbaceous material. Diffuse contact in to:

Table 2: Lithostratigraphic description of borehole BH104A, Canning Town Regeneration Area 7/1C, London Borough of Newham.

Depth (m)	Depth (m OD)	Description
1.80 to 2.40	0.11 to -0.49	10YR 5/2; Ag2 As2; greyish brown silt and clay with iron staining throughout. Diffuse contact in to:
2.40 to 3.50	-0.49 to -1.59	2.5Y 3/1; Ag3 As1 Dl+ Dh+; very dark grey clayey silt with traces of detrital wood and detrital herbaceous material.
3.50 to 3.83	-1.59 to -1.92	2.5Y 3/1; Ag3 As1 Dl+ Dh+ Ga+; very dark grey clayey silt with traces of detrital wood and detrital herbaceous material; occasional very thin fine sand beds. Diffuse contact in to:
3.83 to 3.87	-1.92 to -1.96	7.5YR 4/2; Ga2 Ag1 As1; brown silty clayey sand.

Table 3: Lithostratigraphic description of borehole BH107, Canning Town Regeneration Area 7/1C, London Borough of Newham.

Depth (m)	Depth (m OD)	Description
1.90 to 2.40	0.09 to -0.49	10YR 4/1; Ag3 As1; dark grey clayey silt passing in to 10YR 3/1 very dark grey clayey silt. Diffuse contact in to:
2.40 to 3.60	-0.49 to -1.61	2.5Y 3/1; Ag4 As+; very dark grey silt with a trace of clay. Diffuse contact in to:
3.60 to 4.20	-1.61 to -2.21	2.5Y 3/1; Ag2 As2; very dark grey silt and clay. Diffuse contact in to:
4.20 to 4.70	-2.21 to -2.71	2.5Y 3/1; Ag3 As1; very dark grey clayey silt.

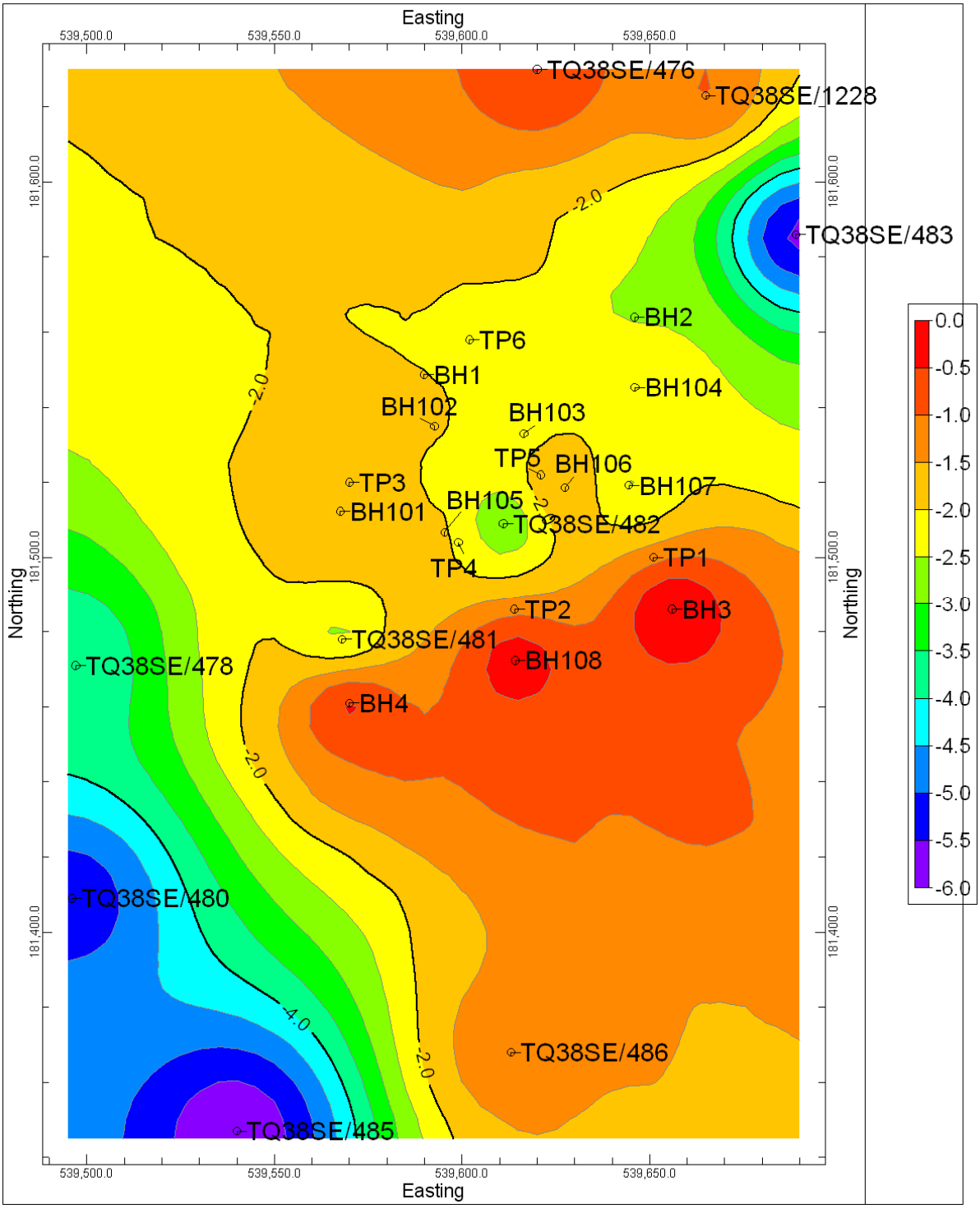

Figure 2: Modelled surface of the Lea Valley Gravel (contour heights in metres OD).

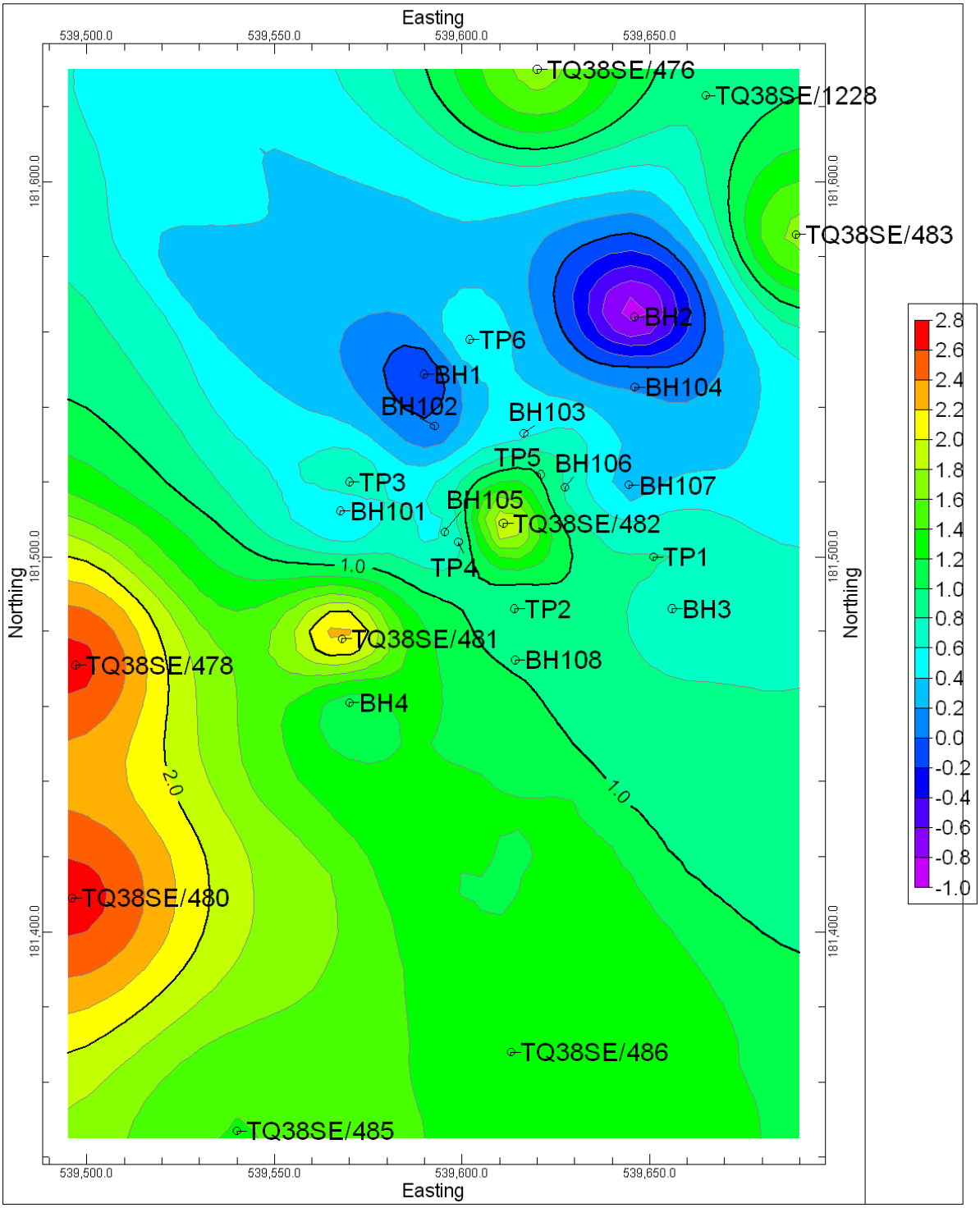

Figure 3: Modelled surface of the Holocene Alluvium (contour heights in metres OD).

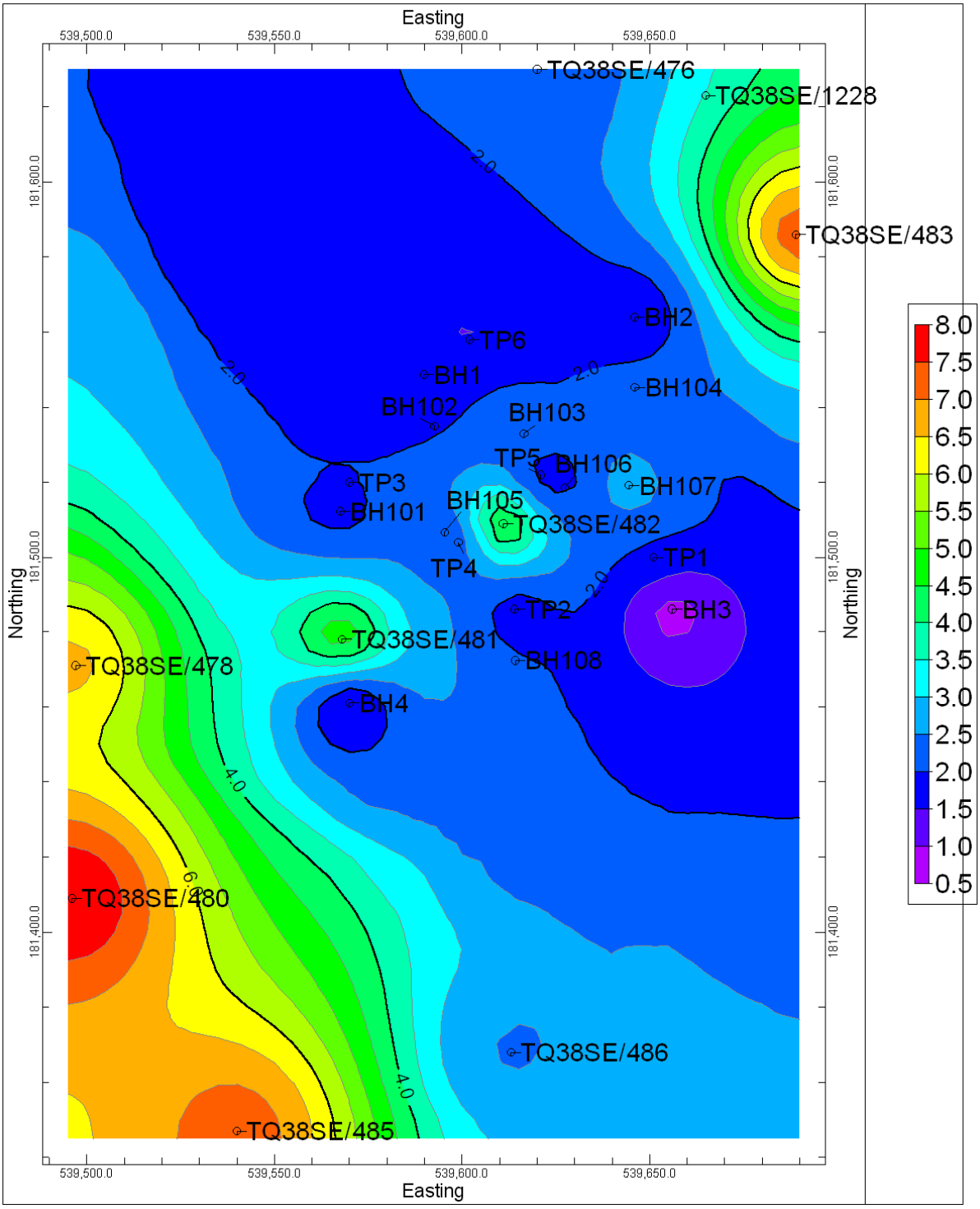

Figure 4: Modelled thickness of the Holocene Alluvium (contour heights in metres OD).

The Holocene Alluvium

The following description of the alluvium is based on the logs for the 12 geotechnical boreholes and six trial pits, supplemented by data arising from the laboratory examination by QUEST of cores from three of the geotechnical boreholes (BH101, BH104, BH107).

The alluvium is remarkably uniform across the site. In eight of the boreholes (BH1, BH2, BH3, BH4 BH102, BH106, BH107, BH108), the alluvium is assigned to a single unit, in all cases described as clay, grey or grey-brown in colour and in most cases described as soft or very soft, silty or very silty, and organic or slightly organic. Variations in the appearance of the alluvium in these boreholes are evident in Borehole BH4 where it is described as a stiff dark brown mottled orange brown silty clay with occasional rootlets; in Borehole BH106 where occasional pockets of dark grey silt and very weak siltstone are recorded, and in Borehole BH107 where the very silty clay alluvium is described as slightly sandy. Borehole BH108 is unusual in having 2.4m of gravel overlying alluvial deposits which are described as soft grey silty organic clay with occasional pockets of peat and pockets and bands of gravel. The significance of this unusual sediment sequence in Borehole BH108 is discussed below.

In the remaining four geotechnical boreholes and in all the trial pits, the Holocene alluvium is divided into two sub-units. These are described most fully in the trial pits where, in four of the pits (TP1, TP3, TP4, TP6), an upper sub-unit is described as firm, mottled brown, grey and orange. Similar sediments are recorded in Borehole BH4. In the trial pits these firm, mottled sub-units pass down into sediment very similar to the alluvium described above – soft or very soft, grey or dark grey, organic, clay or silty clay. Similar sediment forms the whole of the sequences in the other boreholes and trial pits, where separation into two sub-units is based on minor variations of colour or texture.

In all of the trial pits and in three of the boreholes (BH103, BH104, BH105) the soft grey silty clays that form the bulk of the sediment are described as including occasional (or in the case of Borehole BH105 – frequent) pockets or streaks of sediment distinctive mainly in terms of colour, or organic content. In Borehole BH103 and in Trial Pits TP5 and TP6 occasional fragments of mollusc shell were recorded.

Detailed examination of the alluvial sediments in the laboratory confirmed the descriptions in the geotechnical logs and showed that the organic content comprised both detrital herbaceous material and detrital wood.

DISCUSSION

The surface of the Late Devensian Lea Valley Gravel is the platform upon which Holocene alluvial sediments have accumulated. Elsewhere in the valley of the Middle and Lower Thames, the surface of the Late Devensian Shepperton Gravel is often uneven (Gibbard 1985, 1994) with relief features that can be identified as longitudinal gravel bars and palaeochannels with a relief amplitude commonly of 3-4m and in some places up to 6m. The surface of the Lea Valley Gravel beneath the Canning Town site appears to slope unevenly down towards the north with a relief amplitude of ca. 2.0-2.5m. The relatively high level of the surface near the southern boundary of the site may indicate the presence of a gravel 'island' here, but the sediment sequence recorded in Borehole BH108 indicates erosion of this feature with deposition of organic Holocene alluvium in a possible palaeochannel, followed by the redistribution of gravel, burying the Holocene alluvial sediments. Across the rest of the site, the alluvial sediments comprise a single stratigraphic unit consisting mainly of soft grey silty clays containing scattered detrital herbaceous and woody remains which in a few places form thin streaks and pockets of more richly organic silt. In several of the boreholes and trial pits evidence of pedogenic processes was recorded in the upper part of the alluvium forming a sub-unit that was browner, more compact and typically mottled. These features probably represent the remains of the natural soil that formed at the surface of the historic floodplain and their survival suggests that there was little truncation of the alluvium prior to the emplacement of the made ground which covers the site to a depth of about 2.0m.

There is no indication in the Holocene alluvium at the Canning Town site of the tripartite Holocene sequence that is often present beneath the floodplain of the Thames and its tributaries, involving the division of the alluvium into upper and lower units separated by a unit of peat. The absence of this tripartite arrangement in the sediments of the Canning Town site can be taken to indicate that the site was affected by active channel migration throughout the prehistoric period, and in particular during the period of widespread peat formation on the valley floors of the Thames and its tributaries that can be dated to the Neolithic/Bronze Age interval. This pattern of development is consistent with the findings of Corcoran *et al.* (2011) in the Lower Lea valley and with their inclusion of the area around the Canning Town site in their Landscape Zone LZ1.1, where 'The deposit sequence is consistent with in-channel sediments, suggesting that the zone has always been an area of active channels.' (Corcoran *et al.*, 2011 p.48).

CONCLUSIONS

The Holocene sediments recorded at the Canning Town site are in-channel deposits in which no long sediment sequences containing substantial palaeoenvironmental or archaeological

remains are preserved or are likely to be preserved, due to a history of active channel migration affecting the site throughout the prehistoric period.

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